# HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR THE GALLERIA NORTH SCHOOL SITE SUB-AREA

## BMI COMMON AREAS (EASTSIDE)
## CLARK COUNTY, NEVADA

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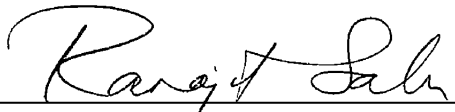
**OCTOBER 2011**

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and to the best of my knowledge comply with all applicable federal, state and local statutes, regulations and ordinances. I hereby certify that all laboratory analytical data was generated by a laboratory certified by the NDEP for each constituent and media presented herein.



October 25, 2011

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| µg/L | microgram per liter |
| µm | micrometer |
| µg/$m^3$ | microgram per cubic meter |
| Aa | alluvial aquifer |
| ADD | average daily dose |
| AOC3 | Settlement Agreement and Administrative Order on Consent, Phase 3 |
| ARR | asbestos-related risk |
| ASTM | American Society for Testing and Materials |
| ATSDR | Agency for Toxic Substances and Disease Registry |
| BCL | Basic Comparison Level |
| bgs | below ground surface |
| BMI | Basic Management, Inc. |
| BRC | Basic Remediation Company |
| CAMU | Corrective Action Management Unit |
| CD | compact disc |
| cm | centimeter |
| $cm^3$ | cubic centimeter |
| CoH | city of Henderson |
| COPC | chemical of potential concern |
| CSF | cancer slope factor |
| CSM | conceptual site model |
| DAF | dilution attenuation factor |
| DBS&A | Daniel B. Stephens & Associates, Inc. |
| DOE | U.S. Department of Energy |
| DQIs | data quality indicators |
| DQOs | data quality objectives |
| DVSR | Data Validation Summary Report |
| EC | exposure concentration |
| ECI | Environmental Conditions Investigation |
| ERM | Environmetal Resources Management |
| FSSOP | Field Sampling and Standard Operating Procedures |
| GC/MS | gas chromatograph/mass spectrometry |
| GES | Geotechnical and Environmental Services |
| GiSdT® | Guided Interactive Statistical Decision Tools |
| HEAST | Health Effects Assessment Summary Tables |
| HHRA | Human Health Risk Assessment |
| HI | hazard index |
| HQ | hazard quotient |

## ACRONYMS AND ABBREVIATIONS (Continued)

| | |
|---|---|
| IEUBK | Integrated Exposure Uptake Biokinetic Model |
| ILCR | incremental lifetime cancer risk |
| IRIS | Integrated Risk Information System |
| IRM | interim remedial measure |
| IUR | inhalation unit risk |
| J | USEPA data qualifier, which indicates an estimated value |
| LADD | lifetime average daily dose |
| LBCL | BCLs for protection of groundwater |
| LCS/LCSD | laboratory control sample/laboratory control sample duplicate |
| LMS | linearized multi-stage |
| LOAEL | lowest-observed-adverse-effect-level |
| mg/kg-d | milligram per kilogram per day |
| mg/kg | milligram per kilogram |
| mg/L | milligram per liter |
| $mg/m^3$ | milligram per cubic meter |
| MS/MSD | matrix spike/matrix spike duplicate |
| msl | mean sea level |
| NDEP | Nevada Division of Environmental Protection |
| NFAD | No Further Action Determination |
| NOAEL | no-observable-adverse-effect-level |
| ORNL | Oak Ridge National Laboratory |
| PAH | polynuclear aromatic hydrocarbon |
| PARCC | precision, accuracy, representativeness, comparability, and completeness |
| PCB | polychlorinated biphenyl |
| pCi/g | picoCurie per gram |
| PEF | particulate emission factor |
| PNNL | Pacific Northwest National Laboratories |
| PPRTVs | Provisional Peer Reviewed Toxicity Values |
| ppt | part per trillion |
| PQL | practical quantitation limit |
| QA/QC | quality assurance/quality control |
| Qal | Quaternary alluvium |
| QAPP | Quality Assurance Project Plan |
| R | rejected |
| RAGS | Risk Assessment Guidance for Superfund |
| RAS | Remedial Alternatives Study |
| RAWP | Removal Action Work Plan |
| RfC | reference concentration |

## ACRONYMS AND ABBREVIATIONS (Continued)

| | |
|---|---|
| RfD | reference dose |
| RIB | Rapid Infiltration Basin |
| ROD | Record of Decision |
| RPD | relative percent difference |
| SAP | Sampling and Analysis Plan |
| SIM | selective ion mode |
| SOP | Standard Operating Procedure |
| SPLP | synthetic precipitation leaching procedure |
| SQL | sample quantitation limit |
| SRC | Site-related chemical |
| SVOC | semi-volatile organic compound |
| TCDD | tetrachlorodibenzo-*p*-dioxin |
| TEF | toxicity equivalency factor |
| TEQ | toxicity equivalency |
| TIC | tentatively identified compound |
| TIMET | Titanium Metals Corporation |
| TMCf | Tertiary Muddy Creek Formation |
| TPH | total petroleum hydrocarbon |
| U | undetected |
| UCL | upper confidence limit |
| UJ | USEPA data qualifier, which indicates a non-detect estimated value |
| USEPA | U.S. Environmental Protection Agency |
| VOC | volatile organic compound |
| WRF | Water Reclamation Facility |
| WRS | Wilcoxon Rank Sum |

## EXECUTIVE SUMMARY

Basic Remediation Company LLC (BRC) has prepared this Human Health Risk Assessment (HHRA) and Closure Report for the Galleria North School Site Sub-Area (Site) of the Basic Management, Inc. (BMI) Common Areas (Eastside) in Clark County, Nevada. The Site is a portion of the Galleria North sub-area that has been defined within Eastside. The purpose of this report is to support a request for a No Further Action Determination (NFAD) by the Nevada Division of Environmental Protection (NDEP) for the Site.

The HHRA evaluates the potential for adverse human health impacts that may occur as a result of potential exposures to residual concentrations of chemicals in soil, groundwater, and air following remediation of the Site. If the residual risks do not pose an unacceptable risk to human health and the environment, then an NFAD will be requested from the NDEP. Upon issuance of an NFAD by the NDEP, redevelopment of the Site is expected to proceed in a manner consistent with the Environmental Covenant that is attached to the property. This report also describes the various remediation actions that were performed and presents the subsequent confirmation data collected in 2009 and 2010 at the Site.

## BACKGROUND

An initial confirmation sampling investigation was conducted at the Site in 2009 in accordance with BRC's *Sampling and Analysis Plan* (SAP, approved by the NDEP on December 12, 2008), with follow-up sampling in 2010. The SAP addressed sampling procedures such that remaining contaminants and their potential impacts to future Site uses (as discussed in Section 1.1 of the *BRC Closure Plan* for the BMI Common Areas [BRC, Environmental Resources Management (ERM), and Daniel B. Stephens & Associates, Inc. (DBS&A) 2007[1]]) can be determined. The Site investigation involved collection of soil matrix and surface flux samples from throughout the Site. The sampling plan performed for this purpose, as described in Section 4 of the SAP (BRC 2008), was consistent with the approach presented in Section 2 of the *Statistical Methodology Report* (NewFields 2006). The *Statistical Methodology Report* describes the statistical methods that are used to confirm the final soils closure at each of the Eastside sub-areas of the BMI Common Areas. Several subsequent rounds of soil remediation and confirmation sampling were performed. The final number of samples collected was determined

[1] The *BRC Closure Plan* was finalized and approved by NDEP in 2007. Subsequent to this date, revisions were made to Section 9 of the *Closure Plan* (Risk Assessment Methodology–Human Health). The latest revision to Section 9 is March 2010. No other sections of the *Closure Plan* have been revised since 2007.

to be adequate for the completion of a statistically robust dataset upon which to perform an HHRA.

## CONCEPTUAL SITE MODEL

The conceptual site model for the Site considers current and potential future land-use conditions. Currently, the Site is undeveloped. Current receptors that may be exposed to Site chemicals of potential concern (COPCs) include on-site trespassers, occasional on-site workers, and off-site residents. Future receptors identified as "on-site receptors" are defined as receptors located within the current Site boundaries (Figure 1), while future "off-site receptors" are those located outside the current Site boundaries. Under the prospective redevelopment plan, the Site is proposed for use by a high school or a middle school (with associated parking, buildings, and recreational fields), and residential redevelopment. However, the HHRA assumes unrestricted future land use. Therefore, future receptors may include on-site residents, school staff, students, and visitors, outdoor maintenance workers, construction workers, trespassers, and off-site residents.

Due to the requirement for use of default reasonable maximum exposure parameters for future receptors, exposures to future receptors are greater than current exposures. Accordingly, only future receptors were assessed in the HHRA. Potential exposures to off-site residents were qualitatively evaluated.

The HHRA conforms to the methodology included in Section 9 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010). This methodology includes the evaluation of residential receptors, but not specifically school receptors. However, potential residential exposures are considered more conservative and, therefore, are protective of any potential school receptors.

The entire Site will be enhanced by restoration and redevelopment once remediation is complete. Therefore, there is no exposure to ecological receptors, because the Site will be prepared for human use in high school or middle school and residential setting.

## DATA REVIEW AND USABILITY EVALUATION

A data review and usability evaluation was performed to identify appropriate data for use in the HHRA. The results of the data usability evaluation indicate that the data collected in 2009 and 2010 are adequate in terms of quality and quantity for use in a risk assessment.

## HUMAN HEALTH RISK ASSESSMENT

An HHRA was conducted to determine if chemical concentrations in Site soils are either: (1) representative of background conditions; or (2) do not pose an unacceptable risk to human health and the environment under current and potential future use conditions. The HHRA followed the procedures outlined in U.S. Environmental Protection Agency (USEPA) and the NDEP guidance documents. As noted above, the HHRA also conforms to the methodology presented in Section 9 of the NDEP-approved *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010) and includes all COPCs for the Site. Radionuclides were not included as COPCs because they were consistent with background conditions. Results of the HHRA are summarized below.

**TABLE ES-1: SUMMARY OF HUMAN HEALTH RISK ASSESSMENT CALCULATIONS**

| | Future On-Site Resident | Construction Worker | Commercial (Indoor) Worker | Maintenance (Outdoor) Worker |
|---|---|---|---|---|
| Non-Cancer HI[1] | 0.14 | 0.040 | 0.0059 | 0.0099 |
| Chemical Cancer Risk[2] | $2 \times 10^{-6}$ | $2 \times 10^{-8}$ | $2 \times 10^{-7}$ | $2 \times 10^{-7}$ |
| Asbestos Risk[3] | 0 to $4 \times 10^{-7}$ | 0 to $7 \times 10^{-7}$ | 0 to $8 \times 10^{-8}$ | 0 to $2 \times 10^{-7}$ |

1 – HI = hazard index; the value presented is the total cumulative non-cancer HI; unless noted with an '(TO)' which indicates the value is the maximum target organ specific HI.
2 – Cancer risk is the maximum theoretical upper-bound incremental lifetime cancer risk (ILCR).
3 – Asbestos risks represent the cumulative asbestos risks for chrysotile and amphibole fibers. However, the risk estimates are dominated by amphibole, which fiber type was not detected at the Site in the confirmation samples. Asbestos risks were calculated for the entire Site and not divided by exposure area.

Indoor air exposures are evaluated on a sample-by-sample basis, per NDEP requirements, using the surface flux data measurements. Because of this, the minimum and maximum surface flux risks and HI estimates are summed with the soil risk and HI estimates to provide a range of cumulative risks and HIs. The risk estimates shown above incorporate the maximum surface flux risks. Primary risk contributors are discussed in the main body of the report.

In addition, BRC has performed a more detailed Site-specific evaluation of vapor intrusion potential at a comparison study area within the Eastside property. Given the results of this study, and based on the results of the tiered approach followed from USEPA's Vapor Intrusion Guidance (2002d), it has been demonstrated that there is no likelihood of adverse vapor intrusion into any indoor spaces that may be constructed on the Site.

The NDEP has recently determined that HHRAs for Eastside property sub-areas do not need to evaluate the pathway of radon migration from groundwater to indoor air for sub-areas with a

separation distance of at least 15 feet between any current or future building structure base and the high water table (letter dated November 9, 2010, from Greg Lovato, NDEP, to Mark Paris, BRC). Therefore, given the depth to groundwater at the Site is at least 25 feet below ground surface (bgs), the intrusion of radon into indoor air is not evaluated in the HHRA.

## EVALUATION OF UNCERTAINTIES

Risk estimates are values that have uncertainties associated with them. These uncertainties, which arise at every step of a risk assessment, are evaluated in the report to provide an indication of the uncertainty associated with a risk estimate. Uncertainties from different sources are compounded in the HHRA. Because the uncertainties are compounded and because the exposure assumptions and toxicity criteria used are considered conservative, the risk estimates calculated in this HHRA are likely to overestimate rather than underestimate potential risks. A detailed discussion of these uncertainties is provided in the Uncertainty Analysis (Section 7) of the report.

## POTENTIAL IMPACTS TO GROUNDWATER

Potential impacts to groundwater of residual chemicals in soil were evaluated, as was the potential impact to groundwater from the prospective future land use of the Site. Potential impacts were evaluated using the SESOIL vertical unsaturated zone migration models. Because future redevelopment will likely result in increased surface water infiltration due to sources such as buried water lines, sewer lines, irrigation lines and/or over-watering of parks, playing fields, and lawns, three surface water infiltration scenarios were evaluated: (1) baseline, pre-development conditions; (2) normal post-development conditions; and (3) post-development enhanced recharge due to overwatering of open space.

The model predicts that inorganic COPCs will exceed their respective comparison levels. However, based upon the differences between the modeled predictions and the lower, actual, observed measurements in groundwater, it is probable that processes not accounted for in the model are reducing/attenuating concentrations as they migrate through the vadose zone. That is, the model is overpredicting the migration potential of COPCs in the vadose zone. Therefore, because of the long elapsed time since any use in the vicinity of the Site and no use on the Site itself, it is unlikely that the concentrations of constituents detected in Site soils represent a risk to groundwater quality.

## SUMMARY

Based on the results of the 2009/2010 sampling, the HHRA, and the conclusions presented there from in this report, exposures to residual levels of chemicals in soil at the Galleria North School

Site sub-area should not result in adverse health effects to any of the future receptors evaluated, or to groundwater quality beneath the Site. As a result, an NFAD for the Galleria North School Site sub-area is warranted, given the following provisos:

1. The NFAD does not pertain to groundwater. BRC retains the responsibility to address any environmental impacts to groundwater beneath the Site, pursuant to the *Settlement Agreement and Administrative Order on Consent, Phase 3* (NDEP 2006). As such, additional investigation may be necessary on the Site as it relates to BRC's responsibilities for groundwater. BRC must be granted access to the Site for activities such as well or soil boring installations or other investigative or remedial efforts.

2. The soils beneath 10 feet bgs of the Recorded Environmental Covenant redevelopment grading plan for the Site have not been evaluated to date. Accordingly, the NFAD does not pertain to soil below the top 10 feet of the redevelopment grading plan for the Site. The property owner should note that these soils should not be disturbed without additional investigation or evaluation. BRC understands that this provision will be reflected in an Environmental Covenant for the Site.

3. The property owner should ensure that activities at the Site do not exacerbate existing, sub-surface, environmental conditions. The redevelopment grading plan (Figure 2) that has been prepared for redevelopment of the Site has been incorporated as an Environmental Covenant for the Site to control subsurface excavation.

4. Site use is otherwise suitable for purposes of residential, recreational, civic, commercial, or industrial use (residential use being protective and representative of any potential school use).

# 1.0 INTRODUCTION

Basic Remediation Company LLC (BRC) has prepared this Human Health Risk Assessment (HHRA) and Closure Report for the Galleria North School Site Sub-Area (Site; Figure 1) of the Basic Management, Inc. (BMI) Common Areas (Eastside) in Clark County, Nevada. The purpose of this report is to support a request for a No Further Action Determination (NFAD) by the Nevada Division of Environmental Protection (NDEP) for the Site. As presented in Section XVII.1.a. of the *Settlement Agreement and Administrative Order on Consent: BMI Common Areas, Phase 3* (AOC3; NDEP 2006), the NDEP acknowledges that discrete Eastside areas may be issued an NFAD as remedial actions are completed for selected environmental media. Any such NFAD request shall identify the remedial actions and other work completed at the property in question, the results of such remedial actions and other work, the proposed land use(s), and the reasons supporting the eligibility of the property for an NFAD. This report provides this information for the Site.

BRC recognizes that the following conditions will be included in a Recorded Environmental Covenant (Instrument 201102030002818 Clark County Recorders Office) as a condition to receiving an NFAD from the NDEP:

1. The NFAD does not pertain to groundwater. BRC retains the responsibility to address any environmental impacts to groundwater beneath the Site, pursuant to the AOC3. As such, additional investigation may be necessary on the Site as it relates to BRC's responsibilities for groundwater. BRC must be granted access to the Site for activities such as well or soil boring installations or other investigative or remedial efforts.

2. The soils beneath 10 feet below ground surface (bgs) of the redevelopment grading plan for the Site have not been evaluated to date. Accordingly, the NFAD does not pertain to soil below the top 10 feet of the redevelopment grading plan for the Site. The property owner should note that these soils should not be disturbed without additional investigation or evaluation.

3. The property owner should ensure that activities at the Site do not exacerbate existing, sub-surface, environmental conditions. The grading plan (Figure 2), which has been prepared for redevelopment of the Site, has been incorporated as an Environmental Covenant for the Site to control subsurface excavation.

4. Site use is otherwise suitable for purposes of residential, recreational, civic, commercial, or industrial use (residential use being protective and representative of any potential school use).

As stated in Section VI of the NDEP's *Record of Decision, Remediation of Soils and Sediments in the Upper and Lower Ponds at the BMI Complex* (ROD; NDEP 2001), cleanup of the Site proceeded under Alternative 4B (soils transferred from the Site to a dedicated Corrective Action Management Unit [CAMU] within the BMI Complex),[2] as identified and described in Section 9 of the Remedial Alternatives Study (RAS) for the Eastside. The *Remedial Alternatives Study for Soils and Sediments in the Upper and Lower Ponds at the BMI Complex* (Environmental Resources Management [ERM] 2000) was submitted to the NDEP in March 2000. The RAS is documented via issuance of the ROD, dated November 2, 2001, by the NDEP.

This report is consistent in format with prior closure reports for other study areas, and incorporates comments received from the NDEP on those reports. This revision of the report, Revision 2, incorporates comments received from the NDEP, dated January 12, 2011, on Revision 1 of the report, dated December 2010; comments received from the NDEP, dated December 2, 2010, on Revision 0 of the report, dated November 2010 (as well as discussions during a December 9, 2010, meeting between BRC and the NDEP); and discussions and comments/resolutions between BRC and the NDEP conducted subsequent to the December 2010 revision of the report regarding approaches for background comparisons for metals. The NDEP comments and BRC's response to these comments are included in Appendix A. Also included in Appendix A is a redline/strikeout version of the text showing the revisions from the December 2010 versions of the report. An electronic version of the entire report, as well as original format files (MS Word and MS Excel) of all text, tables, modeling, and risk calculations are included on the report compact disc (CD) in Appendix B.

## 1.1 PURPOSE OF THE RISK ASSESSMENT

The purpose of the HHRA is to evaluate the potential for adverse human health impacts that may occur as a result of potential exposures to residual concentrations of chemicals in soil, groundwater, and air following remediation, and to assess whether any additional remedial actions are necessary in order to request an NFAD from the NDEP to allow redevelopment of the

[2] Under this alternative, the Site could be developed in accordance with the current development plan and the recorded Environmental Covenant for the Site that assures appropriate management of soils beneath 10 feet bgs (post-graded), should they need to be disturbed in the future.

Site to proceed. The results of the risk assessment provide risk managers an understanding of the potential human health risks associated with background conditions and additional risks associated with past Site activities.[3] Pending issuance of an NFAD by the NDEP, redevelopment of the Site is expected to proceed in a manner consistent with the Recorded Environmental Covenant attached to the property.

As presented in Section 2.5 of the *Sampling and Analysis Plan for the Galleria North Sub-Area, BMI Common Areas (Eastside) Clark County, Nevada* (BRC 2008; hereinafter "SAP"; approved by the NDEP on December 12, 2008), the only remediation conducted at the Site prior to sampling in accordance with the SAP involved tamarisk and debris removal. When the sampling conducted in accordance with the SAP was performed, areas within the Site that warranted remediation were identified, as discussed in Section 3.3. These areas have been addressed. The overall goal of the risk assessment presented in this report, therefore, is to confirm that residual chemical concentrations are: (1) either representative of background conditions; or (2) do not pose an unacceptable risk to human health and the environment under current and potential future land use conditions. Findings of the HHRA are intended to support the Site closure process.

For human health protection, BRC's goal is to remediate Site soils such that they are suitable for residential uses, assuring health-protective conditions at 1/8$^{th}$-acre exposure areas. The 1/8$^{th}$-acre area corresponds to the size of a typical residential lot size, as presented in the U.S. Environmental Protection Agency (USEPA) guidance (1989) and is applicable to future Site conditions. It should be noted that sampling has not occurred on every 1/8$^{th}$-acre exposure area. Rather, the statistical protocol presented in the NDEP-approved *BRC Closure Plan* (BRC, ERM, and Daniel B. Stephens & Associates, Inc. [DBS&A] 2007) and *Statistical Methodology Report* (NewFields 2006) was followed, which allows estimates to be applied to 1/8$^{th}$-acre exposure areas based on similar populations across the Site. The decision can hence be made simultaneously for many 1/8$^{th}$-acre exposure areas based on the data and documentation that the

[3] The HHRA presents incremental risks; that is, the risk in addition to background risk caused by Site contamination. Background risk is the risk to which a population is normally exposed, and does not include risks from Site contamination. Total risk includes both incremental and background risks. Because naturally occurring constituents are typically included in a risk assessment (i.e., metals and radionuclides) the incremental risk will have some element of total risk included. However, because risks are only calculated for a subset of metal and radionuclides, a 'total' risk is not calculated. In instances where the incremental risk is calculated to exceed a cancer risk of $10^{-5}$ (typically when radionuclides are included in the risk assessment calculations), then a background risk, only including those naturally occurring constituents included in the risk assessment, will also be calculated to provide context to the risk assessment results.

exposure areas can be aggregated. This can result in aggregation across the entire Site if concentration distributions appear to be relatively homogeneous and representative of a single population, or within separate sub-areas of the Site if those sub-areas exhibit different distributions. Note that an assumption was made in the SAP for the Galleria North sub-area (see Section 3.4 of that document) that the concentration distribution across the entire Site is relatively homogeneous. This assumption was evaluated prior to performing the risk assessment, and was found to be valid for the Site (Section 6.1.1).

Project-specific risk level and remediation goals consistent with USEPA precedents and guidelines for residential uses have been established, as summarized below. It should be noted that: (1) all comparisons to risk or chemical-specific goals are made on an exposure area basis consistent with likely exposure assumptions; and (2) these comparisons are demonstrated through the use of spatial statistical analysis to apply to each $1/8^{th}$-acre exposure area.

Human health risks are represented by estimated theoretical upper-bound cancer risks and non-cancer hazards derived in accordance with standard USEPA and NDEP methods. If the carcinogenic risks or non-cancer hazards exceed USEPA acceptable levels or NDEP risk goals, then remedial action alternatives must be considered. The acceptable risk levels defined by USEPA for the protection of human health, as identified in Section 9.1.1 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), are:

- Post-NFAD chemical and radionuclide concentrations in Site soils are targeted to have an associated residual, cumulative theoretical upper-bound incremental lifetime cancer risk (ILCR) level point of departure of $10^{-6}$. This is the target risk goal for the project. For cases where the NDEP identifies this goal to be unfeasible, it is BRC's understanding that the NDEP will re-evaluate the goal in accordance with USEPA (1991a) guidance. In no case will the residual, cumulative theoretical upper-bound carcinogenic risk levels exceed those allowed per USEPA guidance.

- Post-NFAD chemical concentrations in Site soils are targeted to have an associated cumulative, non-carcinogenic hazard index (HI) of 1.0 or less. If the screening HI is determined to be greater than 1.0, target organ-specific HIs will be calculated for primary and secondary organs. The final risk goal will be to achieve target organ-specific non-carcinogenic HIs of less than 1.0.

- Where background levels exceed risk level goals or chemical-specific remediation goals, metal concentrations and radionuclide activities in Site soils are targeted to have risks no greater than those associated with background conditions.

In addition to the risk goals discussed above, chemical-specific remediation goals have been established for lead and dioxins/furans. The target goal for lead is 400 milligrams per kilogram (mg/kg) for residential land use, which is a residential soil concentration identified by USEPA (based on the Integrated Exposure Uptake Biokinetic Model [IEUBK] model) as protective of a residential scenario (USEPA 2004a).

For dioxins/furans and polychlorinated biphenyl (PCB) congeners, the USEPA toxicity equivalency (TEQ) procedure, developed to describe the cumulative toxicity of these compounds, is used. This procedure involves assigning individual toxicity equivalency factors (TEFs) to the 2,3,7,8 substituted dioxin/furan and PCB congeners. TEFs are estimates of the toxicity of dioxin-like compounds relative to the toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), which is assigned a TEF of 1.0. Calculating the TEQ of a mixture involves multiplying the concentration of individual congeners by their respective TEF. One-half the detection limit is used for calculating the TEQ for individual congeners that are non-detect in a particular sample. The sum of the TEQ concentrations for the individual congeners is the TCDD TEQ concentration for the mixture. TEFs from USEPA (2000a) are used. Consistent with the Agency for Toxic Substances and Disease Registry (ATSDR) *Update to the ATSDR Policy Guideline for Dioxins and Dioxin-Like Compounds in Residential Soil* (2008a), the target goal for residential land use is the ATSDR screening value and the NDEP residential Basic Comparison Level (BCL; NDEP 2011a) of 50 parts per trillion (ppt) TCDD TEQ.

## 1.2 METHODOLOGY AND REGULATORY GUIDANCE

This risk assessment follows procedures outlined in USEPA *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual* (RAGS; USEPA 1989), and conforms to Section 9 (Risk Assessment Methodology–Human Health) of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010) which was approved by the NDEP on July 16, 2007. Various NDEP guidance documents are also relied on for the risk assessment (as referenced throughout this report). In addition, the NDEP's BCLs (NDEP 2011a) are used for comparison of Site characterization data to provide for an initial screening evaluation, assist in the evaluation of data usability, and aid in determination of extent of contamination. A full list of guidance documents consulted is provided in Section 6 and the References section at the end of this document.

This report also relies upon methodology and information provided in the NDEP-approved *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010). The main text of the *BRC Closure Plan* provides discussions of the following elements relative to the BMI Common Areas project as a whole:

- The project history, including cleanup goals and project objective (Closure Plan Sections 1 and 2);
- The list of Site-related chemicals (SRCs; Closure Plan Section 3);
- The conceptual site model (CSM) addressing potential contaminant sources, the nature and extent of chemical of potential concern (COPC) occurrence, and potential exposure pathways (Closure Plan Section 4; a CSM discussion specific to the Site is provided in Section 5 of this report);
- Data verification and validation procedures (Closure Plan Section 5);
- The procedures used to evaluate the usability and adequacy of data for use in the risk assessment (Closure Plan Sections 6 and 9 [2010 revision]);
- The data quality objectives (DQOs; Closure Plan Section 7[4]);
- The RAS process for the Site (Closure Plan Section 8);
- Risk assessment procedures that will be used for Site closure (Closure Plan Section 9 for human health [2010 revision] and Section 10 for ecological); and
- Data quality assessment (Closure Plan Section 5).

As discussed in this report, the risk assessment for the Site is conducted primarily using the data collected during implementation of the Site-specific SAP and subsequent confirmation sampling events, which have been designed to produce data representative of the conditions to which current (non-remediation workers) and future users would be exposed.

[4] As noted in the *BRC Closure Plan*, per discussions with the NDEP, the DQO process is addressed, on an Eastside sub-area by sub-area basis (for soils), in the respective sub-area SAPs developed for each sub-area relating to the soils cleanup. Therefore, the DQO process for the Site is presented in the SAP and is not repeated here. This DQO process was incorporated in the data usability/data adequacy evaluation for the Site data used in the risk assessment.

## 1.3 REPORT ORGANIZATION

The closure report is composed of 12 sections, as outlined below:

- This section (Section 1) presents the purpose of the risk assessment and the methods used in this assessment.
- Section 2 presents Site background, the environmental setting for the Site, and a summary of previous investigations. Section 2 also presents the CSM for the risk assessment. This includes identification of potentially exposed populations, and the potential pathways of human exposure.
- Section 3 presents the confirmation data collected in 2009 and 2010, as well as discussions on the various remedial actions conducted at the Site.
- Section 4 presents data evaluation procedures, including statistical analysis of background concentrations, and data usability and quality.
- Section 5 presents the selection of COPCs recommended for further assessment, including comparisons of Site metals and radionuclides to background conditions.
- Section 6 presents the HHRA. This includes relevant statistical analyses, determination of representative exposure point concentrations, applicable fate and transport modeling, exposure assessment, toxicity assessment, and risk characterization.
- In Section 7, the uncertainties associated with the risk assessment are discussed.
- A summary of the risk assessment results is provided in Section 8.
- The results of the analysis of potential impacts to groundwater are presented in Section 9.
- The data quality assessment for the risk assessment is presented in Section 10.
- A summary of the HHRA and Closure Report is provided in Section 11; and
- A list of references is provided in Section 12.

Smaller tables with supporting information are inserted in the text at the place of reference. The text is followed by the larger tables, and figures and appendices.

# 2.0 SITE DESCRIPTION

This section presents a description of the Site, including Site background and history, the environmental setting, and a summary of previous investigations. The area known as the "BMI Common Areas," of which the Galleria North School Site sub-area is a part, is delineated in Appendix A of the AOC3. The subject Site is near the BMI Industrial Complex, in Clark County, Nevada, approximately 13 miles southeast of Las Vegas, within the City of Henderson (CoH) corporate limits, northeast of the City Hall (Figure 1). The total extent of the Site is 44 acres. The Site is a portion of the sub-area within Eastside that was previously defined as the Galleria North sub-area in Section 1 and Figure 1-2 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010). The Site is south of the CoH northern Rapid Infiltration Basins (RIBs), east of the CoH Water Reclamation Facility (WRF), and north of the Upper Ponds portion of Eastside. The Weston Hills residential development is approximately 600 feet east of the Site.

The Site is essentially undeveloped desert with the exception of a former effluent conveyance ditch, a portion of which traverses the western portion of the Site along the boundary shared with the City WRF. From 1942 through 1976, various plant wastewaters were discharged into this conveyance ditch (named the Beta Ditch). A segment of the Pittman Lateral pipeline passes south and adjacent to the Site. This east-west trending subsurface feature is a major water supply conduit for the Las Vegas Valley. Since 1976, when wastewater discharge to the Beta Ditch ceased, the Site has been vacant and unused.

## 2.1 SITE HISTORY

Approximately 400 of the more than 2,200 acres comprising the BMI Common Areas contained a network of ditches, canals, flumes, and unlined ponds that were used for the disposal of aqueous waste from the original magnesium plant and, later, other industrial plants and the adjacent municipality. Effluent wastes discharged to the ponds of the BMI Common Areas from the war-time Basic Magnesium operations can be characterized as salts from the production process (chloride salts of a variety of metals and radionuclides), organic solids, and inorganic solids and dissolved components of various types. Chlorinated organic chemicals were included in the effluent. Notable processes that contributed to the waste stream from the plants that succeeded Basic Magnesium included effluents from the manufacture of the following types of products: chlorine and sodium hydroxide (caustic soda); a variety of chlorate and perchlorate compounds, and halogenated boron compounds; manganese dioxide; titanium and related compounds; and a variety of pesticides. Among these wastes were salts, organic and inorganic

chemicals, and metals. A more detailed description of these processes and their effluents is found in Sections 2.2 and 2.3 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010).

## 2.2 ENVIRONMENTAL SETTING

The BMI Common Areas and Complex are located in Clark County, Nevada, and are situated approximately 2 miles west of the River Mountains and 1 mile north of the McCullough Range. The local surface topography slopes in a westerly to northwesterly direction from the River Mountains and in a northerly to northeasterly direction from the McCullough Range. Near the BMI Common Areas and Complex, the surface topography slopes north toward the Las Vegas Wash. The River Mountains and McCullough Range consist of volcanic rocks: dacite in the River Mountains and andesite in the McCullough Range (Umhoefer et al. 2010).

The Site (Figure 3) comprises approximately 44 acres of undeveloped land with little surface relief that is gently sloping to the northeast. The Site is currently undeveloped, except for the previously noted Beta Ditch segment along the western edge of the Site. As depicted on Figure 3, the Site has no other features of historical use; this Site has historically been undeveloped. The native soils are compacted, poorly sorted, non-plastic, light brown to red silty sand with varying amounts of gravel.

### 2.2.1 Site Location, Climate and Physical Attributes

The Site is in the northeastern quarter of Section 5, Township 22 South, Range 63 East Mount Diablo Base and Meridian. The Site is in the Las Vegas Valley, a broad alluvial valley that occupies a structural basin in the Basin and Range Physiographic Province. The valley is about 1,550 square miles in size, and the structural and topographical axis is aligned approximately northwest to southeast. The eastern edge of the valley is about 5 miles west of Lake Mead, a major multipurpose artificial reservoir on the Colorado River. The Las Vegas Valley is surrounded mostly by mountains, ranging from 2,000 to 10,000 feet higher than the valley floor. The valley floor ranges in elevation from about 3,000 feet above mean sea level (msl), in the west at the mountain front, to 1,500 feet above msl, in the east at the Wash (Clark County GIS Management Office 2003). The surrounding mountain ranges are:

- Sheep Range to the north;
- Frenchman and Sunrise Mountains to the northeast;
- River Range to the east;

- McCullough Range to the south; and
- Spring Mountains and Sierra Nevada mountain range of California to the west.

The Site is approximately 0.7 mile south of the Las Vegas Wash (Figure 1) within the CoH corporate limits, northeast of the City Hall, and approximately 13 miles southeast of the city of Las Vegas. The Site is located south of the CoH northern RIBs, east of the CoH WRF, and north of the Upper Ponds portion of Eastside. The Weston Hills residential development is located approximately 600 feet east of the Site.

The Site is situated in a natural desert area, where evaporation/evapotranspiration rates are high, due to high temperatures, high winds, and low humidity. Precipitation in this area averages approximately 0.4 inch per month or 4.8 inches per year (Western Regional Climate Center 2008). As discussed in the *Sources/Sinks and Input Parameters for Groundwater Flow Model Revised Technical Memorandum* (DBS&A 2009), in arid settings, recharge from precipitation is typically a small percentage of annual precipitation. Based on values from Scanlon et al. (2006), recharge as a percentage of annual precipitation for the Site area was estimated to be between 0.1 and 5 percent. Recharge is thus estimated to be between 0.0048 and 0.24 inch per year.

According to the Southern Nevada Water Authority's document entitled *Extent and Potential Use of the Shallow Aquifer and Wash Flow in Las Vegas Valley, Nevada* (1996), annual potential evapotranspiration exceeds 86 inches. Pan evaporation data measured from 1985 through 1988 were as high as 17 inches per month; the months with the highest evaporation (May through September) coincide with those months with the highest intensity of rainfall (Law Engineering 1993). However, evaporation and evapotranspiration are functions of vegetation type and density and other Site-specific conditions (especially anthropogenic conditions). Therefore, Site-specific evaporation/evapotranspiration may vary from these regional conditions. These climatic parameters may be appreciably influenced by future redevelopment (e.g., vegetation removal, pavement extent, and construction).

Wind flow patterns are fairly consistent from one month to another, but vary slightly between measurement stations (McCarran International Airport and a station within the BMI Complex adjacent to the employee parking lot at the Titanium Metals Corporation [TIMET] plant entrance). For the McCarran station, the prevailing wind direction is from the southwest. The TIMET station also showed a predominant wind direction from the southwest, with southeasterly components. Wind velocity at both locations tends to be the highest in the spring and early summer months (April through July).

### 2.2.2 Geology/Hydrology

As is common throughout the Las Vegas Valley, Site soils are primarily sand and gravel, with occasional cobbles. This is consistent with the depositional environment of an alluvial fan. The Site is located on alluvial fan sediments, with a surface that slopes to the north-northeast at a gradient of approximately 0.02 foot per foot towards the Las Vegas Wash. Regional drainage is generally to the east.

The uppermost strata beneath the Site consist primarily of alluvial sands and gravels derived from the River Mountains and from the volcanic source rocks in the McCullough Range, located southeast and southwest of the Site, respectively. These uppermost alluvial sediments were deposited within the last 2 million years and are of Quaternary Age, and are thus mapped and referred to as the Quaternary alluvium (Qal; Carlsen et al. 1991). The Qal is typically on the order of 50 feet thick at the Site with variations due, in part, to the non-uniform contact between the Qal and the underlying Tertiary Muddy Creek Formation (TMCf).

The TMCf underlies the Qal. The Muddy Creek formation, of which the TMCf is the uppermost part, is a lacustrine deposition from the Tertiary Age, and it underlies much of the Las Vegas Valley. It is more than 2,000 feet thick in places. The lithology of the TMCf underlying the Site is typically fine-grained (sandy silt and clayey silt), although layers with increased sand content are sporadically encountered. These TMCf materials have typically low permeability, with hydraulic conductivities on the order of $10^{-6}$ to $10^{-8}$ centimeters per second (Weston 1993). The TMCf in the vicinity of the Site was encountered to the maximum explored depth of 430 feet bgs. Lithologic cross sections are shown on Figures 4 and 5.

Two distinct, laterally continuous water-bearing zones are present within the upper 400 feet of the Site subsurface: (1) an upper, unconfined water-bearing zone primarily within the Qal referred to herein as the alluvial aquifer (Aa); and (2) a deep, confined water-bearing zone that occurs in a sandier depth interval within the silts of the deeper TMCf. Both of these water-bearing zones contain high concentrations of total dissolved solids. Between these two distinct water-bearing zones, a series of saturated sand stringers was sporadically and unpredictably encountered during drilling.

The Aa is an unconfined, shallower, water-bearing zone that occurs across the Site. For the most part, water in the Aa occurs in the Qal. The water surface in the Aa generally follows topography, with the water surface sloping towards the Las Vegas Wash. The depth from the surface to first groundwater at the Site is approximately 25 feet bgs (Figure 3). Wells completed

in the Aa are not highly productive, with sustainable flows typically less than 5 gallons per minute.

### 2.2.3 Surface Water

Surface water flow occurs for brief periods of time during periodic precipitation events. The Las Vegas Wash collects storm water, shallow groundwater, urban runoff, and treated municipal wastewater. It is the receiving water body for all major Las Vegas area discharges. In dry weather, flow in the Wash comprises mainly treated effluent from the Clark County Water Reclamation District and the City of Las Vegas Water Pollution Control Facility. The CoH contributes smaller amounts. Aggregate flow is in excess of 160 million gallons per day (Las Vegas Wash Coordination Committee 2000). Discharge from these sources is sufficient to maintain surface flows in the Wash throughout the year. In winter, low-intensity rains fall over broad areas; in the spring and fall, thunderstorms provide short periods of high-intensity rainfall. The latter creates high run-off conditions. Run-off is also affected by human development, which tends to (1) create conduits for surface water flow and (2) decrease infiltration into native soils by covering them with man-made structures or materials (e.g., pavement).

Under current conditions, it is unlikely that ephemeral surface waters generated within the Site will migrate via overland transport to the Las Vegas Wash from the Site due to (1) the distance to the Wash (greater than 4,000 feet) and (2) the intervening presence of the northern RIBs between the Site and the Wash. However, the presence of the drainage ditch in the western portion of the Site suggests the current potential for rainfall to be carried from that portion of the Site to the Wash. After redevelopment, when the ditch has been removed, there will be an even lower likelihood that ephemeral surface waters generated within the Site will migrate via overland transport to the Las Vegas Wash from the Site because of the proposed design of the future storm water facilities and the regional requirement that nuisance flows not be discharged directly into the Las Vegas Wash unless they do so under existing conditions. (Flows from future development do not meet this criterion).

Groundwater seeps currently exist at various locations north of the BMI Common Areas near the Las Vegas Wash. No seeps currently exist within the Site. Evidence that they have existed within the Site in the past 70 years is equivocal. In the series of aerial photographs taken regularly over the 70-year period between 1941 and 2011, those from the mid- to late-1960s appear to show a dark feature that could be water. It is not possible to definitively interpret these photographs, and no photographs taken before or after this time period show the same dark feature. There is no chemical or hydrological evidence that seeps have existed on the Site. On the contrary, as

evaluated and discussed in Section 5.2, these short-lived seeps, if present, do not appear to have affected soil chemistry at the Site. The estimated locations of any hypothesized historical seeps in the Site vicinity are depicted on Figure 3.

## 2.3 SUMMARY OF HISTORICAL INVESTIGATIONS

Several historical field investigations were conducted at the Site to characterize the nature and extent of chemical occurrence in Site soils and groundwater. Based on these sampling events, BRC identified portions of the Site that warranted remediation for protection of human health and the environment,[5] and subsequently performed remediation in those areas. The SAP presents a detailed analysis of data collected during the historical field investigations conducted at the Galleria North sub-area. Of those investigations, the following sampling events included sampling within the Site boundaries:

- The BMI Common Areas Environmental Conditions Investigation (ECI) conducted during March and April 1996 (dataset 1a). The soil investigation activities were performed in accordance with a work plan approved by the NDEP in February 1996 (ERM 1996a). The soil sampling results for the investigation activities were presented in the ECI report (ERM 1996b), which was approved by the NDEP in March 1997. Data validation results are presented in the Data Validation Summary Report (DVSR) for dataset 1a (ERM 2006a), which was approved by the NDEP on September 12, 2006.

- The BMI Exclusion Areas Characterization conducted during April and May 1996 (dataset 1b). The soil investigation activities were performed in accordance with a work plan approved by the NDEP in February 1996 (ERM 1996c). The soil sampling results for the investigation activities were presented in the Environmental Characterization Report for the exclusion areas (ERM 1997). Data validation results are presented in the DVSR for dataset 1b (ERM 2006b), which was approved by the NDEP on October 10, 2006.

- Supplemental soil investigation conducted in May/June 2001 (dataset 20c). These data were not collected under a formal NDEP-approved work plan. Data validation results are presented in the DVSRs for dataset 20c (ERM 2007), which same dataset was approved by the NDEP on February 5, 2007.

[5] It should be noted that this determination was based on comparison of chemical detections to then-applicable human-health risk-based screening levels.

The Site-related data from the above investigations were also presented in Appendix B of the SAP. During these investigations, soil samples at various depths were collected and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), organochlorine pesticides, organophosphorus pesticides, PCBs, chlorinated herbicides, dioxins/furans, aldehydes, glycols/alcohols, organic acids, metals, perchlorate, radionuclides, and/or asbestos. The data from these investigations have been validated, as noted above. Data validations are presented in the respective DVSRs for each of the datasets, and all have been approved by the NDEP.

Previous investigations focused on the portion of the Galleria North sub-area that contained the Upper Ponds and ditches; only five of these sampling locations were within the Site boundaries. Furthermore, several of the samples collected during previous investigations were composite samples and were collected at least 9 years ago; few of the previous samples were analyzed for all of the major chemicals or chemical families now mandated; several analyses used different analytical methods than established in the current analytical program for the BMI Common Areas; and spatial coverage of the Site was incomplete. Therefore, because of these various factors, the data collected as part of the SAP in 2009 and 2010 (as discussed in Section 3) are considered more representative of current Site conditions[6] than data collected from previous investigations, and these recent 2009/2010 data are therefore relied upon for risk assessment purposes as described in this report.

## 2.4 HISTORICAL REMEDIAL ACTIVITIES

Prior to 2009, remedial activities had not been conducted within the Site boundaries. However, in 2007, BRC conducted a broad-scale removal of tamarisk plants and debris across the Eastside property. The tamarisk removal efforts covered the majority of the Site (approximately 30 acres; see Figure 3) and involved removal of minimal amounts of Site soil incorporated in the plant roots. In March-April 2000, an interim remedial measure (IRM) was conducted in the adjacent Sunset North Commercial and Upper Ponds sub-areas. This IRM area is also shown on Figure 3.

## 2.5 CONCEPTUAL SITE MODEL

The CSM is a tool used in risk assessment to describe relationships between chemicals and potentially exposed human receptor populations, thereby delineating the relationships between the suspected sources of chemicals identified at the Site, the mechanisms by which the chemicals

[6] This determination is also based on the data usability evaluation summarized in Section 4.2.

might be released and transported in the environment, and the means by which the receptors could come in contact with the chemicals. The CSM provides a basis for defining DQOs, guiding Site characterization, and developing exposure scenarios. The Site history, land uses, climate, physical attributes, including geology and hydrogeology, and various field investigations are described in Sections 2.1 through 2.4 of this HHRA. The history and environmental conditions of the BMI Common Areas are described in Sections 2 and 4 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), and in the Sitewide CSM (in preparation).

The HHRA evaluates current and potential future land-use conditions. The Site is currently undeveloped. The potential on-site and off-site receptors are currently trespassers, occasional on-site workers, and off-site residents. Exposures to current receptors are being managed through Site access control.

Under the prospective redevelopment plan, the Site will have a school land use, including parking lots, buildings, streets, and recreational fields, and/or residential land use. The entire Site will be enhanced by restoration and redevelopment once remediation is complete. Therefore, exposures to ecological receptors will be mitigated or removed. Future receptors identified as "on-site receptors" are defined as receptors located within current Site boundaries (Figure 1), while future "off-site receptors" are those located outside current Site boundaries. Many potential human receptors are possible at the Site in the period during and after redevelopment. The potentially exposed populations and their potential routes of exposure are discussed in Section 2.5.3.

The current development plan for the Site is shown on Figure 6 (note the high school overlay on this figure was prepared subsequent to the development plan shown). This is an example and actual features may change in the future. To construct the high school and associated features, the land will be cut and/or filled, paved with roads or foundations, and nurtured with imported top soils[7] as needed. Figure 2 shows the Redevelopment Grading Plan for the Site, indicating which areas will be filled and which areas will be cut.

[7] Imported soil data are not included in risk assessment calculations. However, the chemical data for fill material from a given site may be useful for evaluating sub-areas to receive fill from that site. Because no soil will be exported from the Galleria North School Site sub-area, the Site data will not be used for this purpose.

The CSM includes the planned redevelopment of the Site. All potential transfer pathways are included in the CSM. The human health aspects of the CSM for the Site are presented on Figure 7.

Numerous release mechanisms influence chemical behavior in environmental media. Under both current and future land use conditions at the Site, the principal release mechanisms involved are:

- Vertical migration in the vadose zone;
- Storm/surface water runoff into surface water and sediments;
- Fugitive dust generation and transport;
- Vapor emission and transport; and
- Uptake by plants.

Although these release mechanisms are identified here, no quantitative modeling is presented in this section. Instead, those primary release mechanisms identified for particular receptors are presented in this section, and are quantitatively evaluated in Section 6.

### 2.5.1 Impacted Environmental Media

Environmental media at the Site consist of five categories: surface soil, subsurface soil, groundwater, indoor air, and ambient outdoor air. Samples relative to Site baseline conditions have been collected at the Site for soil. Generally, impacted soil is the source of chemical exposures for other media at the Site.

Because the background water quality of groundwater beneath the Site and in the surrounding area is generally poor (viz., high salt concentrations) and because BRC will place Environmental Covenants in the form of a deed restriction to prevent future users from utilizing groundwater beneath the Site, the use of private water wells by residents, businesses, or parks for drinking water, irrigation water, or other non-potable uses (e.g., washing cars, filling swimming pools) will not occur in the post-redevelopment phase. Therefore, exposure pathways relating to this type of use are incomplete, as defined by USEPA (1989).

Although direct exposures to groundwater will not occur; indirect exposures are possible. The primary indirect exposure pathway from groundwater is the infiltration of VOCs from soil and

groundwater to indoor air. In addition, residual levels of chemicals in soil may leach and impact groundwater quality beneath the Site.

### 2.5.2 Inter-Media Transfers

Exposure to Site chemicals may be direct, as in the case of impacted surface soil, or indirect following inter-media transfers. Impacted soil is the initial source for inter-media transfers at the Site, which can be primary or secondary. For example, upward migration of VOCs from impacted subsurface soil into ambient air thereby reaching a point of human inhalation represents a secondary inter-media transfer.

These inter-media transfers represent the potential migration pathways that may transport one or more chemicals to an area away from the Site where a human receptor could be exposed. Discussions of each of the identified potential transfer pathways are presented below. Figure 7 presents a conceptualized diagram of the inter-media transfers and fate and transport modeling for the Site.

Five initial transfer pathways for which chemicals can migrate from impacted soil to other media have been identified. The first of these pathways is volatilization from soil and upward migration from soil into ambient air. Ambient air can be both indoor and outdoor air. The pathway of volatilization from both soil and groundwater and upward migration into ambient air was evaluated using the surface flux measurements collected. The secondary transfer pathway is downward migration of chemicals from soil to groundwater. The third transfer pathway is migration of chemicals in surface soil via surface runoff to sediments or surface water bodies. However, as discussed in Section 2.2.3 because of the intervening City RIBs, it is unlikely that surface waters (which are ephemeral) will drain to the Las Vegas Wash from the Site. Therefore, the surface water pathway was not evaluated in this risk assessment. The fourth transfer pathway is on-site fugitive dust generation. Finally, chemicals in soil can be transferred to plants grown on the Site via uptake through the roots. The plant uptake pathway is evaluated for residential receptors.

### 2.5.3 Potential Human Exposure Scenarios

The following section summarizes land use and the human exposure scenarios that are assessed herein.

*2.5.3.1 Current and Future Land Use*

Current receptors that may use the Site include trespassers, occasional on-site workers, and off-site residents. Current exposures to native soils at the Site are minimal, but exposures to future receptors will be much greater. For example, future receptors evaluated in the HHRA include on-site residents who are assumed to be exposed to soil at the Site for 350 days per year for 30 years, which is much greater than any current exposure scenario. In addition, as discussed above, exposures to current receptors are limited through Site access control. Therefore, a current land use scenario is not quantitatively evaluated in this risk assessment.

USEPA risk assessment guidance (1989) states that potential future land use should be considered in addition to current land use when evaluating the potential for human exposure at a site. As indicated above, under the prospective redevelopment plan, the Site will be used for a school, including parking lots, buildings, recreational fields, and streets, and/or for a residential redevelopment.

The entire Eastside property will be redeveloped in several phases. Throughout the redevelopment process, the sub-areas of the Site will be redeveloped sequentially. Future receptors identified as "on-site receptors" are defined as receptors located within the current Site boundaries (Figure 1), while future "off-site receptors" are those located outside the current Site boundaries. "On-site receptors" are those future receptors that will be located within the sub-area under evaluation. "Off-site receptors" are those future receptors that will be located outside the sub-area under evaluation that may have complete exposure pathways associated with sources within the sub-area. As noted above, remediation of the Site is to on-site residential standards. Consequently, risks to off-site receptors are addressed qualitatively in this risk assessment.

*2.5.3.2 Identification of Potentially Exposed Populations and Pathways*

Many potential human receptors are possible at the Site in the period during and after redevelopment. The potentially exposed populations and their potential routes of exposure are presented on Figure 7 and summarized below. For a complete exposure pathway to exist, each of the following elements must be present (USEPA 1989):

- A source and mechanism for chemical release;
- An environmental transport medium (i.e., air, water, soil);
- A point of potential human contact with the medium; and
- A route of exposure (e.g., inhalation, ingestion, dermal contact).

As presented in Section 9 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), the following are the primary exposure pathways for each of the potential receptors following remediation and redevelopment at the Site.

- Adult and child residents[8]
  - Incidental soil ingestion*
  - External exposure from soil†
  - Dermal contact with soil
  - Consumption of homegrown produce*
  - Outdoor inhalation of dust*‡
  - Indoor inhalation of dust*‡
  - Outdoor and indoor inhalation of VOCs from soil and groundwater
- Indoor commercial workers
  - Incidental soil ingestion*
  - External exposure from soil†
  - Indoor inhalation of VOCs from soil and groundwater
- Outdoor maintenance workers
  - Incidental soil ingestion*
  - External exposure from soil†
  - Dermal contact with soil
  - Outdoor inhalation of dust*‡
  - Outdoor inhalation of VOCs from soil and groundwater
- Construction workers
  - Incidental soil ingestion*
  - External exposure from soil†
  - Dermal contact with soil
  - Outdoor inhalation of dust*‡
  - Outdoor inhalation of VOCs from soil and groundwater

*Includes radionuclide exposures
†Only radionuclide exposures
‡Includes asbestos exposures

[8] The Closure Plan methodology includes evaluation of residential receptors, but not school receptors. However, potential residential exposures are considered more conservative, and therefore, protective and representative of any potential school receptors. For example, residential versus school exposure rates are assumed to be similar, whereas, the exposure duration for a residential receptor is 30 years (for both child [0 to 6 years of age] and adult [7 to 30 years of age]) versus 4 years for a high school student. Worker receptor exposures as defined in the Closure Plan are considered applicable for a school site scenario.

Although trespassers/recreational users and downwind off-site residents are another potential receptor identified in the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), exposures for these receptors are less than those evaluated above. As noted in Sections 9.1.1 and 9.7.1 of the *Closure Plan*, potential exposures for trespassers/recreational users will only be evaluated in areas of the BMI Common Areas that are designated as recreational end use (specifically the Western Hook-Open Space sub-area shown on Figure 1). Also, as noted in Section 9.5.4 of the *Closure Plan*, off-site dust levels based on USEPA's model are much lower than those generated for on-site, construction-related activities. Therefore, risks evaluated for an on-site construction worker, as performed in this HHRA, are considered protective of off-site residents. Thus, trespassers/recreational users and downwind off-site receptors are not evaluated further in this report.

# 3.0 CONFIRMATION DATA PROCESS AND SUMMARY

Based on the historical data for the Site, no remediation was proposed prior to implementing the sampling prescribed in the SAP. Decisions for excavation during SAP implementation were based on the initial data (discussed below) in accordance with the Risk Assessment Methodology provided in the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010). The following is the initial scope of work for investigating the Site and meeting the SAP objectives. Much of the discussion below regarding confirmation soil sampling is taken from the *Statistical Methodology Report* (NewFields 2006).

## 3.1 INITIAL CONFIRMATION SOIL SAMPLING

As per Section 2 of the *Statistical Methodology Report*, the initial confirmation sampling at the Site was conducted on the basis of combined random and biased (judgmental) sampling, as follows:

- **Stratified Random Locations:** For this purpose, the Site was covered by a 3-acre cell grid network. Within each 3-acre cell, a sampling location was randomly selected. Sampling locations were randomly selected within both full and partial grid cells if they were greater than 50 percent of the total grid cell area (based on the project-wide grid cell network and the Site boundaries; those partial grid cells that contain less than 50 percent of their area within the Site were included in the adjacent sub-area SAPs). The main objective of this stratified random sampling was to provide uniform coverage of the Site.

- **Biased Locations:** Additional sampling locations were selected within or near small-scale contamination points of interests, including but not limited to previous debris locations, ponds, and berms. For this purpose, the randomly selected location within a corresponding 3-acre cell was adjusted to cover a nearby point of interest. In the event that currently unknown impacted areas were identified during remediation, the presence of these areas were drawn to the NDEP's attention, the need for additional biased sampling points to address those areas was evaluated, and the sampling program modified as needed.

A Site reconnaissance was performed in July and August 2008 to check for environmentally significant features such as debris piles or stained soil. Ten debris piles were observed within the Site boundaries during the reconnaissance (identified as station numbers 17 through 23, 45, 46, and 53 in Table 3 of the SAP; labeled accordingly on Figure 8 of this HHRA). Biased sampling locations were selected at each of the debris piles/soil staining location. In some cases, random

sampling locations were shifted slightly to address the debris locations. A final reconnaissance was performed prior to sampling to check for any additional environmentally significant features since the initial reconnaissance; if found, these additional features would also have been sampled. No such features were found. Biased sampling was also conducted along the length of the Beta Ditch, at approximately 200-foot linear spacing (six locations within the Site). Figure 8 and accompanying Table 3-1 (see Tables section) show the sampling locations within the Site. Rationale for each of the biased sampling locations is presented below:

- GNC1-JS09 through -JS11 were included to provide coverage within debris areas observed at the Site; and
- GNC1-JD07 through -JD11 were included to provide coverage within the Beta Ditch.

Elevated detections of dioxins/furans/PCB congeners were reported in initial SAP samples collected from the southern half of the Site. In response, an additional four biased samples (GNC1-JA04 through -JA07) were collected from the Site for dioxins/furans/PCB congener analyses in August 2009. These sampling locations were outside the boundaries of Site soil removal actions initially performed in accordance with the Removal Action Work Plan (RAWP, BRC 2009) (Section 3.3.1), and triggered an additional removal action at location GNC1-JA04.

The following discusses the multi-depth soil samples that were collected and analyzed for the SRC list at each selected location. Samples were collected at:

1. Existing surface (0 foot bgs) and 10 feet bgs for sample locations in relatively flat (ungraded) locations;
2. Existing surface (0 foot bgs), post-grading surface (post-redevelopment as shown on Figure 2), and post-grade 10 feet bgs for sample locations with substantial grading (that is, cut depths greater than 2 feet[9]) and the uppermost sampled soil is expected to be used as surface fill;
3. Existing surface (0 foot bgs) and 10 feet bgs for sample locations with minimal grading (that is, cut depths less than 2 feet) and the uppermost sampled soil is expected to be used as surface fill (at any Eastside location); and

[9] Because sample collection was over a 2- to 3-foot depth interval, locations with an anticipated cut depth less than 3 feet were only sampled at the surface and one post-grade subsurface depth. The sample depth designation (e.g., 10 feet bgs) is based on the center depth of the sample collection interval.

4. Existing surface (0 foot bgs) and 10 feet bgs for sampling locations in an area expected to be covered by fill material.

Additionally, at one sampling location (GNC1-BF20), soil physical parameter data were collected at 20 feet and every subsequent 10-foot interval until groundwater was reached.

The analytical sample results were then divided into surface (0- to 2-foot depth), subsurface (2- to 10-foot depth), and deep (>10-foot depth) layers, according to the following rules:

- **Rule 1: IF** the sample was collected in a relatively flat (ungraded) part of the Site (i.e., an area not targeted for substantial grading), **THEN** the depth of the collected soil sample is used to designate its soil layer grouping.

- **Rule 2: IF** the sample was collected in a part of the Site targeted for substantial grading, **AND** the sampled soil is located in an area expected to be covered by fill material (e.g., exposed excavated surfaces of ponds), **THEN** the current surface soil sample is classified as a surface (0- to 2-foot depth) sample, and the soil layer grouping of the remaining deeper sampled soil is determined based on the difference between its elevation and the final (post-graded) surface elevation in that part of the Site.

- **Rule 3: IF** the sample is collected in a part of the Site targeted for substantial grading, **AND** the cut depth is expected to be greater than 2 feet, **AND** the sampled soil is expected to be used as surface fill (e.g., soil within a berm), **THEN** the current surface soil sample is classified as a fill material sample, a final (post-graded) surface sample is classified as a surface (0- to 2-foot depth) sample, and the soil layer grouping of the remaining deeper sampled soil is determined based on the difference between its elevation and the final (post-development, graded) surface elevation in that part of the Site.

- **Rule 4: IF** the sample is collected in a part of the Site targeted for substantial grading, **AND** the cut depth is expected to be less than 2 feet, **AND** the sampled soil is expected to be used as surface fill (e.g., soil within a berm), **THEN** the current surface soil sample is classified as both a fill material sample and as a surface (0- to 2-foot depth) sample, and the soil layer grouping of the remaining deeper sampled soil is determined based on the difference between its elevation and the final (post-graded) surface elevation in that part of the Site.

A schematic example of these rules is shown on Figure 9. The Redevelopment Grading Plan for the Site is shown on Figure 2.[10] The sample-specific collection depths are presented in Table 3-1 (Tables section).

As noted above, soil samples were generally collected over a 2- to 3-foot depth interval. This was because of volume of soil required for completion of all analyses. The 10 feet bgs (and deeper) samples were collected in 2- to 3-foot intervals centered on 10 feet (or centered on the deeper sampling depth as indicated in Table 3-1). Confirmation samples, which usually have a shortened analyte list, were collected over a smaller sampling interval. Contamination by the historical manufacturing processes upgradient is usually found predominantly in surface soils. The objective of remedial actions at the Site was to remove surface soils that were impacted by surface releases of off-site chemicals. Therefore, higher concentrations are expected – and have been generally observed – in surface samples. However, to adequately characterize the vertical extent of possible contamination, one or more deeper samples were also collected at each sampling location, as described above.

As discussed in Section 6.1.1, given the potential for change to the prospective grading plan, these samples were classified into two different exposure depths: surface and all (surface and subsurface) depths. These different soil exposure depth classifications are considered to represent all possible exposure potential for all receptors, and thus a reasonable worst-case scenario has been assessed.

Although some samples are designated as Fill samples, the grading across the Site is anticipated to be primarily shallow grading with limited 'cut' areas. The separate evaluation of fill data is done primarily to determine if fill material from a particular sub-area can be used elsewhere. Given the limited amount of cut areas across the Site, the few samples designated as 'Fill,' that more fill areas exist than cut areas, and that the limited amount of fill material will likely be used with the Site, the separate evaluation of the fill data was not conducted for the Site.

Initial sampling for the Site was conducted in January and February 2009. All soil samples were tagged in the database with numeric designations of their corresponding assigned soil layer grouping based on the rules presented above. During these initial sampling events (Table 3-1), 51 soil samples were collected from 23 locations (including field duplicates, but not including deep

[10] Note that the grading plan is reflected in an Environmental Covenant for the Site as a condition to receiving an NFAD from NDEP.

samples collected for soil physical parameter data).[11] This included 15 "random"[12] and eight "biased" sample locations. At these locations, BRC initially collected 28 surface samples (one at each location, and duplicates at five locations in accordance with the duplicate frequency specified in the *BRC Quality Assurance Project Plan* (QAPP; BRC and ERM 2009a) and 23 subsurface soil samples. Three of the surface soil samples also represent Fill samples. All sampling results are presented electronically on the report CD in Appendix B, and in Tables B-1 through B-12.

## 3.2 CHEMICALS SELECTED FOR ANALYSIS

The analyte list for soil samples collected during the initial 2009 investigation comprised the BRC project SRC list, and was consistent with the analytical program presented in Section 3 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010)[13] and Table 3-2 (Tables section), with the following exceptions for this Site:

- Asbestos and dioxins/furans were only analyzed for in surface soil samples.[14]
- USEPA Method 8141A for organophosphorus pesticides was not conducted. There have been only 47 detections of these compounds in over 10,000 soil sample records (<0.5 percent) from throughout the Eastside, and no detections in any soil sample records associated with prior sampling within the Site. The few detections are well below the NDEP BCLs.
- USEPA Method 8151A for chlorinated herbicides was not conducted. There have been no detections of these compounds in over 1,400 soil sample records from throughout the Eastside. Detection limits are below the NDEP BCLs.

[11] Note that in Table 3-4, which summarizes the analyses performed on Site samples, the number of samples reported in that table for a given analysis does not always equal 51. This is due to (1) inclusion in the final dataset of supplemental samples collected to assess the extent of chemical impacts in certain areas; (2) certain analytes were not included in the subsurface samples, as noted in the following section; and (3) rejected data are not included in the statistical summary in Table 3-4.
[12] As noted before, in some cases, random sampling locations were shifted slightly to address debris locations.
[13] Specific analytes and analyte-specific reporting limits for each analysis are listed in Table 4 of the QAPP.
[14] Note that all samples collected at the Site were discrete samples, with the exception of asbestos samples, which were composite samples collected as per the NDEP-approved Standard Operating Procedure [SOP]-12 as provided in the *Field Sampling and Standard Operating Procedures* [FSSOP; BRC, ERM and MWH 2009]).

- HPLC Method for organic acids was not conducted. There have been only three detections of these compounds in 567 soil sample records (<0.5 percent) from throughout the Eastside. Moreover, the NDEP has not established BCLs for these compounds.

- USEPA Method 8015B for non-halogenated organics (e.g., methanol and glycols) was not conducted. There have been only five detections of these compounds in 420 soil sample records (1 percent) from throughout the Eastside. The few detections have been well below the NDEP BCLs.

- USEPA Method 8015 for total petroleum hydrocarbons (TPH) was not conducted. There have been only three detections of these compounds in over 299 soil sample records (1 percent) from throughout the Eastside. The few detections have been below 100 mg/kg, which is the typical low-end aesthetic threshold used for these compounds There are no indications of possible TPH source areas (e.g., abandoned vehicles, dumping of oils/hydraulic fluids) at the Site. While TPH was not analyzed for, its components were via other methods. In addition, TPH cannot be included in a risk assessment while its components can.

- Consistent with the current project analyte list, the following radionuclides were analyzed for: radium-226, radium-228, thorium-228, thorium-230, thorium-232, uranium-233/234, uranium-235/236, and uranium-238.

The soil analyte list consisted of 280 of the 418 compounds (including water-only parameters) on the project SRC list, as well as physical parameters to support the evaluation of potential impacts to groundwater from migration of chemicals from soil. The analytical and preparatory methods (Table 3-2) used in accordance with the SAP adhered to the most recent version of the BRC QAPP (BRC and ERM 2009a; see Section B4, Table 4 of that document). As noted in Section 3.6, the analyte list for surface flux samples was composed of the list specified in the NDEP-approved Standard Operating Procedure (SOP)-16, as provided in the *Field Sampling and Standard Operating Procedures* (FSSOP; BRC, ERM and MWH 2009). Surface flux samples were analyzed for VOCs by USEPA Method TO-15 full scan, plus selective ion mode (SIM) analyses for a subset of the analytes.

## 3.3 INTERMEDIATE SAMPLING AND CLEANUP

### 3.3.1 2009 Removal Action

All initial data were reviewed and a determination made, in consultation with the NDEP, as to whether localized soil removals were warranted. In September 2009, BRC submitted a RAWP (BRC 2009) to the NDEP. This RAWP was approved by the NDEP on September 22, 2009. The overall goal of the RAWP was to present a cleanup strategy for the Site that effectively minimized, to the extent feasible, the human health risks associated with the identified soil in the impacted areas of the Site.

There were four different remediation areas proposed for the Site: two ditch locations (which contained elevated SVOCs, polynuclear aromatic hydrocarbons (PAHs), and/or dioxins/furans/PCB congeners) and two non-ditch areas (which contained elevated metals and/or dioxins/furans/PCB congeners). Remediation was proposed by excavation and removal of impacted soils to the CAMU. The extent of the excavations is depicted in Figure 10.

The non-ditch remediation areas were developed based on a Thiessen map overlaid across the Site. Thiessen maps are constructed from a series of polygons formed around each sampling location. Thiessen polygons are created so that every location within a polygon is closer to the sampling location in that polygon than any other sampling location. These polygons do not take into account the respective concentrations at each location. These polygons were used as the basis for the areal extent of remediation for each of the non-ditch locations with elevated dioxins/furans/PCB congeners or metals levels. There were two polygons associated with elevated chemical levels that were remediated at the Site. These polygons were centered around (1) locations GNC1-BE20/GNC1-JS09/GNC1-JS10 and (2) GNC1-BE22. In August 2009, four supplemental samples (GNC1-JA04 through JA07) were collected from the southern half of the Site and analyzed for dioxins/furans/PCB congeners to provide further delineation of the extent of elevated levels detected in this area.

For the ditch locations, the remediation area was centered about the initial sampling locations that triggered remediation (GNC1-JD07 for dioxins/furans/PCB congeners and GNC1-JD09 for PAHs and SVOCs). The extent of excavation at both of these areas was a 50-foot-wide segment of the ditch, extended such that the limits of excavation reached half the distance to the adjacent ditch samples to the north and south.

Following remediation, confirmation surface soil samples were collected at each of the original sample locations associated with the remediation area polygons and ditch segments described above (i.e., GNC2-BE20C, GNC2-BE22C, GNC2-JS09C, GNC2-JS10C, GNC2-JD07C, and GNC2-JD09C[15]). All sampling locations are shown on Figure 11. The analyte list was composed of those chemicals that triggered the remediation at each sampling location. These included dioxins/furans/PCB congeners, metals, SVOCs, and PAHs.

### 3.3.2 2010 Removal Action

Following the review of data collected from the 2009 remedial action, four additional remediation areas were identified for the Site (Figure 10). These areas were part of a larger remediation plan for the northern portion of the entire Eastside property. BRC did not submit a formal work plan to the NDEP for conducting remediation at these areas, but discussed the planned excavations with the NDEP in June 2010. The rationale for each additional remediation area is reiterated below.

- Supplemental sampling location GNC1-JA04; this sample was collected during the first phase of excavation to assess the extent of dioxins/furans/PCB congeners occurrence in the vicinity of the GNC1-BE20/GNC1-JS09/GNC1-JS10 polygon. The detection of dioxins/furans/PCB congeners at TEQ levels above the 50 ppt threshold triggered additional remediation in this area. The remediation area was based on a 50- by 50-foot square area around this sampling location. One confirmation sample and a duplicate were collected from this location (GNC2-JA04). In addition, supplemental samples GNC2-JE01 and -JE02 were collected from the vicinity in April 2010; these two samples were analyzed for dioxins/furans/PCB congeners to provide further delineation of the extent of elevated levels detected in this area. These two samples did not trigger additional excavation.

- Subsequent to the 2009 remedial action, issues regarding the counting rules for asbestos were identified. Based on these issues, the initial asbestos results were re-evaluated. This re-evaluation led to the decision to remediate additional surface areas based on asbestos for sampling locations GNC2-BE20C, GNC2-JS09C, and GNC1-JD10. These remediation areas

[15] The naming convention for confirmation samples uses the same sample identification as the initial (pre-remediation) sample, with an updated numerical prefix. For example, confirmation samples associated with GNC1-JD09 are named GNC2-JD09 (after one round of confirmation sampling) or GNC3-JD09 (after a second scrape and round of confirmation sampling).

were defined using the Thiessen polygon method. Three confirmation samples were collected from these locations (GNC3-BE20, GNC3-JS09C, and GNC2-JD10).

As before, the analyte list was composed of those chemicals that triggered the remediation at each sampling location. These included metals, dioxins/furans/PCB congeners, and/or asbestos.

## 3.4 FINAL CONFIRMATION DATASET

Post-scrape analyses associated with follow-up rounds of remediation focused on the constituents triggering that additional remediation and, therefore, did not include the full suite analyses of the original analytical program. Analytical results from the original SAP dataset were retained for all constituents except those that were re-analyzed after additional scraping. The final confirmation dataset included the following sampling results:

- SAP sampling data, retaining the results that were not superseded by subsequent sampling;
- Data generated after intermediate sampling and remediation (retaining the results that were not superseded by subsequent sampling); and
- Additional samples collected for confirmation after completion of remediation activities.

The soil dataset was subjected to a series of statistical analyses to determine representative exposure concentrations for the sub-area, as described in Sections 4 and 5 of the NDEP-approved *Statistical Methodology Report* (NewFields 2006). Consistent with the project *Statistical Methodology Report*, kriging or geostatistical analysis was not performed on the data because each measurement was assumed to be equally representative for that chemical at any point in each sub-area of the Eastside property. Hence, calculation of the 95 percent upper confidence limit (UCL) by exposure area directly from the data is considered reasonable.

As discussed in Section 4, all data have been validated. Results of all confirmation sampling and analysis are presented in Appendix B, and electronically on the report CD in Appendix B, as is the dataset used in the HHRA for the Site. All confirmation sampling locations for the Site are shown on Figure 11. Table 3-3 provides a matrix of which analytical suite was analyzed for in each of the samples collected from the Site. Geotechnical and Environmental Services (GES) conducted all field work at the Site. The GES field reports, including boring logs, for each investigation are provided electronically in Appendix C (included on the report CD in Appendix B).

## 3.5 FINAL CONFIRMATION DATA SUMMARY

Using the compound-specific information presented in Table 2 of the QAPP (BRC and ERM 2009a), the comparison levels for each chemical included in the investigation were compiled for comparison to Site data. Specific soil comparison levels used for this effort were as follows:

- NDEP BCLs for residential soil (NDEP 2011a);
- NDEP BCLs for protection of groundwater (LBCL), assuming dilution attenuation factors (DAF) of 1 and 20 (NDEP 2011a); and
- The maximum background concentration (for metals and radionuclides only), derived from the background soil dataset presented in Chapter 5.[16]

A DAF of 1 is used when little or no dilution or attenuation of soil leachate concentrations is expected, and a DAF of 20 may be used when significant attenuation of the leachate is expected due to Site-specific conditions. For the Site, the LBCLs based on a DAF of 1 were used for discussion purposes. Data for the Site, including the number of instances in which chemical concentrations exceed each of the comparison levels, are listed in Table 3-4,[17] and summarized below. It is important to note that these comparisons are used to provide for an initial screening evaluation, assist in the evaluation of data usability, and determine the extent of contamination. They are not used for decision-making purposes or as an indication of the risks associated with the Site.

*Aluminum*

Aluminum was detected in all 53 of the soil samples in which it was analyzed for (30 surface and 23 subsurface samples; Table B-4). All of the detections were lower than the 77,200 mg/kg BCL, but were higher than the 75 mg/kg $LBCL_{DAF1}$. However, none exceeded the 15,300 mg/kg maximum background concentration.

[16] This value is used for comparison only; as discussed in Section 5.1, background comparisons were performed for the Site dataset using statistical tests.

[17] Pre-scrape data for the target constituents are not included in Table 3-4. That is, these have been replaced by post-scrape data; however, pre-scrape data for the non-target constituents are included in Table 3-4. Because of this, the total number of analyses does not always coincide with the total number of analyses reported in the tables in Appendix B, which include all data, regardless of status.

*Arsenic*

Arsenic was detected in 51 of the 53 soil samples in which it was analyzed for (30 surface and 23 subsurface samples; Table B-4). All of the detections were higher than the 0.39 mg/kg BCL and the 1 mg/kg $LBCL_{DAF1}$. However, all of the detections were lower than the maximum shallow soil background level (27.6 mg/kg).

In addition, arsenic was reported as a non-detection in two samples (surface soil confirmation samples GNC2-JA04 and a duplicate); the associated analytical reporting limits (5 and 5.1 mg/kg, respectively) are higher than the comparison levels and it is not known whether arsenic is present at concentrations above the comparison levels at this location. However, these analytical reporting limits were sufficiently low to indicate that neither sample contained arsenic at concentrations above background.

*Barium*

Barium was detected in all 53 of the soil samples in which it was analyzed for (30 surface and 23 subsurface samples; Table B-4). None of the detections were higher than the 15,300 mg/kg BCL, but all of the barium detections exceeded the 82 mg/kg $LBCL_{DAF1}$. However, none of the detections exceeded the maximum background concentration of 836 mg/kg.

*Boron*

Boron was detected in seven of the 53 soil samples in which it was analyzed for (30 surface and 23 subsurface samples; Table B-4). None of the detections were higher than the 15,600 mg/kg BCL; however, two of the detections were higher than the 23.4 mg/kg $LBCL_{DAF1}$. These two detections (maximum detection 47.1 mg/kg in the surface soil sample from GNC1-BE19) were lower than the maximum shallow soil background level (57 mg/kg).

Most of the analytical reporting limits were lower than the boron BCL and $LBCL_{DAF1.}$ The five boron non-detections with reporting limits above the 23.4 mg/kg $LBCL_{DAF1}$ (ranging from 51.3 to 53 mg/kg) are associated with confirmation samples (GNC2-BE20C, GNC2-JS09C, and GNC2-JS10C) for locations at which the boron BCL and $LBCL_{DAF1}$ were not exceeded in the original sample.

*Cadmium*

Cadmium was detected in 39 of the 53 soil samples in which it was analyzed for (30 surface and 23 subsurface samples; Table B-4). None of the detections were higher than the 38.9 mg/kg BCL; however, one of the detections was higher than the 0.4 mg/kg $LBCL_{DAF1}$. This detection, which was also higher than the maximum shallow soil background level (0.26 mg/kg), was a surface soil sample collected from GNC1-BE22 (0.44 mg/kg). The analytical reporting limits for non-detections were lower than the BCL and $LBCL_{DAF1}$.

*Cyanide*

Cyanide was detected in 10 of the 51 soil samples in which it was analyzed for[18] (28 surface and 23 subsurface samples; Table B-3). None of the detections were higher than the 1,220 mg/kg BCL; however, one of the detections was higher than the 2 mg/kg $LBCL_{DAF1}$. This detection was a surface soil sample collected from GNC1-BF19 (5.8 mg/kg). The analytical reporting limits for non-detections were sufficiently low such that BCL or $LBCL_{DAF1}$ exceedances would have been observed.

*Total Chromium*

Total chromium was detected in all 53 of the soil samples in which it was analyzed for (30 surface and 23 subsurface samples; Table B-4). None of the detections were higher than the 100,000 mg/kg BCL, but all total chromium detections were higher than the 2 mg/kg $LBCL_{DAF1}$. Of these, three detections were higher than the 24.2 mg/kg maximum background detection. These three total chromium exceedances higher than background are as follows:

- GNC1-BF21 at 0 foot bgs: 24.8 mg/kg;
- GNC1-JD10 at 0 foot bgs: 31.2 mg/kg; and
- GNC1-BE22 at 0 foot bgs: 62.8 mg/kg.

[18] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. Cyanide analysis was only performed for initial SAP samples (i.e., was not included in the analyses for confirmation samples); thus the tally of cyanide analyses is lower than for some of the other analytical suites, such as metals.

*Iron*

Iron was detected in all 53 of the soil samples in which it was analyzed for (30 surface and 23 subsurface samples; Table B-4). None of the detections were higher than the 54,800 mg/kg BCL, but all detections were higher than the 7.56 mg/kg $LBCL_{DAF1}$. Of these, three detections were higher than the 22,500 mg/kg maximum background detection. These three iron exceedances higher than background are as follows:

- GNC2-JA04 at 0 foot bgs: 25,600 mg/kg;
- GNC1-BE22 at 0 foot bgs: 26,900 mg/kg; and
- GNC2-JA04 at 0 foot bgs: 27,300 mg/kg.

*Magnesium*

Magnesium was detected in all 53 of the soil samples in which it was analyzed for (30 surface and 23 subsurface samples; Table B-4). None of the detections were higher than the 100,000 mg/kg BCL, but all detections were higher than the 649 mg/kg $LBCL_{DAF1}$. However, all but one of the magnesium detections were lower than the 17,500 mg/kg maximum background detection. That exceedance (28,500 mg/kg) was associated with a soil sample collected from 11 feet bgs at GNC1-BF19.

*Manganese*

Manganese was detected in all 53 of the soil samples in which it was analyzed for (30 surface and 23 subsurface samples; Table B-4). Of these detections, none were higher than the 1,820 mg/kg BCL; however, all detections were higher than the 3.26 mg/kg $LBCL_{DAF1}$. All of the manganese detections were lower than the maximum background concentration for manganese (2,070 mg/kg).

*Mercury*

Mercury was detected in 16 of the 53 soil samples in which it was analyzed for (30 surface and 23 subsurface samples; Table B-4). None of the detections were higher than the 23.5 mg/kg BCL. However, one detection (0.122 mg/kg) was higher than the 0.105 mg/kg $LBCL_{DAF1}$ (surface soil sample collected at GNC2-BE20C). This detection was also higher than the 0.11 mg/kg maximum background detection. The exceedance was associated with a duplicate sample; the original sample detection (0.0614 mg/kg) was lower than the $LBCL_{DAF1}$ and was

within the background range. The analytical reporting limits for non-detections were lower than the BCL and $LBCL_{DAF1}$.

*Nickel*

Nickel was detected in all 53 of the soil samples in which it was analyzed for (30 surface and 23 subsurface samples; Table B-4). None of these detections exceeded the 1,540 mg/kg BCL, but all were higher than the 7 mg/kg $LBCL_{DAF1}$. However, all of the detections were lower than the maximum background concentration for nickel (30 mg/kg).

*Selenium*

Selenium was detected in one of the 53 soil samples in which it was analyzed for (30 surface and 23 subsurface samples; Table B-4). That detection (0.47 mg/kg in a soil sample collected from 11 feet bgs at GNC1-JD11) was lower than the 391 mg/kg BCL, but it was higher than the 0.3 mg/kg $LBCL_{DAF1}$. However, this detection was lower than the 0.6 mg/kg maximum background detection. The analytical reporting limits for the non-detections (0.4 mg/kg standard reporting limit) were lower than the BCL; however, they were higher than the $LBCL_{DAF1,}$ such that exceedances would not necessarily have been observed.

*Other Inorganics*

As seen in Table 3-4 (Tables section) and Tables B-3 and B-4 in Appendix B, several inorganic constituents in addition to those listed above were routinely detected in soil samples. None of these additional inorganic constituents were detected at concentrations in excess of either the BCL or the $LBCL_{DAF1}$. In all cases, except as noted below, the analytical reporting limits for these additional inorganic constituents were lower than the BCL and $LBCL_{DAF1}$.

Exceptions included:

- Antimony, for which the standard reporting limit was 0.315 mg/kg (0.3 mg/kg $LBCL_{DAF1}$); and
- Thallium, for which the standard reporting limit was 0.75 mg/kg (0.4 mg/kg $LBCL_{DAF1}$).

*Organochlorine Pesticides*

Organochlorine pesticides were analyzed for in 51 soil samples[19] (28 surface and 23 subsurface samples; Table B-5). The following constituents were detected in at least one sample:

- 2,4-DDE
- 4,4-DDD
- 4,4-DDE
- 4,4-DDT
- alpha-BHC
- beta-BHC
- alpha-Chlordane
- Chlordane
- Endosulfan sulfate
- Endrin
- Endrin aldehyde
- gamma-Chlordane
- Methoxychlor

4,4-DDE, 4,4-DDT, and beta-BHC were the most commonly detected (in more than 35 percent of the samples in which they were analyzed for). None of the detections were higher than the BCL, and most of the detections (exceptions are noted, below) were lower than the $LBCL_{DAF1}$. There was one alpha-BHC detection (0.0022 mg/kg) that was higher than the 0.00003 mg/kg $LBCL_{DAF1,}$ and all 18 of the beta-BHC detections were higher than the 0.0001 mg/kg $LBCL_{DAF1}$. The 18 $LBCL_{DAF1}$ beta-BHC exceedances were associated with the samples listed in Table 3-5.

**TABLE 3-5: BETA-BHC DETECTIONS GREATER THAN $LBCL_{DAF1}$**

| Sample ID | Depth (ft bgs) | Reported Value (mg/kg) |
|---|---|---|
| GNC1-JS09 | 0 | 0.0022 |
| GNC1-JS09 | 0 | 0.0027 |
| GNC1-JD10 | 0 | 0.0027 |
| GNC1-JS11 | 0 | 0.0031 |
| GNC1-BD20 | 0 | 0.0037 |
| GNC1-BG19 | 0 | 0.004 |
| GNC1-BE20 | 0 | 0.0043 |
| GNC1-BE19 | 0 | 0.0043 |
| GNC1-BE22 | 0 | 0.0047 |

| Sample ID | Depth (ft bgs) | Reported Value (mg/kg) |
|---|---|---|
| GNC1-BF20 | 0 | 0.0048 |
| GNC1-JS11 | 0 | 0.0048 |
| GNC1-BF22 | 0 | 0.0054 |
| GNC1-BD21 | 0 | 0.0095 |
| GNC1-JS10 | 0 | 0.0099 |
| GNC1-BG20 | 0 | 0.011 |
| GNC1-BE20 | 0 | 0.013 |
| GNC1-BG20 | 0 | 0.014 |
| GNC1-BF21 | 0 | 0.019 |

The standard analytical reporting limits for most organochlorine pesticides were lower than the comparison levels. The exceptions are alpha- and beta-BHC, for which the reporting limits were routinely higher than the $LBCL_{DAF1}$.

[19] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. Organochlorine pesticide analysis was only performed for initial SAP samples (i.e., was not included in the analyses for confirmation samples); thus the tally of organochlorine pesticide analyses is lower than for some of the other analytical suites, such as metals.

*Volatile Organic Compounds*

VOCs were analyzed for in 51 soil samples[20] (28 surface and 23 subsurface samples; Table B-10). As seen in Table 3-4 and Table B-10, the following 11 VOCs were detected in at least one sample:

- 1,2,4-Trimethylbenzene
- 1,2-Dichlorobenzene
- 1,3,5-Trimethylbenzene
- 1,3-Dichlorobenzene
- 1,4-Dichlorobenzene
- Acetone
- Dichloromethane
- Ethylbenzene
- Nonanal
- n-Propylbenzene
- Toluene

1,2,4-Trimethylbenzene and dichloromethane were detected the most frequently, in approximately 33 and 47 percent of the samples, respectively. None of the detections were above the BCL. With the exception of dichloromethane, the VOC detections were also lower than the $LBCL_{DAF1}$. Dichloromethane was detected in the 24 soil samples listed in Table 3-6 at concentrations in excess of the 0.001 mg/kg $LBCL_{DAF1}$.

**TABLE 3-6: DICHLOROMETHANE DETECTIONS GREATER THAN $LBCL_{DAF1}$**

| Sample ID | Depth (ft bgs) | Reported Value (mg/kg) |
|---|---|---|
| GNC1-BE20 | 0 | 0.0014 |
| GNC1-JS09 | 0 | 0.0027 |
| GNC1-JD07 | 10 | 0.0028 |
| GNC1-JD07 | 0 | 0.0031 |
| GNC1-BD20 | 0 | 0.0032 |
| GNC1-JS09 | 10 | 0.0033 |
| GNC1-BD20 | 10 | 0.0039 |
| GNC1-JS10 | 0 | 0.0041 |
| GNC1-JS10 | 10 | 0.0046 |
| GNC1-BD21 | 0 | 0.0051 |
| GNC1-BD19 | 10 | 0.0083 |
| GNC1-BD19 | 0 | 0.0099 |

| Sample ID | Depth (ft bgs) | Reported Value (mg/kg) |
|---|---|---|
| GNC1-BE20 | 0 | 0.011 |
| GNC1-JD09 | 10 | 0.014 |
| GNC1-BD21 | 10 | 0.015 |
| GNC1-JD08 | 10 | 0.015 |
| GNC1-JD08 | 0 | 0.016 |
| GNC1-JD09 | 0 | 0.016 |
| GNC1-BG21 | 10 | 0.017 |
| GNC1-JD09 | 0 | 0.017 |
| GNC1-BG22 | 0 | 0.018 |
| GNC1-BG22 | 10 | 0.018 |
| GNC1-BE19 | 0 | 0.019 |
| GNC1-JS09 | 0 | 0.028 |

[20] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. VOC analysis was only performed for initial SAP samples (i.e., was not included in the analyses for confirmation samples), thus the tally of VOC analyses is lower than for some of the other analytical suites, such as metals.

It should be noted that the analytical reporting limits for dichloromethane were often higher than the $LBCL_{DAF1}$; therefore, concentrations in excess of this comparison level, if present, could have potentially gone unreported. For the other VOCs, the standard reporting limits were lower than the BCL and $LBCL_{DAF1}$.

*Semi-Volatile Organic Compounds*

SVOCs were analyzed for in 49 soil samples[21] (26 surface and 23 subsurface samples; Table B-9). As seen in Table 3-4 and Table B-9, the following SVOCs were detected in one or more samples:

- Benzoic acid
- bis(2-ethylhexyl)Phthalate
- Butylbenzyl phthalate
- Di-n-butyl phthalate
- Fluoranthene
- Phthalic acid

Fluoranthene was detected the most often, in 12 percent of the samples. All SVOC detections were lower than the BCL and the $LBCL_{DAF1}$. For SVOC non-detects, the standard reporting limits were lower than the BCL, except for dichloromethyl ether, which routinely had analytical reporting limits higher than the BCL.

For several other SVOC non-detections, the analytical reporting limits are higher than the $LBCL_{DAF1}$, and it is unknown whether these constituents are present in those samples at concentrations in excess of the $LBCL_{DAF1.}$ The constituents with reporting limits routinely higher than the $LBCL_{DAF1}$ are as follows:

- 2,2'-Dichlorobenzil
- 2,4,6-Trichlorophenol
- 2,4-Dichlorophenol
- 2,4-Dinitrophenol
- 2,4-Dinitrotoluene
- bis(2-chloroethyl)Ether
- Hexachloroethane
- Isophorone
- Nitrobenzene
- n-Nitrosodi-n-propylamine

[21] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. The tally of SVOC analyses is lower than for some of the other analytical suites, such as metals because SVOC analysis was inadvertently not performed at one location (10 feet bgs sample from GNC1-BE21) and two pre-scrape samples (GNC1-JD09 and its duplicate) were superseded by a single confirmation sample.

- 2,6-Dinitrotoluene
- 3,3'-Dichlorobenzidine
- p-Chloroaniline
- Pentachlorophenol

*Dioxins and Furans*

For dioxins/furans, as discussed in Section 1.1, the USEPA TEQ procedure, developed to describe the cumulative toxicity of these compounds, is used. Dioxins and furans were analyzed for in 35 surface soil samples[22] (Table B-2). All of the individual dioxins and furans congeners analyzed were reported as detections in at least one sample. None of the samples analyzed had calculated TCDD TEQ concentrations in excess of the NDEP BCL of 50 ppt. $LBCL_{DAF1}$ values have not been established for dioxin/furans, thus the potential for impacts to groundwater quality due to their presence could not be assessed by comparisons to the $LBCL_{DAF1}$.

*Polychlorinated Biphenyls*

PCBs were analyzed for in 35 surface soil samples[23] (individual PCB congeners) (Table B-7). All of the PCB congeners were detected in at least one sample. BCL values have not been established for individual congeners. PCB congeners are included in the calculation of the TCDD TEQ, and are evaluated in this manner, not on an individual congener basis. $LBCL_{DAF1}$ values have not been established for individual PCB congeners.

*Polynuclear Aromatic Hydrocarbons*

PAHs were analyzed for in 51 soil samples[24] (28 surface, 23 subsurface; Table B-6); each PAH constituent was detected in at least one soil sample. The PAH detections did not exceed either the BCL or the $LBCL_{DAF1}$ where established. The standard PAH analytical reporting limits were lower than the BCL and the $LBCL_{DAF1}$, thus concentrations in excess of these comparison levels, if present, would have been reported.

[22] This tally includes field duplicates and confirmation samples.
[23] This tally includes field duplicates and confirmation samples.
[24] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. The tally of PAH analyses is lower than for some of the other analytical suites, such as metals because PAH analysis was not performed at one location (10 feet bgs samples from GNC1-BE21), and two pre-scrape samples (GNC1-JD09 and its duplicate) were superseded by a single confirmation sample.

*Aldehydes*

Aldehydes were analyzed for in 51 soil samples[25] (28 surface and 23 subsurface samples; Table B-9). Acetaldehyde was detected in one sample, and formaldehyde was detected in 30 samples. None of the detections exceeded the BCL. The analytical reporting limits were lower than the BCL, thus concentrations in excess of the BCL, if present, would have been reported. $LBCL_{DAF1}$ values have not been established for these compounds.

*Radionuclides*

Radionuclides were detected in all 50 of the soil samples analyzed[26] (28 surface and 22 subsurface soil samples; Table B-8). Exceedances of comparison levels for radionuclides are shown in Table 3-4 for the eight radionuclides currently included in the project analyte list (radium-226, radium-228, thorium-228, thorium-230, thorium-232, uranium-233/234, uranium-235/236, and uranium-238). Of those activities greater than comparison levels, most are lower than the maximum background activity, as shown in Table 3-4. As seen in that table, only uranium-235/236 was reported at activities higher than comparison levels and background. Uranium-235/236 activities were higher than the 0.11 picoCurie per gram (pCi/g) BCL in five samples. However, only two of the detections were higher than the 0.241 pCi/g maximum background activity. Those results are as follows:

- GNC1-BG21 at 10 feet bgs: 0.274 mg/kg; and
- GNC1-JD07 at 10 feet bgs: 0.31 mg/kg.

An $LBCL_{DAF1}$ has not been established for this constituent.

As presented in NDEP guidance (NDEP 2009a), as part of the process used to evaluate radionuclide data for the BMI Common Areas, BRC assessed whether radionuclides are in

[25] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. Aldehyde analysis was only performed for initial SAP samples (i.e., was not included in the analyses for confirmation samples); thus the tally of aldehyde analyses is lower than for some of the other analytical suites, such as metals.

[26] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. Radionuclide analysis was only performed for initial SAP samples (i.e., was not included in the analyses for confirmation samples). In addition, radionuclide analysis was not performed at one location (10 feet bgs samples from GNC1-BE21. Thus the tally of radionuclide analyses is lower than for some of the other analytical suites, such as metals.

secular equilibrium. As discussed in Section 5.1, secular equilibrium is an indication of background conditions.

The data indicate that radionuclides are in secular equilibrium at the Site. Specifically, the mean radioactivities for the Thorium-232 decay chain (i.e., thorium-232, radium-228, and thorium-228) are comparable (1.4, 1.3, and 1.4 pCi/g, respectively). Similarly, the mean values for the uranium-238 decay chain (uranium-238, uranium-233/234, thorium-230, and radium-226) are also comparable, ranging from 0.96 to 1.2 pCi/g. All of the mean values are lower than their respective maximum background activity levels. A quantitative evaluation of secular equilibrium is presented in Section 5.1.

*Summary of Soil Exceedances*

As summarized above and in the associated data tables (Table 3-4 and Appendix B), some BCL and $LBCL_{DAF1}$ exceedances are currently observed in Site soils. The following constituents were reported at concentrations higher than the BCL and the maximum shallow background concentration (where applicable):

- Uranium-235/236 (2 samples)

The following constituents were reported at concentrations higher than the $LBCL_{DAF1}$ and the maximum shallow background concentration (where applicable):

- Cadmium (1 sample)
- Total chromium (3 samples)
- Iron (3 samples)
- Magnesium (1 sample)
- Mercury (1 sample)
- Cyanide (1 sample)
- alpha-BHC (1 sample)
- beta-BHC (18 samples)
- Dichloromethane (24 samples)

BRC's evaluation of the data revealed that the surface soil sample at one location (GNC1-BE22) exhibited elevated concentrations of several metals. This sample exhibited the maximum detections reported for any Site samples for the following metals: cadmium, chromium, hexavalent chromium, cobalt, copper, lead, molybdenum, and tin. Elevated concentrations of dioxins/furans, organochlorine pesticides, PAHs, and PCBs were also reported in this sample, but only the dioxins/furans/PCB congeners detections were high enough to trigger remediation.

The confirmation sample collected after remediation (GNC2-BE22C) indicated that dioxins/furans/PCB congener detections had been significantly reduced. Following procedures defined in the SAP, this confirmation sample was not analyzed for constituents that did not trigger remediation, and post-remediation concentrations of metals, remaining organochlorine pesticides, and PAHs are unknown for this location. It is likely that the low concentrations for these constituents have also been reduced. Sample location GNC1-BE22 was a biased sample location that coincided with debris pile #53. This debris area was described in Table 3 of the SAP as being an area of approximately 20-foot radius, consisting of concrete debris, rags, soil stockpiles, carpet, lumber, and circuit boards. Because all of the metal, organochlorine pesticide and PAH detections were lower than their respective BCL (or the maximum background concentration) and because the sample location was subsequently excavated during remediation, it is not appropriate to consider the associated data as a hot spot or a separate exposure area in the HHRA.

The limited number of BCL and $LBCL_{DAF1}$ exceedances indicates that there is a low likelihood of adverse impacts to human health and the environment due to residual chemical concentrations in Site soils. Consistent with the methodology in the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), an HHRA was conducted to further evaluate this possibility, as discussed in subsequent sections of this report. In addition, using the SESOIL and VLEACH unsaturated zone leaching models, BRC evaluated the potential impacts to groundwater quality due to residual chemical concentrations, as summarized in Section 9.

## 3.6 SURFACE FLUX SAMPLING

Concurrent with the confirmation soil sampling, BRC implemented surface flux sampling across the Site. This sampling conformed to the most recent NDEP-approved version of SOP-16 (BRC, ERM, and MWH 2009). The sampling procedure for the effort included the USEPA surface emission isolation flux chamber (flux chamber) sampling to support an air pathway analysis for the Site.

It should be noted that while radon samples were collected, they are not included in this HHRA for the following reason: BRC recently submitted a technical memorandum to the NDEP (BRC 2010), in which the results of recent radon testing performed in groundwater and indoor air samples were presented. Based on the findings of this memorandum, the NDEP concluded that HHRAs for Eastside property sub-areas do not need to evaluate the pathway of radon migration from groundwater to indoor air for sub-areas with a separation distance of at least 15 feet between any current or future building structure base and the high water table (letter dated

November 9, 2010, from Greg Lovato, NDEP, to Mark Paris, BRC). Based on this conclusion and given the depth to groundwater at the Site is at least 25 feet bgs, the intrusion of radon into indoor air is not evaluated in the HHRA. Furthermore, as discussed in Section 5.1, other radionuclides are consistent with background levels, which indicate that radon should also be consistent with background, naturally occurring levels in soil.

The flux chamber sample collection rationale was based on the project goal of obtaining a representative dataset of air emissions per sub-area. Flux chamber samples were collected from 15 locations (Figure 11): 11 random sampling locations and four biased locations (and one duplicate). This density of sample collection is considered adequate for sub-area characterization given the biased nature of the sample locations, the size of the sub-area, and the number of sample locations suggested by the USEPA (1986) in the flux chamber User's Guide for assessing zones of homogeneous site properties.

The analyte list for surface flux samples is composed of the list provided in the most recent NDEP-approved version of SOP-16 (BRC, ERM, and MWH 2009). This analyte list is provided in Table 3-7, and consists of the USEPA Method TO-15 full scan, plus SIM analyses for a subset of the analytes. The analytical results are summarized in Table B-11 (Appendix B), and the principal investigator Report of Findings (which includes descriptions of sampling procedures) is provided in Appendix D (included on the report CD in Appendix B).[27] It should be noted that, in addition to VOC data for the Site, the flux chamber report also contains data for the remainder of the Galleria North sub-area outside the Site boundaries. Data collected from outside the Site boundaries are not included in this HHRA. A data summary for the flux chamber sample results is provided in Table 3-8.

As seen in Tables 3-8 and B-11, 35 organic constituents were detected in at least one surface flux sample. The most commonly detected constituents were benzene, carbon tetrachloride, chloroform, and tetrachloroethene, which were detected in more than 85 percent of the samples using the SIM method. Nearly all of the detections were qualified with "J" flags, indicating the reported concentrations were estimated. The highest concentrations were of acetone (0.247 $\mu g/m^2,min^{-1}$ at GNC1-BE20 and 0.206 $\mu g/m^2,min^{-1}$ at GNC1-BE21) and dichloromethane (0.239 $\mu g/m^2,min^{-1}$ at GNC1-BE21). Both these constituents are common laboratory contaminants.

[27] Note that this report was prepared prior to data validation; therefore, data qualifiers may differ from those in the remainder of this report.

As discussed in Section 4, all data have been validated. The HHRA surface flux dataset for the Site is included on the report CD in Appendix B. Surface flux sample locations are shown on Figure 11.

## 3.7 LEACHATE DATA

As specified in the SAP, one sample collected within the Site during the initial sampling event was submitted for synthetic precipitation leaching procedure (SPLP) analysis.[28] This sample was collected from location GNC1-BE21 at 10 feet bgs. This soil sample was analyzed for aldehydes, general chemistry and ions, metals, organochlorine pesticides, PAHs, radionuclides, and SVOCs. As noted in the SAP, these constituents are considered those of greatest concern for potential migration and impacts to groundwater. Data associated with this SPLP sample are summarized in Appendix B, Table B-12. For reference, Table B-12 includes constituent-specific comparison levels (viz., NDEP's residential water BCLs and USEPA Maximum Contaminant Levels). As summarized in Table B-12, there were few detections in the leachate sample from GNC1-BE21. All of the detections in this leachate sample were inorganic constituents (i.e., general chemistry and ions, metals and radionuclides); organic compounds were not detected. Of these detections, only perchlorate (0.148 milligrams per liter [mg/L]) and arsenic (0.0034 mg/L) detections were higher than their respective comparison levels. Potential impacts to groundwater are further evaluated in Section 9.

[28] SPLP analysis was prepped per USEPA Method 1312 - West solution pH 4.95 with 60/40 weight sulfuric/nitric acid.

# 4.0 DATA EVALUATION

This section describes the procedures used to evaluate the acceptability of data for use in the risk assessment. Overall quality of sample results is a function of proper sample management. Management of samples began at the time of collection and continued throughout the analytical process. SOPs were followed to ensure that samples were collected and managed properly and consistently and to optimize the likelihood that the resultant data are valid and representative.

The primary objective of the data review and usability evaluation was to identify appropriate data for use in the HHRA. The analytical data were reviewed for applicability and usability following procedures in USEPA's *Guidance for Data Usability in Risk Assessment (Part A)* (1992a) and *Risk Assessment Guidance for Superfund: Volume I* (1989), and the NDEP's *Supplemental Guidance for Assessing Data Usability for Environmental Investigations at the BMI Complex and Common Areas* (2008a). A quality assurance/quality control (QA/QC) review of the analytical results was conducted during the sampling events. According to the USEPA Data Usability Guidance, there are six principal evaluation criteria by which data are judged for usability in risk assessment. The six criteria are:

- Reports to risk assessor (availability of information associated with Site data);
- Documentation;
- Data sources;
- Analytical methods and detection limits;
- Data review; and
- Data quality indicators (DQIs), including precision, accuracy, representativeness, comparability, and completeness (PARCC).

A summary of these six criteria for determining data usability is provided below. In addition to the six principal evaluation criteria, the NDEP's Data Usability Guidance includes a step for data usability analysis, which is discussed after these six USEPA evaluation criteria. Data usability evaluation tables are provided electronically in Appendix E (included on the report CD in Appendix B).

## 4.1 CRITERION I – REPORTS TO RISK ASSESSOR (AVAILABILITY OF INFORMATION ASSOCIATED WITH SITE DATA)

The usability analysis of the site characterization data requires the availability of sufficient data for review. The required information is available from documentation associated with the Site data and data collection efforts. Data have been validated as described in the following DVSRs, which are provided electronically in Appendix F:

- *Data Validation Summary Report, Galleria North Sub-Area Soil Investigations, January-March 2009; July-August 2009 (Dataset 60)* (BRC and ERM 2010b), approved by the NDEP on June 14, 2010;
- *Data Validation Summary Report, Sunset North Commercial and Galleria North Sub-Areas 2nd Round Confirmation Soil Investigations – September 2009, December 2009, January 2010 and May 2010 (Dataset 60a)* (BRC and ERM 2010c), approved by the NDEP on September 10, 2010; and
- *Data Validation Summary Report, 2010 Eastside North Confirmation Soil Investigations – April through September 2010 – Part I (Dataset 72a)* (BRC and ERM 2010d), approved by the NDEP on December 21, 2010.

The information sources and the availability of such information for the data usability process are as follows:

- A Site description provided in this report and the NDEP-approved SAPs identifies the location and features of the Site, the characteristics of the vicinity, and contaminant transport mechanisms.
- A Site map with sampling locations is provided on Figure 11.
- Sampling design and procedures were provided in the NDEP-approved SAPs.
- Analytical methods and sample quantitation limits (SQLs) are provided in the dataset file included on the report CD in Appendix B.
- A complete dataset is provided in the dataset file included on the report CD in Appendix B.

- A narrative of qualified data is provided with each analytical data package; the laboratory provided a narrative of QA/QC procedures and results. These narratives are included as part of the DVSRs (BRC and ERM 2010b, c, d).

- QC results are provided by the laboratory, including blanks, replicates, and spikes. The laboratory QC results are included as part of the DVSRs (BRC and ERM 2010b, c, d).

- Data flags used by the laboratory were defined adequately.

- Electronic files containing the raw data made available by the laboratory are included as part of the DVSRs (BRC and ERM 2010b, c, d).

## 4.2 CRITERION II – DOCUMENTATION REVIEW

The objective of the documentation review is to confirm that the analytical results provided are associated with a specific sampling location and collection procedure, using available documentation. For the purposes of this data usability analysis, the chain-of-custody forms prepared in the field were reviewed and compared to the analytical data results provided by the laboratory to ensure completeness of the dataset as discussed in the DVSRs (BRC and ERM 2010b, c, d). Based on the documentation review, all samples analyzed by the laboratory were correlated to the correct geographic location at the Site, as shown on Figure 11. The samples were collected in accordance with the SAP and RAWP (BRC 2009), and the SOPs developed for the BMI Common Areas as provided in the FSSOP (BRC, ERM, and MWH 2009). Field procedures included documentation of sample times, dates, and locations; other sample-specific information such as sample depth was also recorded. Information from field forms generated during sample collection activities was imported into the project database.

The analytical data were reported in a format that provides adequate information for evaluation, including appropriate QC measures and acceptance criteria. Each laboratory report describes the analytical method used, provides results on a sample-by-sample basis along with sample specific SQLs, and provides the results of appropriate QC samples such as laboratory control spike samples, sample surrogates and internal standards, and matrix spike samples. All laboratory reports, except for asbestos, were prepared as provided by the documentation required by USEPA's Contract Laboratory Program (USEPA 2003a, 2004b, c) which includes chain-of-custody records, calibration data, QC results for blanks, duplicates, and spike samples from the field and laboratory, and all supporting raw data generated during sample analysis were also included. Reported analytical results were imported into the project database.

Measurement of asbestos was conducted consistent with the NDEP's *Technical Guidance for the Calculation of Asbestos-Related Risk in Soils* (2009b). The recommended method for providing asbestos data that are useful for risk assessment purposes was performed by EMSL Analytical, Inc., in Westmont, New Jersey. Although this laboratory is not currently certified in Nevada, it does have State of California and U.S. accreditation for asbestos analysis. Because many of the QC procedures associated with other analyses do not apply to asbestos analysis (e.g., laboratory blanks, duplicates and spikes), data validation of the asbestos laboratory reports involved a somewhat lesser level of effort than for other analyses (consistent with the NDEP's *Technical Guidance for the Calculation of Asbestos-Related Risk in Soils*).

## 4.3 CRITERION III – DATA SOURCES

The review of data sources is performed to determine whether the analytical techniques used in the site characterization process (i.e., SAP sampling) are appropriate for risk assessment purposes. The data collection activities specified in the SAP were developed to characterize a broad spectrum of chemicals potentially present on the Site, including asbestos, aldehydes, general chemistry and ions, VOCs, SVOCs, metals, dioxins/furans, PAHs, organochlorine pesticides, radionuclides, and PCBs (SRCs and analyses performed under SAP implementation n are listed in Table 3-2, and Table 3-7 for surface flux samples).[29] Because of the soil removals that have occurred on the Site, data collected prior to SAP implementation had significant gaps and inconsistencies in analytical methodology, and as discussed in Section 2, those historical data are not evaluated further in the data usability process, or the HHRA. Only post-remediation data collected under the SAP (and subsequent RAWPs) are being used in the HHRA, and these were subjected to the formal data usability evaluation described in this section. Figure 11 demonstrates that samples collected in accordance with the SAP are situated across the entire Site; analyses associated with these samples are summarized in Tables 3-2 (soil) and 3-7 (surface flux).

The State of Nevada is in the process of certifying the laboratories used to generate the analytical data. As such, standards of practice in these laboratories follow the quality program developed by the Nevada Revised Statutes and are within the guidelines of the analytical methodologies established by the USEPA. Based on the review of the available information, the data sources for chemical and physical parameter measurements are adequate for use in a risk assessment.

[29] Although radon samples were collected and analyzed for the Site, radon has been evaluated through a separate process and is not considered further in the data usability process (see Section 3.6).

## 4.4 CRITERION IV – ANALYTICAL METHODS AND DETECTION LIMITS

In addition to the appropriateness of the analytical techniques evaluated as part of Criterion III, it is necessary to evaluate if the detection limits are low enough to allow adequate characterization of risks. At a minimum, this data usability criterion can be met through the determination that routine USEPA and U.S. Department of Energy (DOE) reference analytical methods were used in analyzing samples collected from the Site. The USEPA and DOE methods that were used in conducting the laboratory analysis of soil and surface flux samples are identified in the dataset file included on the report CD in Appendix B. Each of the identified methods is considered the most appropriate method for the respective constituent class and each was approved by the NDEP as part of the SAP and RAWPs (BRC 2008, 2009). As recommended by NDEP's guidance on *Detection Limits and Data Reporting* (NDEP 2008b), the laboratory reported SQL was used in evaluating detection limits.

Laboratory practical quantitation limits (PQLs) were based on those outlined in the reference method, the SAP (BRC 2008), and the project QAPP. In accordance with respective laboratory SOPs, the analytical processes included performing instrument calibration, laboratory method blanks, and other verification standards used to ensure QC during the analyses of collected samples.

The range of SQLs achieved in field samples was compared to NDEP BCLs (NDEP 2011a). As seen in the summary of the Site dataset provided in Tables 3-4 (soil) and 3-8 (surface flux), of the standard analytes, only three constituents had SQLs that exceeded their respective residential soil BCLs. Twenty SPLP constituents exceeded their respective residential water BCLs. The SQLs exceedances of NDEP BCLs are discussed below.

- The arsenic SQL in two of 55 sample analyses was higher than the BCL; this constituent was detected in all of the other samples tested. These two results were qualified due to equipment blank contamination and the reporting limits were raised to the PQL.

- Organics with SQLs higher than the BCL were n-nitrosodi-n-propylamine in 39 of 51 samples, and dichloromethyl ether in all 51 samples analyzed. Neither of these compounds was detected in any samples. The n-nitrosodi-n-propylamine SQL was only slightly higher than the BCL. The dichloromethyl ether SQL is greater than 200 times the BCL and a reduction in the SQL is not likely to be easily achieved by the laboratory. Therefore, the analytical SQLs are considered adequate for risk assessment purposes.

- The following analytes have SPLP SQLs higher than their residential water BCL: toxaphene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno-(1,2,3-cd)pyrene, 1,2-diphenylhydrazine, 2,2'-dichlorobenzil, 2,4,6-trichlorophenol, 2,4-dinitrotoluene, 3,3-dichlorobenzidine, bis(2-chloroethyl) ether, bis(2-chloroisopropyl) ether, bis(2-ethylhexyl) phthalate, hexachlorobenzene, hexachlorobutadiene, hexachloro-ethane, nitrobenzene, n-nitrosodi-n-propylamine, and pentachlorophenol. Of these, only benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno-(1,2,3-cd)pyrene, bis(2-ethylhexyl) phthalate were detected in soils. Because the non-detect SPLP data were also not detected in soils, they are not anticipated to be of concern with respect to potential impacts to groundwater. While n-nitrosodi-n-propylamine SQLs also exceeded the soil BCL for the majority of its samples, as noted above, it was only slightly exceeded. For the detected constituents, the soil concentrations were all below the $LBCL_{DAF1}$.

As discussed in the *2008 Supplemental Shallow Soil Background Report* (BRC and ERM 2009b), there are differences in SQLs among datasets that may affect data comparability for datasets comprised primarily of non-detect values. For these datasets, left-censored data can result in difficulties in differentiating whether datasets are actually different or merely an artifact of detection limits.

## 4.5 CRITERION V – DATA REVIEW

The data review portion of the data usability process focuses primarily on the quality of the analytical data received from the laboratory. Soil and surface flux sample data were subject to data validation. DVSRs were prepared as separate deliverables (BRC and ERM 2010b, c, d; Appendix F). The analytical data were validated according to the internal procedures using the principles of USEPA National Functional Guidelines (USEPA 1999, 2004d, 2005a, 2008) and were designed to ensure completeness and adequacy of the dataset. Additionally, the DVSRs were issued utilizing the NDEP's two *Supplemental Guidance on Data Validation* documents (NDEP 2009c, d). Any analytical errors and/or limitations in the data have been addressed and an explanation for data qualification provided in the respective data tables. The results of ERM's data review for these issues are presented in the DVSRs and are summarized below.

Only one data point was rejected (an ammonia result for GNBF19-11). The rejection was due to a very low matrix spike/matrix spike duplicate (MS/MSD) recovery and does not reflect a larger concern for this compound, sample, or method. Data qualifications are discussed in the subsections that follow.

### 4.5.1 Holding Time Exceedances / Sample Condition Qualifications

Holding time refers to the period of time between sample collection and the preparation and/or analysis of the sample. The accuracy of analytical results may depend upon analysis within specified holding times and sample temperature. In general, a longer holding time is assumed to result in a less accurate measurement due to the potential for loss or degradation of the analyte over time. Sample temperature is of greatest concern for VOCs that may volatilize from the sample at higher temperatures. As described in the DVSRs (BRC and ERM 2010b, c, d), sample results were reviewed for compliance with the method-prescribed preparation and analysis holding times.

USEPA guidance for validation allows professional judgment to be used in evaluating qualification due to holding time exceedances. Sample results that were generated after the required holding time but less than two times after the holding time were qualified as estimated (J- or UJ-flagged). If the samples were prepared after two times the holding time was exceeded, non-detect results were qualified as rejected (R). Qualifications to five samples were made on the basis of exceeded holding times (see Table 2-2 of DVSRs 60 and 60a [BRC and ERM 2010b, c]; Appendix F), as follows:

- Hexavalent chromium results for three soil samples in two laboratory data packages (TestAmerica data packages F9A290238 [GNC1-BD19-0 and GNC1-BD19-10, 3 days beyond the method-prescribed 4-day period], F9B120206 [SPLP sample GNC1-BE21-10, 4.5 hours past the holding time], were qualified due to holding time exceedances. The results were qualified as estimated with a potential low bias (UJ).

- Dioxin/furan results associated with soil sample GNC1-JD09-0 and its duplicate were associated with analyses performed one day outside the method-prescribed holding time. The results were qualified as estimated with a potential low bias ("J-") for detections or "UJ" for non-detections.

As noted in the DVSRs (BRC and ERM 2010b, c, d), all samples were received at the laboratory within the required temperatures range of 4° ±2° Celsius. No sample results were qualified based on sample temperatures or other sample preservation issues.

### 4.5.2 Blank Contamination

Blanks are artificial samples designed to evaluate the nature and extent of contamination of environmental samples that may be introduced by field or laboratory procedures. Field and

laboratory blanks, consisting of contaminant-free water, were prepared and analyzed as part of standard QA/QC procedures to monitor for potential contamination of field equipment, laboratory process reagents, and sample containers. As presented in the DVSRs (BRC and ERM 2010b,c,d) 318 results were qualified as undetected (U) or estimated (J+) due to laboratory or field blank contamination, as discussed below. Detections of constituents qualified as non-detections due to comparable detections in laboratory or field blanks are known as "censored" data, and are presented in Tables 2-5 and 2-6 of DVSR 60, Tables 2-4 and 2-5 of DVSR 60a, and Tables 2-3 and 2-4 of DVSR 72a (Appendix F). In these cases, non-detections are represented in the database as "< [*the PQL*]" in the case of inorganics detected below the PQL, or as "<[*result value*]" for all others.[30]

These censored data are summarized in Appendix E, Table E-14 (included on the report CD in Appendix B) by compound class. As seen in that table, analytes were initially reported as detections in samples, but were later qualified as non-detections based on the presence of comparable concentrations of that analyte in blank samples. As seen in Appendix E, compounds most often censored for soil results included the following:

- Acetone (43 samples)
- Dichloromethane (18 samples)
- Styrene (16 samples)
- Mercury (23 samples)
- 1,2,4-Trimethylbenzene (33 samples)
- Cyanide (34 samples)

In addition, benzene was frequently censored for surface flux samples (14 of 16 TO-15 full scan samples).

Table 4-1 presents the metals most likely to be affected by this issue:

**TABLE 4-1: METALS MOST FREQUENTLY CENSORED DURING BLANK SAMPLE EVALUATION**

| Metal | Number of Detect | Number of Samples | Number of Censored Results | Max Non-Detect (mg/kg) | NDEP Residential BCL (mg/kg) |
|---|---|---|---|---|---|
| Antimony | 0 | 53 | 53 | 2.7 | 31 |
| Boron | 7 | 53 | 46 | 53 | 15,633 |
| Selenium | 1 | 53 | 52 | 2.7 | 391 |
| Thallium | 0 | 53 | 53 | 0.75 | 5.5 |

[30] Although NDEP has issued recent guidance regarding qualifying data due to blank contamination (NDEP 2011b); BRC has addressed this issue in the *Technical Memorandum – BRC Comments on NDEP Blank Contamination Guidance* (BRC 2011a) and, consistent with this Technical Memorandum, no changes were made to the Site dataset.

This table demonstrates that while the number of censored results is high compared to the number of detections, the censored values are still much lower than residential soil BCLs.

### 4.5.3 Sample/Duplicate Differences Outside Permissible Range or Greater than Permissible Values

During the data validation process, sample/duplicate results are evaluated to determine whether differences in those results suggest potential issues with data quality. Specifically, the analyst evaluates the following:

- MS/MSD relative percent difference (RPDs), to determine if the RPDs are outside acceptance limits;
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) RPDs, to determine if the RPDs are outside acceptance limits;
- Sample/field duplicate results to determine if differences are greater than the permissible value; and
- Sample/laboratory duplicate results to determine if differences are greater than the permissible value.

#### *4.5.3.1 Qualifications Due to MS/MSD Recoveries Outside Acceptance Criteria*

As discussed in the DVSRs (BRC and ERM 2010b, c, d), inorganic constituent results for 345 sample results were qualified as estimated (either UJ for non-detections or J for detections; "+" or "–" added to denote potential high or low bias, respectively) based on MS/MSD recoveries; there was one rejection for data associated with MS/MSD recoveries. The qualifications applied on the basis of MS/MSD recoveries were as follows:

- One ammonia result GNBF19-11 was qualified and rejected due to a recovery much lower than the acceptance criterion;
- The Total Kjeldahl Nitrogen results for the following nine soil samples were qualified as estimated due to a recovery greater than the acceptance criteria: GNC1-JD07-0, GNC1-JD07-10, GNC1-JS09-0, GNC1-JS09-0-FD, GNC1-JS09-10, and GNC1-JS10-0 in data package F9A310166, and GNC1-JS11-0, GNC1-JS11-0-FD, and GNC1-JS11-10 in data package F9A300184); and

- Metals results for soil samples in various laboratory data packages were qualified due to recoveries outside the acceptance criteria, as summarized in Table 4-2 below.

**TABLE 4-2: METALS SAMPLES QUALIFIED DUE TO RECOVERIES OUTSIDE ACCEPTANCE CRITERIA**

| Laboratory Data Package | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Copper | Lead | Lithium | Manganese | Mercury | Molybdenum | Potassium | Selenium | Silver | Strontium | Tin | Titanium | Tungsten | Uranium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F9A290238 | - | | + | | | | | | | | | | + | | + | | | | - | | | |
| F9A300184 | - | | + | | | | | + | | | | | | | + | | | | - | | | - |
| F9A310166 | - | | | | | | | | | | + | | | | | | | | - | | | |
| F9B060191 | - | | - | | | | | | | | | | | | + | | | | | | - | |
| F9B070176 | - | | - & + | | | + | + | | | | - | | + | | + | | | | - | | + | - & + |
| F9B100109 | - | | - | + | | | | | + | | | | | | + | | | | - | + | | - & + |
| F9B140120 | - | | | | + | - | | - | | | | | + | | + | | | | - | | - | - |
| F9B180129 | - | | | | + | - | | - | | | | | + | | | | | | - | | - | - |
| F9H140144 | - | + | - & + | | + | | + | + | | | - | | + | | | - | | + | - | + | + | + |
| F0A090446 | - | + | + | | + | | + | + | + | | | + | + | + | + | + | + | + | | + | + | + |
| F0H030409 | - | | + | | | | | | | + | | | + | | | | | | - | | | |

+ = Recovery greater than the acceptance limits
- = Recovery less than the acceptance limits
Blank entry signifies that the recovery was within the acceptance limits

Appendix E, Table E-11 (included on the report CD in Appendix B) lists the samples and associated analytes exhibiting MS/MSD percent recoveries below the laboratory control limits. In cases in which the recoveries were higher than the acceptance criteria, the results have the potential of being similarly biased high, and using these data in the HHRA could result in risks being calculated that are higher than would be associated with actual Site conditions. Of more concern for the HHRA is underestimation of risk, which could be associated with the use of data that are biased low.

As indicated in that table (Table E-11), reported detections and non-detects for soil data were flagged as estimated ("J-" or "UJ," respectively) due to low MS/MSD recoveries (i.e., from 30 to

74 percent for metals)[31]. Detections associated with "very low" MS/MSD recoveries (i.e., less than 30 percent for metals), are generally rejected as unusable. Because only one of the MS/MSD recoveries was that low, only one sample result was rejected on this basis.

The data flagged as estimated based on low MS/MSD recoveries were subjected to further review in terms of data usability for the Site, as discussed in Section 4.6.2.3.

*4.5.3.2 Qualifications due to LCS/LCSD Recoveries Outside Acceptance Criteria*

Organic and inorganic constituent results for four samples were qualified as estimated (either UJ for non-detections or J for detections; "+" or "–" added to denote potential high or low bias, respectively) based on LCS/LCSD recoveries. The qualifications applied on the basis of LCS/LCSD recoveries are summarized in Table 4-3.

**TABLE 4-3: RESULTS QUALIFIED DUE TO LCS/LCSD RECOVERIES OUTSIDE ACCEPTANCE CRITERIA**

| Sample ID | Lab ID | Analyte | Result | Unit | Recovery | Limits |
|---|---|---|---|---|---|---|
| GNC1-BD19-0 | F9A290238010 | Cyanide, Total | < 0.087 UJ | mg/kg | 83 | 85-115 |
| GNC1-BD19-10 | F9A290238011 | Cyanide, Total | <0.53 UJ | mg/kg | 83 | 85-115 |
| GNC1-JS11-0 | F9A300184006 | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 12 J | pg/g | 78 | 79-140 |
| GNC1-JS11-0-FD | F9A300184007 | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 49 J | pg/g | 78 | 79-140 |

As noted above, recoveries below the lower laboratory limits are of the most concern in terms of data usability. Appendix E, Table E-11 (included on the report CD in Appendix B) lists the samples and associated analytes exhibiting LCS/LCSD percent recoveries below the lower laboratory control limit. No results were rejected as unusable based on very low LCS/LCSD recovery. The data flagged as estimated based on low LCS/LCSD recoveries were subjected to further review in terms of data usability for the Site, as discussed in Section 4.6.2.3.

*4.5.3.3 Qualifications due to Sample/Field Duplicate Differences Outside Acceptance Criteria*

The following eight soil field duplicates were collected during the sampling activities

- GNC1-BE20-0-FD
- GNC1-BG20-0-FD
- GNC1-JD09-0-FD
- GNC1-JS11-0-FD
- GNC2-BE20C-0-DUP
- GNC2-JS10C-0-DUP

[31] If additional validation criteria (aside from the MS/MSD recoveries) did not suggest a low bias for a given result, the sample result was flagged with "J" (no bias inferred).

- GNC1-JS09-0-FD
- GNC2-JA04-0-DUP

In addition, the following surface flux field duplicate was also collected during the sampling activities: GNC1-JS11-R.[32]

Field duplicate differences in excess of acceptance limits were noted in eight field duplicate pairs of soil samples. The differences are presented in Appendix E, Table E-12 (included on the report CD in Appendix B). All associated data were flagged as estimated (J/UJ). No data were rejected on the basis of sample/field duplicate differences.

#### *4.5.3.4 Qualifications due to Sample/Laboratory Duplicate Differences Outside Acceptance Criteria*

Of the samples representing post-remediation conditions (i.e., excluding those data points associated with samples from soil intervals subsequently removed from the Site), 26 samples had sample/laboratory duplicate differences greater than the permissible values (i.e., 1 pCi/g for radionuclides and RPD > 20 percent criteria for cation exchange capacity). These samples are listed in Table 4-4.

**TABLE 4-4: RESULTS QUALIFIED DUE TO SAMPLE/LABORATORY DUPLICATE DIFFERENCES OUTSIDE ACCEPTANCE CRITERIA**

| Field Sample ID | Lab Sample ID | Analyte | Result | Unit | RPD or Difference |
|---|---|---|---|---|---|
| GNC1-BD19-0 | F9A290238010 | Cation Exchange Capacity | 16.7 | meq/100g | RPD=22 |
| GNC1-BD19-10 | F9A290238011 | Cation Exchange Capacity | 20.7 | meq/100g | RPD=22 |
| GNC1-BE19-0 | F9B060191008 | Cation Exchange Capacity | 22.6 | meq/100g | RPD=44 |
| GNC1-BE19-10 | F9B060191009 | Cation Exchange Capacity | 20.2 | meq/100g | RPD=44 |
| GNC1-BE22-0 | F9B060191016 | Cation Exchange Capacity | 12.8 | meq/100g | RPD=44 |
| GNC1-BE22-10 | F9B060191017 | Cation Exchange Capacity | 13.5 | meq/100g | RPD=44 |
| GNC1-BF19-0 | F9B060191010 | Cation Exchange Capacity | 16.4 | meq/100g | RPD=44 |
| GNC1-BF19-11 | F9B060191011 | Cation Exchange Capacity | 15.4 | meq/100g | RPD=44 |
| GNC1-BF21-0 | F9B060191014 | Cation Exchange Capacity | 18.8 | meq/100g | RPD=44 |
| GNC1-BF21-10 | F9B060191015 | Cation Exchange Capacity | 12.9 | meq/100g | RPD=44 |
| GNC1-BG19-0 | F9B060191012 | Cation Exchange Capacity | 17.5 | meq/100g | RPD=44 |
| GNC1-BG19-10 | F9B060191013 | Cation Exchange Capacity | 13.2 | meq/100g | RPD=44 |
| GNC1-BG20-0 | F9B060191001 | Cation Exchange Capacity | 10 | meq/100g | RPD=44 |
| GNC1-BG20-0-FD | F9B060191002 | Cation Exchange Capacity | 16.5 | meq/100g | RPD=44 |
| GNC1-BG20-10 | F9B060191003 | Cation Exchange Capacity | 6.3 | meq/100g | RPD=44 |

[32] The Galleria North-School Site includes a sub-set of the entire Galleria North sub-area. Field duplicates noted in this section do not reflect the total number of field duplicates collected during the Galleria North sub-area sampling events.

**TABLE 4-4: RESULTS QUALIFIED DUE TO SAMPLE/LABORATORY DUPLICATE DIFFERENCES OUTSIDE ACCEPTANCE CRITERIA**

| Field Sample ID | Lab Sample ID | Analyte | Result | Unit | RPD or Difference |
|---|---|---|---|---|---|
| GNC1-BG21-0 | F9B060191004 | Cation Exchange Capacity | 14.2 | meq/100g | RPD=44 |
| GNC1-BG21-10 | F9B060191005 | Cation Exchange Capacity | 15.4 | meq/100g | RPD=44 |
| GNC1-BG22-0 | F9B060191006 | Cation Exchange Capacity | 16.5 | meq/100g | RPD=44 |
| GNC1-BG22-10 | F9B060191007 | Cation Exchange Capacity | 11.9 | meq/100g | RPD=44 |
| GNC1-JD10-0 | 224260001 | Radium-228 | 1.14 | pCi/g | Difference=1.41 |
| GNC1-JD10-11 | 224260002 | Radium-228 | 1.38 | pCi/g | Difference=1.41 |
| GNC1-JD11-0 | 224260003 | Radium-228 | 0.958 | pCi/g | Difference=1.41 |
| GNC1-JD11-11 | 224260004 | Radium-228 | 1.11 | pCi/g | Difference=1.41 |
| GNC1-JS11-0 | 223713010 | Radium-228 | 1.3 | pCi/g | Difference=1.166 |
| GNC1-JS11-0-FD | 223713011 | Radium-228 | 2.18 | pCi/g | Difference=1.166 |
| GNC1-JS11-10 | 223713012 | Radium-228 | 1.52 | pCi/g | Difference=1.166 |

The above data flagged as estimated (J) based on sample/laboratory duplicate differences were subjected to further review in terms of data usability for the Site, as discussed in Section 4.6.2.3.

### 4.5.4 Internal Standards Outside Acceptance Criteria

Internal standards are prepared for certain organic gas chromatograph/mass spectrometry (GC/MS) and inductively coupled plasma/mass spectrometry analyses by adding compounds similar to target compounds of interest to sample aliquots. Internal standards are used in the quantitation of target compounds in the sample or sample extract. The evaluation of internal standards involved comparing the instrument response and retention time from the target compounds in the sample with the response and retention time of specific internal standards added to the sample extract prior to analysis.

As presented in the DVSRs (BRC and ERM 2010b, c, d), no sample results were rejected based on internal standards. The following results were qualified due to internal standard exceedances:

- SVOC results for one soil sample (GNC1-BE20-10);
- PCB results for one soil sample (GNC1-BF22-0);
- VOC results for 10 surface flux samples (GNC1-BE22, GNC1-BF19, GNC1-BF20, GNC1-BF21, GNC1-BG19, GNC1-BG20, GNC1-BG21, GNC1-BG22, GNC1-JS09, and GNC1-JS10); and
- VOC results for 10 soil samples, as listed in Table 4-5.

**TABLE 4-5: VOC SOIL SAMPLE RESULTS QUALIFIED DUE TO INTERNAL STANDARDS OUTSIDE ACCEPTANCE CRITERIA**

| Laboratory Data Package # | Sample ID |
|---|---|
| F9B060191 | GNC1-BE19-0 GNC1-BE22-0 GNC1-BG19-0 GNC1-BG20-0 GNC1-BG20-0-FD |
| F9B070176 | GNC1-BE20-0 GNC1-BE20-0-FD GNC1-BF22-0 |
| F9A300184 | GNC1-JS11-0 GNC1-JS11-0-FD |

- Dioxins/furans results for three soil samples, as listed in Table 4-6.

**TABLE 4-6: DIOXIN/FURAN SOIL SAMPLE RESULTS QUALIFIED DUE TO INTERNAL STANDARDS OUTSIDE ACCEPTANCE CRITERIA**

| Laboratory Data Package # | Sample ID |
|---|---|
| F9B070176 | GNC1-BF22-0 GNC1-BE21-0 |
| F9B100109 | GNC1-JD10-0 |

### 4.5.5 Surrogate Percent Recoveries Outside Laboratory Control Limit

As discussed in the DVSRs (BRC and ERM 2010b, c, d), surrogate spikes were added to each of the samples submitted for organic analysis to monitor potential interferences from the matrix. Results associated with unacceptable surrogate recoveries were qualified as estimated (J+ or UJ). Generally, when surrogate recoveries are less than 10 percent, associated non-detect results are qualified as rejected (R) because false negatives are a possibility. No sample results were rejected due to surrogate recoveries. The soil samples listed in Table 4-7 were qualified due to surrogate recovery exceedances.

**TABLE 4-7: RESULTS QUALIFIED DUE TO SURROGATE RECOVERIES OUTSIDE LABORATORY CONTROL LIMIT**

| Sample ID | Lab ID | Analysis | Recovery | Acceptable Range |
|---|---|---|---|---|
| GNC1-BE19-0 | F9B060191008 | Organochlorine pesticides | 160 | 61-150 |
| GNC1-BE20-0 | F9B070176006 | Organochlorine pesticides | 60 | 72-130 |
| GNC1-BE20-0-FD | F9B070176007 | VOCs | 152 | 46-150 |
| GNC1-BG19-0 | F9B060191012 | VOCs | 170 | 46-150 |
| GNC1-JD10-0 | F9B100109008 | Organochlorine pesticides | 171 | 61-150 |
| GNC1-JS10-0 | F9A310166011 | Organochlorine pesticides | 220 | 61-150 |

In addition, two surface flux samples (GNC1-BG19 and GNC1-BG22) were qualified due to surrogate recovery exceedances, both higher than the acceptable range.

Appendix E (included on the report CD in Appendix B) lists the samples and associated analytes exhibiting surrogate percent recoveries below the laboratory control limits. As seen in that appendix, with the exception of the organochlorine pesticide results for GNC1-BE20-0, the recoveries outside the acceptance criteria were higher than the upper laboratory control limit. The GNC1-BE20-0 organochlorine pesticide results were subjected to further review in terms of data usability for the Site, as discussed in Section 4.6.2.3.

### 4.5.6 Calibrations Outside Laboratory Control Limits

Requirements for instrument calibration ensure that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of analytical run. Continuing calibrations checks document satisfactory maintenance and adjustment of the instrument on a day-to-day basis. As presented in the DVSRs (BRC and ERM 2010b, c, d), certain data were qualified due to initial or continuing calibration issues. Of specific concern are analytes with a final qualifier indicating a low bias due to calibration. In the following tables, the percentage of analyte recovered is based on the percent difference of the actual amount and recovered amount reported from the continuing calibration. As the percentage decreases, the potential for false negatives increases.

Table 4-8 summarizes the SVOC results that were qualified due to evaluation of calibration control limits.

**TABLE 4-8: SUMMARY OF SVOC RESULTS QUALIFIED DUE TO CALIBRATIONS OUTSIDE LABORATORY CONTROL LIMIT**

| Analyte | # of Samples Qualified | Percent of Qualified Non-Detect | Percentage of Analyte Recovered as Indicated by Outlier |
|---|---|---|---|
| 1,4-Dioxane | 5 | 100% | 57-72% |
| 3,3'-Dichlorobenzidine | 5 | 100% | 69-74% |
| 3-Nitroaniline | 10 | 100% | 61-74% |
| 4-Nitroaniline | 22 | 100% | 64-70% |
| Acetophenone | 5 | 100% | 69-71% |
| Benzoic Acid | 15 | 100% | 67-74% |
| bis[Chlorophenyl]sulfone | 11 | 100% | 74% |
| bis[p-Chlorophenyl]disulfide | 2 | 100% | 72% |
| Carbazole | 10 | 100% | 56-75% |
| Diphenyl sulfone | 11 | 100% | 74% |
| Hexachlorocyclopentadiene | 2 | 100% | 60% |
| Octachlorostyrene | 3 | 100% | 69% |
| Phthalic Acid | 11 | 100% | 45-65% |

Table 4-9 summarizes the organochlorine pesticide results that were qualified due to calibrations.

**TABLE 4-9: SUMMARY OF ORGANOCHLORINE PESTICIDE RESULTS QUALIFIED DUE TO CALIBRATIONS OUTSIDE LABORATORY CONTROL LIMIT**

| Analyte | # of Samples Qualified | Percent of Qualified Non-Detect | Percentage of Analyte Recovered as Indicated by Outlier |
|---|---|---|---|
| 4,4'-DDT | 3 | 66% | 81-83% |
| Heptachlor | 8 | 100% | 82-83% |
| Methoxychlor | 4 | 100% | 83-84% |

Table 4-10 summarizes the VOC results that were qualified in soil samples due to calibrations.

**TABLE 4-10: SUMMARY OF VOC SOIL RESULTS QUALIFIED DUE TO CALIBRATIONS OUTSIDE LABORATORY CONTROL LIMIT**

| Analyte | # of Samples Qualified | Percent of Qualified Non-Detect | Percentage of Analyte Recovered as Indicated by Outlier |
|---|---|---|---|
| Freon 12 | 16 | 100% | 71% |
| Methyl iodide | 5 | 100% | 71% |
| MTBE | 14 | 100% | 73% |

In addition, low instrument response was noted for ethanol, acetonitrile, and methyl ethyl ketone as indicated by the relative response factor.

Table 4-11 summarizes the VOC results that were qualified in surface flux samples due to calibrations.

**TABLE 4-11: SUMMARY OF VOC SURFACE FLUX SAMPLE RESULTS QUALIFIED DUE TO CALIBRATIONS OUTSIDE LABORATORY CONTROL LIMIT**

| Analyte | # of Samples Qualified | Percent of Qualified Non-Detect | Percentage of Analyte Recovered as Indicated by Outlier |
|---|---|---|---|
| 1,2,4-Trichlorobenzene | 7 | 100% | 33-70% |
| 1,2,4-Trimethylbenzene | 3 | 0% | 67% |
| 2-Methyl-1-propanol | 11 | 91% | 55-66% |
| 2,2-Dichloropropane | 1 | 100% | 57% |
| Acetone | 9 | 44% | 48-67% |
| Bromoform | 1 | 100% | 61% |
| Bromomethane | 1 | 100% | 39% |
| Carbon disulfide | 4 | 50% | 48-58% |
| Chloroethane | 1 | 100% | 69% |
| cis-1,3-Dichloropropene | 1 | 100% | 66% |
| Cymene | 5 | 100% | 65-69% |
| Ethanol | 3 | 100% | 50% |
| Methyl ethyl ketone | 1 | 0% | 69% |
| Methyl iodide | 1 | 100% | 43% |
| Naphthalene | 4 | 100% | 60% |
| n-Butylbenzene | 8 | 100% | 61-69% |
| Tert-Butylbenzene | 8 | 100% | 62-69% |
| Trans-1,3-Dichloropropene | 1 | 100% | 50% |
| Trichloroethene | 4 | 100% | 65-68% |
| Vinyl acetate | 1 | 100% | 70% |

### 4.5.7 Tentatively Identified Compounds

For the GC/MS methods, a list and estimated concentrations for tentatively identified compounds (TICs) was provided by the laboratory if detected. Most of the reported TICs were identified as "unknown" or "unknown aldol condensate." Others were as follows:

.beta.-Sitosterol
1-Bromo-11-iodoundecane
1-Bromo-4-bromomethyldecane
1-Decanol, 2-hexyl-
1H-Indene, 5-butyl-6-hexyloctahydro-
2,5-Furandione, 3-dodecyl-
28-Nor-17.alpha.(H)-hopane
2-Dodecen-1-yl(-)succinic anhydride
2-Naphthalenol, 1-((4-methyl-2-nitrophen
5-Bromo-4-oxo-4,5,6,7-tetrahydrobenzofur
6-Isopropenyl-4,8a-dimethyl-4a,5,6,7,8,8
9-Octadecenamide, (z)-
9-Octadecenoic acid, (e)-
alpha-Methylstyrene
Benzamide, N-propyl-
Cholestan-3-one, (5.alpha.)-
Cholestane
Cyclotetradecane, 1,7,11-trimethyl-4-(1-
D-Homoandrostane, (5.alpha.,13.alpha.)-
Eicosane
Ecocide, 9-cyclohexyl-
Erucylamide
Ethyl acetate
Heneicosane, 11-cyclopentyl-
Heneicosane, 11-pentyl-
Heptacosane, 1-chloro-
Heptadecane
Heptadecane, 9-octyl
Hexacosane
Hexadecanamide
Hexadecane, 2,6,10,14-tetramethyl-
Hexadecanoic acid
Imidazole, 2-fluoro-1-triacetylribofuran
Myristin, 2,3-diaceto-1-
N1-Tetrahydrofuran-2-ylmethyl-2-(4-chlor
n-Hexadecane
Nonadecane
Nonadecane, 1-chloro-
Octacosane
Octadecanamide
Octadecane, 1-chloro-
Octadecanoic acid
PCB 138
PCB 156
PCB 167
PCB 175
PCB 187
Silane, trichlorooctadecyl-
Stearic acid hydrazide
Tetradecanamide
Tricosane
Vitamin E

Only six of the detected TICs—alpha-methylstyrene, ethyl acetate, and the PCBs—have associated toxicity criteria. Others do not. Reported TICs such as siloxanes and amides are indicative of column breakdown and saturated fatty acids. With the exception of the PCBs, vitamin E, and beta-sitosterol, the above named compounds are indicative of column breakdown and are not likely to be Site-related. The PCBs are included in the PCB congener analysis USEPA method 1668. It is unknown what the source of vitamin E could be; however, it is unlikely to result in adverse health effects to those exposed. Beta-sitosterol is a plant sterol and could be present due to organic matter collected along with the soil sample.

### 4.5.8 Data Review Summary

For 801 of the 15,487 analytical results in the final HHRA dataset, quality criteria were not met and various data qualifiers were added to indicate limitations and/or bias in the data. The definitions for the data qualifiers, or data validation flags, used during validation are those defined in SOP-40 (BRC, ERM, and MWH 2008) and the project QAPP (BRC and ERM 2009a). Of the 801 qualified sample results, only one was rejected. Sample results are rejected based on findings of serious deficiencies in the ability to properly collect or analyze the sample and meet QC criteria. Only rejected data are considered unusable for decision-making purposes and rejected analytical results are not used in the HHRA.

As noted above, only one sample result (an ammonia result for GNBF19-11) was rejected in the Site dataset and excluded from the HHRA for the reasons previously noted. Other data points were excluded from the risk assessment not due to data quality issues, but for one of the following reasons: the sample was reanalyzed by the laboratory or the sample location was removed during a removal action.

## 4.6 CRITERION VI – DATA QUALITY INDICATORS

DQIs are used to verify that sampling and analytical systems used in support of project activities are in control and the quality of the data generated for this project is appropriate for making decisions affecting future activities. The DQIs address the field and analytical data quality aspects as they affect uncertainties in the data collected for site characterization and risk assessment. The DQIs include PARCC. The project QAPP provides the definitions and specific criteria for assessing DQIs using field and laboratory QC samples and is the basis for determining the overall quality of the dataset. Data validation activities included the evaluation of PARCC parameters, and all data not meeting the established PARCC criteria were qualified during the validation process using the guidelines presented in the National Functional Guidelines for Laboratory Data Review for Organics, Inorganics, and Dioxin/Furans (USEPA 1999, 2004d, 2005a, 2008).

### 4.6.1 Evaluation of Data Precision

Precision is a measure of the degree of agreement between replicate measurements of the same source or sample. Precision is expressed by RPD between replicate measurements. Replicate measurements can be made on the same sample or on two samples from the same source. Precision is generally assessed using a subset of the measurements made. The precision of the

data was evaluated using several laboratory QA/QC procedures. Based on BRC's review of the results of these procedures, the general level of precision for the Site data and the background data (BRC and ERM 2009b) does not appear to limit the usability of a particular analyte, sample, method, or dataset as a whole.

### 4.6.2 Evaluation of Data Accuracy

Accuracy measures the level of bias that an analytical method or measurement exhibits. To measure accuracy, a standard or reference material containing a known concentration is analyzed or measured and the result is compared to the known value. Several QC parameters are used to evaluate the accuracy of reported analytical results, including:

- Holding times and sample temperatures;
- Calibration limits;
- LCS percent recovery;
- MS/MSD percent recovery;
- Spike sample recovery (inorganics);
- Surrogate spike recovery (organics); and
- Blank sample results.

Detailed discussions of specific exceedances to precision and accuracy (with tables) are provided in the DVSRs (BRC and ERM 2010b, c, d) and data qualified as a result of this evaluation are presented with qualifiers in the data usability tables in Appendix E (included on the report CD in Appendix B). As presented in Section 4.5, only one sample result (an ammonia result for GNBF19-11) was rejected in the Site dataset and excluded from the HHRA. The remaining results were considered sufficiently accurate for risk assessment purposes, as discussed below.

#### *4.6.2.1 Holding Time Exceedances/Sample Condition*

There is a potential for analyte loss if the holding time for a sample is exceeded. As discussed in Section 4.5.1, holding times were exceeded in three soil samples for hexavalent chromium analysis (less than 1 percent of the samples analyzed for that constituent), and in one sample and its duplicate for dioxin/furan analysis (less than 1 percent of the samples analyzed). All three

samples were qualified as estimated. Based on the limited holding time issues, there is not likely to be a significant potential for a low bias to the hexavalent chromium or dioxin/furan datasets for Site soils.

As presented in the DVSRs (BRC and ERM 2010b, c, d), all Site samples with temperature requirements were received at the laboratory within the required range of 4° ±2° Celsius. No sample results were qualified based on sample temperatures or due to lack of proper preservation.

*4.6.2.2 Calibration Violations Indicating a Low Bias*

The instrument calibration checks that resulted in a low bias are summarized in the tables presented in Section 4.5.6. Five TO-15 surface flux analytes (1,2,4-trichlorobenzene, acetone, bromomethane, carbon disulfide, and methyl iodide) had recoveries below 50 percent in some samples. 1,2,4-Trichlorobenzene, acetone, and carbon disulfide were qualified in all samples due to calibration violations. However, only 1,2,4-trichlorobenzene was non-detect in all samples. 1,2,4-Trichlorobenzene is evaluated further in the Uncertainty Analysis (Section 7) of the report. For the other non-detect analytes with SQLs, the maximum SQLs were compared to the residential soil BCL. It is unlikely, even with a potential for a false negative, that the bias could affect the result to such a degree that the analyte is present at the Site in excess of the BCL.

*4.6.2.3 MS/MSD or LCS/LCSD Recoveries below Acceptance Criteria*

During the data usability review, results associated with MS/MSD and/or LCS/LCSD recoveries that were only slightly lower than the lower acceptance limit (i.e., 50 to 75 percent recoveries for inorganics) were accepted as usable without further evaluation. Samples with lower percent recoveries (i.e., recoveries lower than 50 percent for inorganics and one-half the lower limit or 30 percent, whichever is greater, for organics) were reviewed more closely to assess if it was appropriate to use them in the HHRA. Inorganic results with MS/MSD recoveries less than 50 percent [33] were as follows:

- An ammonia result for one soil sample (GNC1-BF19-11) in TestAmerica data package F9B060191 (a non-detection, which was later rejected on this basis);

[33] Only samples associated with MS/MSD results in which both recoveries were below 50 percent are listed.

- Antimony results for two soil samples in TestAmerica data package F9A290238 (both non-detections); and

- Antimony and tungsten results for two soil samples in TestAmerica data package F9H030409 (all non-detections).

Given the small number of samples involved, these data points are not likely to have a significant effect on risk assessment. Furthermore, antimony was not detected in any Site soil samples and it is unlikely that it was present in the four samples listed above. Similarly, tungsten was detected in three of 55 Site samples. No organic results were associated with recoveries below the lower laboratory limit.

As noted in Section 4.5.3, LCS/LCSD recoveries lower than the lower laboratory control limit were observed for cyanide for two soil samples (GNC1-BD19-0 and GNC1-BD19-10), both non-detections and for two detections of 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin (TestAmerica data package F9A300184). Because the cyanide and dioxin recoveries (83 and 78 percent, respectively) were only slightly lower than the lower laboratory control limit (85 and 79 percent, respectively), no concerns were identified regarding their usability.

*4.6.2.4 Surrogate Percent Recoveries below Laboratory Control Limit*

As noted in Section 4.5.5, surrogate recoveries lower than the lower laboratory control limit were observed for organochlorine pesticides in one laboratory batch (TestAmerica data package F9B070176). Because the recoveries in this analytical batch (60 percent) were not substantially lower than the lower laboratory control limit (72 percent), no concerns were identified regarding their usability.

*4.6.2.5 Blank Contamination*

As noted in Section 4.5.2, certain detections were flagged during the data review as being non-detections or estimated with a high bias due to laboratory or field blank contamination. If the associated constituent qualified as being a non-detection was, in fact, present in the samples related to the affected blank sample, revising its status to non-detect could result in risk underestimation. In the dataset for the Site, 318 results were censored due to blank contamination. Affected analytes are listed in Table 4-12.

**TABLE 4-12: SUMMARY OF ANALYTES CENSORED DURING BLANK SAMPLE EVALUATION**

| Analyte | # of Censored Results | Analyte | # of Censored Results | Analyte | # of Censored Results |
|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane (Flux) | 1 | bis(2-Ethylhexyl) phthalate | 2 | o-Xylene (Flux) | 2 |
| 1,1,2-Trichloroethane (Flux) | 1 | Boron | 5 | Radium-226 | 1 |
| 1,2,3,4,6,7,8-Heptachloro-dibenzo-p-dioxin | 2 | Cadmium | 4 | Selenium | 8 |
| 1,2,4-Trimethylbenzene | 33 | Cyanide, Total | 34 | Selenium (SPLP) | 1 |
| 1,2-Dichlorobenzene (Flux) | 2 | Dichloromethane | 18 | Styrene | 16 |
| 1,3-Dichlorobenzene (Flux) | 2 | 1,2-Dibromoethane (Flux) | 2 | Tetrachloroethene (Flux) | 1 |
| 1,4-Dichlorobenzene (Flux) | 2 | Formaldehyde | 4 | Thorium-230 | 3 |
| Acetaldehyde | 1 | Isopropylbenzene (Flux) | 1 | Tin | 8 |
| Acetone | 43 | m & p-Xylene (Flux) | 1 | Toluene (Flux) | 3 |
| Acetone (Flux) | 3 | Mercury | 23 | Total Kjeldahl Nitrogen (TKN) (SPLP) | 1 |
| Acetonitrile (Flux) | 1 | Mercury (SPLP) | 1 | Total Organic Carbon | 9 |
| Ammonia (as N) | 2 | Methyl ethyl ketone (Flux) | 1 | Total Organic Carbon (SPLP) | 1 |
| Antimony | 3 | Molybdenum | 8 | Trichloroethene (Flux) | 7 |
| Antimony (SPLP) | 1 | Octachlorodibenzodioxin | 5 | Tungsten | 3 |
| Arsenic | 2 | Orthophosphate | 7 | Uranium-233/234 | 11 |
| Benzene (Flux) | 14 | Orthophosphate (SPLP) | 1 | Uranium-235/236 | 1 |
| | | | | Uranium-238 | 12 |

The constituents for which this potential concern has the most bearing in risk assessment are those in soil samples for which the detections are close to or exceed either (1) background conditions, or (2) relevant human health comparison levels (e.g., the NDEP BCLs). As determined during that evaluation, qualification of detections as non-detections based on blank contamination is not likely to have an appreciable effect on the risk estimates, as discussed below.

Censored results that are less than the maximum background concentration and the residential soil BCL have a negligible impact on risk assessment findings. If a portion of the result reflects an actual site concentration, then the uncertainty related to the censored result is low. However, data censored at values at or above background or the residential soil BCLs, may pose a potential underestimation of human health risks. Therefore, censored results at values in excess of the residential soil BCL (or the maximum background concentration, if higher) were evaluated further. With the exception of arsenic and three radionuclides, none of the soil data censored due to blank contamination was in excess of the BCLs. The four analytes with censored results greater than the BCLs are listed in Table 4-13.

**TABLE 4-13: ANALYTES CENSORED DURING BLANK SAMPLE EVALUATION WITH RESULTS GREATER THAN BCLs**

| Analyte | Range of Censored Results | BCL | Maximum Background Concentration |
|---|---|---|---|
| Arsenic (2 censored results) | 3.8 to 4 mg/kg | 0.39 mg/kg | 7.2 mg/kg |
| Radium-226 (1 censored result) | 0.773 pCi/g | 0.0071 pCi/g | 2.36 pCi/g |
| Uranium-235/236 (1 censored result) | 0.247 pCi/g | 0.11 pCi/g | 0.21 pCi/g |
| Uranium-238 (12 censored results) | 0.533 to 0.989 pCi/g | 0.46 pCi/g | 2.37 pCi/g |

With the exception of the sole uranium-235/236 result, all of the above-listed censored data were lower than the maximum background concentration. The uranium-235/236 results were determined to be in secular equilibrium and within the range of background. Therefore, these censored data do not represent a significant potential for risk underestimation.

Surface flux data are not comparable with BCLs. Benzene was associated with 14 censored data points (of 16 surface flux samples); the remaining censored analytes were associated with five or fewer surface flux samples. Benzene was detected at 14 of 16 surface flux locations, but was qualified as non-detect in 14 of 16 for the full scan analysis and 0 of 16 in the SIM analysis. Widespread blank contamination was noted for the full scan surface flux analysis of benzene. Benzene has been detected in groundwater across the BMI Complex. Since benzene was also detected in the SIM analysis (and not censored), risk estimates were calculated for benzene based on the SIM analysis results. Therefore, there is likely no effect on the final risk estimates for the Site. Benzene is discussed further in the Uncertainty Analysis (Section 7) of this report.

*4.6.2.6 Data Usability Summary*

As discussed above, because the qualifications with the potential for low bias were small in number, the data usability evaluation determined it was unlikely that they could lead to significant risk underestimation. Furthermore, the small amount of rejected data points (one ammonia result) does not represent a significant data gap in terms of risk assessment.

### 4.6.3 Evaluation of Data Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of the population at a sampling point or an environmental condition (USEPA 2002a). There is no standard method or formula for evaluating representativeness, which is a qualitative term.

Representativeness is achieved through selection of sampling locations that are appropriate relative to the objective of the specific sampling task, and by collection of an adequate number of samples from the relevant types of locations. The sampling locations at the Site were based on both systematic sampling with random point placement within each grid cell, as well as focused samples collected from specific areas to further investigate potential areas of concern.

The samples were analyzed for a broad spectrum of chemical classes across the Site. Samples were delivered to the laboratory in coolers with ice to minimize the loss of analytes. In a few instances, such as samples being analyzed slightly beyond the holding time or delayed preservation of SPLP samples, the representativeness of the associated data is in question; however, there were limited instances of this, as discussed in Section 4.5.1. As previously noted, no sample results were qualified based on sample temperatures or preservation.

Sample specific results are discussed in the DVSRs. A discussion of representativeness for the background dataset is provided in each of the background investigation reports.

### 4.6.4 Evaluation of Data Completeness

Completeness is commonly expressed as a percentage of measurements that are valid and usable relative to the total number of measurements made. Analytical completeness is a measure of the number of overall accepted analytical results, including estimated values, compared to the total number of analytical results requested on samples submitted for analysis after review of the analytical data. Some of the data were eliminated due to data usability concerns. The percent completeness for the Site is 99.99 percent and includes the surface flux chamber data. The percent completeness for the soil-only dataset is 99.99 percent. The percent completeness for the background dataset used in the HHRA is 99.4 percent.

### 4.6.5 Evaluation of Data Comparability

Comparability is a qualitative characteristic expressing the confidence with which one dataset can be compared with another. The desire for comparability is the basis for specifying the analytical methods; these methods are generally consistent with those used in previous investigations of the Site. The comparability goal is achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units. The ranges of detected sample results from the current investigation are generally comparable to recent results at the Eastside, as well as to the Site background datasets (Section 5).

One exception may be uranium-235/236, which has reported activities that are somewhat elevated compared to background and other reported isotopes of uranium. This difference may be because the Site dataset's radionuclide analyses were performed at a different laboratory than the background dataset. The laboratory that performed the Site radionuclide analysis has indicated that the activities for uranium-235/236 hover around the noise level of the instrument and secular equilibrium is still achieved. Therefore, activities at the noise level of the instrument may vary between the instruments used at either laboratory.

There are differences in SQLs among datasets that may affect data comparability for datasets comprised primarily of non-detect values. Examples of the differences in SQLs at the Site and in shallow background for several analytes with low detection frequency are provided in Table 4-14.

**TABLE 4-14: LOW DETECTION ANALYTES EXHIBITING SQL DIFFERENCES BETWEEN BACKGROUND AND SITE SAMPLES**

| Analyte | Background Min SQL | Background Max SQL | Site Min SQL | Site Max SQL[34] |
|---|---|---|---|---|
| Antimony | 0.0394 | 0.3298 | 0.225 | 2.7 |
| Boron | 3.2 | 5.4 | 16.5 | 53 |
| Mercury | 0.0072 | 0.0072 | 0.005 | 0.0373 |
| Selenium | 0.1579 | 0.1579 | 0.4 | 2.7 |
| Thallium | 0.5428 | 1.3 | 0.105 | 1 |

All results in units of mg/kg.

Cumulative probability plots and side-by-side boxplots for the background and Site datasets are included in Appendix G. For these datasets, left-censored data can result in difficulties in differentiating whether datasets are actually different or merely an artifact of detection limits. Note that for constituents with SQLs that meet project limit requirements, comparisons between Site and background may be less important as these left-censored data are likely to indicate conditions that pose an "acceptable" risk and further evaluation is not necessary.

## 4.7 DATA ANALYSIS

Data validation and usability evaluations tend to look at the data on a result-by-result basis. The data analysis step is intended to take a step back and look at the dataset as a whole. The intent of this is to identify any anomalies or unusual data trends that may indicate potential laboratory

[34] The SQLs reported here may differ from the detection limits reported elsewhere (e.g., background comparisons). Detection limits may be raised due to blank contamination.

issues. This is performed by reviewing summary statistics, cumulative probability plots and side-by-side boxplots, or other visual aids. The soil dataset used for the HHRA is summarized in tabular format in Table 3-4. While it is not feasible to present all the detected analytes in a graphical format, cumulative probability plots and side-by-side boxplots are provided in Appendix G for the analytes included in the background comparisons (that is, metals and radionuclides). No anomalies in the dataset were identified.

As discussed in Section 4.5, the data validation process resulted in numerous sample results being qualified as estimated, with only the above-listed results being rejected. Sample results qualified as estimated are likely to be quantitatively biased to some degree; estimated analytical results are used in the HHRA. Data qualified as anomalous, as defined in the DVSRs, refers to data that were qualified ("U") due to blank contamination, and are used in the HHRA. These data usability decisions follow the guidelines provided in the *Guidance for Data Usability in Risk Assessment (Part A)* (USEPA 1992a).

For the HHRA, all soil data associated with post-remediation conditions that were not rejected during data validation, replaced by reanalysis results, or removed during a soil removal action were included. Some data were qualified as estimated due to recoveries being outside the acceptance criteria. In cases where the recoveries were higher than the acceptance criteria, the results have the potential of being similarly biased high, and using these data in the risk assessment could result in risks being calculated that are higher than would be associated with actual Site conditions. Of more concern for the HHRA is underestimation of risk, which could be associated with the use of data that are biased low. Results associated with the following QA/QC issues could lead to results that are biased low, and were subjected to further scrutiny during the data usability evaluation:

- Results associated with holding time exceedances;
- Detections qualified during the data review as being non-detections due to laboratory or field blank contamination;
- Results associated with calibration violations indicating a low bias;
- Results associated with MS/MSD or LCS/LCSD recoveries below acceptance criteria; and/or
- Results associated with surrogate percent recoveries below laboratory control limits.

Such data, which are listed above in Section 4.5, were evaluated during the data usability process to determine whether it was appropriate to use them in the risk assessment. The data usability evaluation determined that the estimated results listed in Section 4.5 were appropriate for use in the risk assessment and that the rejected data did not constitute significant data gaps and/or were not otherwise likely to lead to an underestimation of risk, as discussed in Section 4.6.2.

# 5.0 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The broad suite of analytes sampled for was the initial list of potential COPCs at the Site. However, to ensure that a risk assessment focuses on those substances that contribute the greatest to the overall risk (USEPA 1989), the following procedures were used to eliminate analytes as COPCs for quantitative evaluation in the risk assessment:[35]

- Identification of chemicals with detected levels similar to background concentrations (where applicable) (Section 5.1);
- Site and background lithology considerations (Section 5.2);
- Chemicals that are considered essential nutrients (Section 5.3); and
- Chemicals with maximum concentrations below risk-based comparison levels (i.e., below one-tenth of the residential soil BCLs) (Section 5.4).

Following USEPA guidance (1989), compounds reliably associated with Site activities based on historical information were not eliminated from the risk assessment, even if the results of the procedures given in this section indicate that such elimination is possible. The procedures for evaluating COPCs relative to background conditions and further selection of COPCs based on the other procedures are presented below.

## 5.1 EVALUATION OF CONCENTRATIONS/ACTIVITES RELATIVE TO BACKGROUND CONDITIONS

Some chemicals at the Site, particularly metals and radionuclides, are known to be naturally occurring constituents of soils and groundwater. A risk assessment should consider the contribution of background concentrations to overall Site risks, as differentiated from those concentrations associated with historical Site operations or regional anthropogenic conditions. Therefore, it is necessary to establish Site-specific background conditions to support the risk assessment.

[35] Note that these procedures for selection of COPCs deviate somewhat from those presented in the BRC Closure Plan, but are consistent with discussions between BRC and NDEP and their consultants in a December 9, 2010, meeting. BRC will use these procedures for all subsequent risk assessments. BRC will also revise the Closure Plan accordingly to make it consistent with these procedures.

As discussed in BRC's draft *Evaluations Conducted for Multiple Lines of Evidence for the Selection of Metal COPCs* (BRC 2011b), background data recommended for the Site is the entire Qal background dataset. The lithology for the Site and surrounding area is shown on Figure 12. Therefore, comparison of Site-related soil concentrations to background levels was conducted using the entire Qal background dataset presented in the *Background Soil Compilation Report* (BRC and ERM 2010a). The background dataset used is included in the dataset file on the enclosed report CD in Appendix B.

Background comparisons were performed using the Quantile test, Slippage test, the *t*-test, and the Wilcoxon Rank Sum (WRS) test with Gehan modification. The computer statistical software program, Guided Interactive Statistical Decision Tools (GiSdT®; Neptune and Company 2009), was used to perform all background comparison statistics. A weight-of-evidence approach is utilized to interpret the results of these analyses. If the detection frequency in both Site and background datasets is greater than 40 percent, then the following rationale is used for evaluation: (1) where one or two results fail one or more of the statistical tests, the remaining testing and statistical information (boxplots, summary statistics) are reviewed to support decision-making regarding whether or not the chemical should be considered consistent with background (as described by the rationale in the table below); and (2) where three or more statistical tests fail, the constituent is considered inconsistent with background. If the detection frequency is less than 40 percent in either the background or Site datasets, then the constituent is evaluated based on boxplots and summary statistics.

For samples with primary and field duplicate results, the Site sample and field duplicate[36] are treated as independent samples and both are included in all subsequent data analyses, regardless of whether one or both are non-detect. This is considered appropriate because field duplicate samples represent a discrete and unique measurement of soil chemical conditions proximal to the primary sample (unlike split samples). The field duplicates were compared to the primary sample during the course of data validation. The variances were not out of the line with the variance in results across the Site. Therefore, as distinct soil chemical measurements, they are treated as unique samples in the analyses.

[36] Field duplicates are shown in Appendix B and indicated with the "FD" qualifier under the column entitled "Sample Type."

The entire Qal background dataset was compared to the Site HHRA dataset as a whole. The results of the background comparison evaluation are presented in Table 5-1 (Tables section), and summarized in Table 5-2 below.

**TABLE 5-2: SUMMARY OF STATISTICAL BACKGROUND COMPARISON EVALUATION**

| Chemical | Statistical Tests Greater than Background? | Geochemical Evaluation Greater than Background?[1] | Greater than Background? | Basis |
|---|---|---|---|---|
| Aluminum | **YES** | NO | NO | Geochemical evaluation |
| Antimony | NO | N/A | NO | Multiple tests; ND in Site |
| Arsenic | NO | NO | NO | Multiple tests; geochemical evaluation |
| Barium | **YES** | NO | NO | Geochemical evaluation |
| **Beryllium** | **YES** | N/A | **YES** | Multiple tests |
| **Boron** | **YES** | N/A | **YES** | Multiple tests |
| **Cadmium** | **YES** | N/A | **YES** | Multiple tests |
| Calcium | **YES** | NO | NO | Geochemical evaluation |
| **Chromium** | **YES** | N/A | **YES** | Multiple tests |
| Chromium (VI) | NO | N/A | NO | Multiple tests |
| Cobalt | **YES** | NO | NO | Geochemical evaluation |
| **Copper** | **YES** | N/A | **YES** | Multiple tests |
| Iron | **YES** | NO | NO | Geochemical evaluation |
| **Lead** | **YES** | N/A | **YES** | Multiple tests |
| Lithium | NO | N/A | NO | Multiple tests |
| Magnesium | **YES** | NO | NO | Geochemical evaluation |
| Manganese | **YES** | NO | NO | Geochemical evaluation |
| **Mercury** | **YES** | N/A | **YES** | Multiple tests |
| **Molybdenum** | **YES** | N/A | **YES** | Multiple tests |
| **Nickel** | **YES** | N/A | **YES** | Multiple tests |
| **Potassium** | **YES** | N/A | **YES** | WRS test |
| **Selenium** | **YES** | N/A | **YES** | Multiple tests |

**TABLE 5-2: SUMMARY OF STATISTICAL BACKGROUND COMPARISON EVALUATION**

| Chemical | Statistical Tests Greater than Background? | Geochemical Evaluation Greater than Background?[1] | Greater than Background? | Basis |
|---|---|---|---|---|
| Silver | NO | N/A | NO | Multiple tests |
| Sodium | NO | N/A | NO | Multiple tests |
| Strontium | **YES** | NO | NO | Geochemical evaluation |
| Thallium | NO | N/A | NO | Multiple tests; ND in Site |
| **Tin** | **YES** | N/A | **YES** | Multiple tests |
| **Titanium** | **YES** | N/A | **YES** | Multiple tests |
| **Tungsten** | **YES** | N/A | **YES** | Multiple tests |
| Uranium | NO | N/A | NO | Multiple tests |
| Vanadium | **YES** | NO | NO | Geochemical evaluation |
| **Zinc** | **YES** | N/A | **YES** | Multiple tests |
| Radium-226 | NO | N/A | NO | Multiple tests |
| Radium-228 | NO | N/A | NO | Multiple tests |
| Thorium-228 | NO | N/A | NO | Multiple tests |
| Thorium-230 | NO | N/A | NO | Multiple tests |
| Thorium-232 | NO | N/A | NO | Multiple tests |
| Uranium-233/234 | NO | N/A | NO | Multiple tests |
| Uranium-235/236 | NO | N/A | NO | Other radionuclides (and uranium) not greater than background; all results near noise level of instrument |
| Uranium-238 | NO | N/A | NO | Multiple tests |

[1]Geochemical evaluation presented in Section 5.2.
N/A = Not evaluated.

Cumulative probability plots and side-by-side boxplots[37] were also prepared and are included in Appendix G. These plots give a visual indication of the similarities and differences between the Site and background datasets. The results of this comparison indicate that a number of metals are

[37] Site and background boxplots were segregated by depth (and all data). This is different than how the data were segregated in the development of exposure point concentrations as presented in Section 6.1.

statistically significant (greater than) with respect to background levels. Due to the large number of sample data in both the Site and background datasets, even small differences between the two are identified as statistically significant. For example, although there were small differences in median concentrations, cobalt, copper, and nickel were found to be statistically greater than background, as shown in Table 5-3.

**TABLE 5-3: EXAMPLE DIFFERENCES IN SITE AND BACKGROUND MEDIAN CONCENTRATIONS FOR CHEMICALS STATISTICALLY GREATER THAN BACKGROUND**

| Metal | Difference[1] (median concentrations) |
|---|---|
| Cobalt | 0.80 mg/kg |
| Copper | 2.3 mg/kg |
| Nickel | 1.0 mg/kg |

1 These differences in median concentrations were small relative to both background median concentrations and residential soil BCLs.

It should be noted that statistically significant differences may not represent scientifically and technically relevant differences. Therefore, the metals identified above as greater than background using statistical tests are evaluated further in Section 5.2.

**Secular Equilibrium for Radionuclides.** For radionuclides, secular equilibrium exists when the quantity of a radioactive isotope remains constant because its production rate (due to the decay of a parent isotope) is equal to its decay rate. In theory, if secular equilibrium exists, the parent isotope activity should be equivalent to the activity of all daughter radionuclides. Pure secular equilibrium is not expected in environmental samples because of the effect of natural chemical and physical processes. However, approximate secular equilibrium is expected under background conditions (NDEP 2009e). Both the thorium-232 and uranium-238 chains were determined to be in approximate secular equilibrium following equivalence testing outlined in the NDEP's *Guidance for Evaluating Secular Equilibrium at the BMI Complex and Common Areas February* (NDEP 2009e). The results of the equivalence testing for secular equilibrium are provided in Table 5-4.

**TABLE 5-4: SECULAR EQUIVALENCE TESTING RESULTS**

| Chain | Equivalence Test | | Secular Equilibrium? | Mean Proportion | | | |
|---|---|---|---|---|---|---|---|
| | Delta | *p*-value | | Ra-226 | Th-230 | U-233/234 | U-238 |
| U-238 | 0.1 | 0.0025 | Yes | 0.2869 | 0.2547 | 0.2279 | 0.2305 |
| | | | | Ra-228 | Th-228 | Th-232 | |
| Th-232 | 0.1 | <0.0001 | Yes | 0.3172 | 0.3498 | 0.3333 | |

Therefore, since no radionuclides failed any background tests and all are in secular equilibrium, all radionuclides are considered to be similar to background. Radionuclides are therefore not evaluated further in the HHRA.

## 5.2 GEOCHEMICAL EVALUATION

Because of the number of metals that are indicated by the statistical tests in Section 5.1 to have statistically significant differences when compared to the background dataset, a geochemical evaluation was also conducted for the Site. Appendix H provides the methodology and results of the geochemical evaluation of the concentrations of selected metals in background and Site soil samples.[38] The geochemical evaluation was performed to provide independent lines of evidence to compliment the standard statistical site-to-background comparisons performed in Section 5.1. Statistical site-to-background comparisons for trace elements in soil commonly have high false-positive and false-negative error rates. They also consider only the absolute concentrations of individual elements, disregarding the interdependence of element concentrations and the geochemical mechanisms controlling element behavior. A full discussion on the geochemical evaluation methodology and results is presented in Appendix H. Based on the results of the geochemical evaluation, the following metals, which were initially considered greater than background using the standard site-to-background comparisons performed in Section 5.1, are considered to be naturally occurring:

- Calcium
- Magnesium
- Aluminum
- Arsenic
- Strontium
- Iron
- Vanadium
- Cobalt
- Barium

[38] The geochemical evaluation was not performed for all metals.

## 5.3 ESSENTIAL NUTRIENTS

An essential nutrient is a chemical required for normal body functioning that either cannot be synthesized by the body at all, or cannot be synthesized in amounts adequate for good health, and thus must be obtained from a dietary source. USEPA (1989) states that "Chemicals that are (1) essential human nutrients, (2) present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and (3) toxic only at very high doses (i.e., much higher than those that could be associated with contact at the Site) need not be considered further in the quantitative risk assessment. Examples of such chemicals are calcium, iron, magnesium, potassium, and sodium." As discussed with and approved by the NDEP[39] and consistent with guidance and standard practices, no further quantitative evaluations are required for these essential nutrients.

## 5.4 COMPARISON TO RESIDENTIAL SOILS BCLS

BCLs for residential soils are chemical-specific, risk-based concentrations in soils that are protective of a residential land use scenario (NDEP 2011a). As discussed with and approved by the NDEP (see footnote 35), if the maximum detected concentration for a constituent is less than one-tenth of the residential soil BCL, then no further quantitative evaluation is required for that constituent. For those constituents with 100 percent non-detect values, if the maximum non-detect concentration[40] for a constituent is less than one-tenth of the residential soil BCL, no further evaluation will be conducted. If the maximum non-detect concentration is greater than one-tenth of the residential soil BCL, no further quantitative evaluation will be conducted; however, a discussion is provided in the Uncertainty Analysis (Section 7) for these constituents.

Consistent with the Closure Plan, if the TCDD TEQ concentrations do not exceed the NDEP residential BCL of 50 ppt for any sample within the Site,[41] dioxins/furans are not retained as COPCs. Therefore, because this criterion is met for the Site, dioxins/furans are not considered COPCs, and are not evaluated further in the HHRA. Lead was also not evaluated further in the HHRA since all concentrations were below its target goal of 400 mg/kg for residential land use.

The results of comparisons to one-tenth of the residential soil BCL are presented in Table 5-5 (Tables section), and summarized in Table 5-6 below.

[39] Meeting with NDEP on December 9, 2010.
[40] The non-detect value is equal to the SQL.
[41] See Section 2.5 for a discussion on future land use for the Galleria North-School Site sub-area.

**TABLE 5-6: RESULTS OF COMPARISON TO RESIDENTIAL SOILS BCLs**

| Chemical | Maximum Concentration Greater than 1/10th BCL? | Notes |
|---|---|---|
| **Perchlorate** | **YES** | |
| All other metals/inorganics | NO | |
| **Butylbenzyl phthalate** | **YES** | |
| **Benzo(a)pyrene** | **YES** | |
| **Benzo(b)fluoranthene** | **YES** | |
| **Dibenzo(a,h)anthracene** | **YES** | |
| All other organic compounds | NO | |

Note: Only metals and radionuclides greater than background (Sections 5.1 and 5.2 were included in the comparison to one-tenth of the residential soil BCL.

Four organic compounds and one inorganic compound were found to exceed their respective one-tenth of the residential soil BCL.

## 5.5 SUMMARY OF SELECTION OF COPCS

The procedures for COPC selection were discussed above. Results of the selection of COPCs, including the rationale for excluding chemicals as COPCs, are presented in Table 5-7.[42]

These procedures apply to soil results. Indoor air exposures are evaluated on a sample-by-sample basis, per NDEP requirements, using the surface flux data measurements. Because of this, elimination of COPCs from the surface flux data is not done. Instead, every chemical detected in an individual surface flux location is included in the evaluation for that location. Therefore, the minimum and maximum surface flux risk estimates are summed with the soil risk estimates to provide a range of cumulative risks.

[42] Consistent with the BRC Closure Plan and prior submittals approved by the NDEP, COPCs identified in Table 5-7 are also carried through to the soil-leaching-to-groundwater evaluation. There is not a separate selection of COPCs for the soil leaching-to-groundwater pathway.

# 6.0 HUMAN HEALTH RISK ASSESSMENT

This section presents the HHRA of all COPCs identified in Section 5 for all receptors of concern via all complete pathways. The methods used in the risk assessment follow standard USEPA guidance. Specifically, the methods used in the risk assessment followed basic procedures outlined in the USEPA's *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual* (USEPA 1989). Other guidance documents consulted include:

- *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual. Supplemental Guidance: Standard Default Exposure Factors* (USEPA 1991b).
- *Guidelines for Exposure Assessment* (USEPA 1992b).
- *Soil Screening Guidance: Technical Background Document* (USEPA 1996).
- *Exposure Factors Handbook, Volumes I-III* (USEPA 1997).
- *Soil Screening Guidance for Radionuclides* (USEPA 2000b).
- *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (USEPA 2002b).
- *Technical Support Document for a Protocol to Assess Asbestos-Related Risk. Final Draft* (USEPA 2003b).
- *Child-Specific Exposure Factors Handbook* (USEPA 2006).
- *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* (USEPA 2004e).
- *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)* (USEPA 2009).

Various NDEP guidance documents are also relied on for the HHRA. These include:

- *Supplemental Guidance for Assessing Data Usability for Environmental Investigations at the BMI Complex and Common Areas in Henderson, Nevada* (NDEP 2008a).
- *Guidance for Evaluating Secular Equilibrium at the BMI Complex and Common Areas* (NDEP 2009a).

- *Technical Guidance for the Calculation of Asbestos-Related Risk in Soils for the Basic Management Incorporated (BMI) Complex and Common Areas* (NDEP 2009b, 2010).
- *Supplemental Guidance on Data Validation* (NDEP 2009c, d).
- *Guidance for Evaluating Radionuclide Data for the BMI Plant Sites and Common Areas Projects* (NDEP 2009e).

The risk assessment is a deterministic risk assessment, meaning that single values based on conservative assumptions are used for all modeling, exposure parameters, and toxicity criteria. These conservative estimates compound each other so that the calculated risks likely exceed the true risks at the Site.

The method used in the risk assessment consists of several steps. The first step is the calculation of exposure point concentrations representative of the particular area, for each medium of concern. This step includes fate and transport modeling to predict concentrations that may be present when direct measurements are not available. The second step is the exposure assessment for the various receptors present in the particular areas. The next step is to define the toxicity values for each COPC. The final step is risk characterization where theoretical upper-bound cancer risks and non-cancer HIs are calculated.

## 6.1 DETERMINATION OF EXPOSURE POINT CONCENTRATIONS

A representative exposure concentration is a COPC-specific and media-specific concentration value. In risk assessment, these exposure concentrations are values incorporated into the exposure assessment equations from which potential baseline human exposures are calculated. As described below, the methods, rationale, and assumptions employed in deriving these concentration values follow USEPA guidance and reflect Site-specific conditions.

Chemical, physical, and biological processes may affect the fate and transport of chemicals in water, soil, and air. Chemical processes include solubilization, hydrolysis, oxidation-reduction, and photolysis. Physical processes include advection and hydrodynamic dispersion, volatilization, dispersion, and sorption/desorption to soil, sediment, and other solid surfaces. Biological processes include biodegradation, bioaccumulation, and bioconcentration. All of these processes are dependent upon the physical and chemical properties of the chemicals, the physical and chemical properties of the soil and water, and other environmental factors such as temperature, humidity, and the conditions of water recharge and movement. The net effect of these environmental factors is a time-dependent reduction of chemical concentrations in water,

soil, and air. The determination of exposure point concentrations for media other than soil take into account chemical-specific physical parameters and inter-media transfers as discussed below. All modeling input parameters, calculations and results are presented in Appendix I (included on the report CD in Appendix B).

### 6.1.1 Soil

Due to the uncertainty associated with determining the true average concentration at a site, where direct measurements of the site average are infeasible and unavailable, the USEPA recommends using the lower of the maximum detected concentration or the 95 percent UCL as the concentration of a chemical to which an individual could be exposed over time (USEPA 1992b). For the 95 percent UCL concentration approach, the 95 percent UCL was computed to represent the area-wide exposure point concentrations. The 95 percent UCL is a statistic that quantifies the uncertainty associated with the sample mean. If randomly drawn subsets of Site data are collected and the UCL is computed for each subset, the UCL equals or exceeds the true mean roughly 95 percent of the time. The purpose for using the 95 percent UCL is to derive a conservative, upper-bound estimate of the mean concentration, which takes into account the different concentrations to which a person may be exposed at the Site. That is, an individual will be exposed to a range of concentrations that exist at an exposure area, from non-detect to the maximum concentration, over an entire exposure period.

The 95 percent UCL statistical calculations were performed using the GiSdT® (Neptune and Company 2009). Section 5.1 outlines the treatment of sample locations with field duplicates prior to the 95 percent UCL statistical calculations described in this section. For these calculations, chemical non-detect results are assigned a value of one-half the SQL. The formulas for calculating the 95 percent UCL COPC concentration (as the representative exposure concentration) are presented in USEPA (1992c, 2002c) and GiSdT® (Neptune and Company 2009). Three UCL methods are employed in the GiSdT® software. They include the Student's t UCL, the bootstrap percentile UCL, and the bootstrap BCa UCL. The maximum UCL of these three methods was used as the exposure point concentration, unless the maximum UCL of the three methods was greater than the maximum detected concentration. In these cases, the maximum detected concentration was selected as the exposure point concentration.

The representativeness of the 95 percent UCLs for the exposure area, that is, a Sitewide mean concentration is valid for all receptors at the Site, is further supported by the intensity plot figures included in Appendix J. Figures for each of the COPCs are included in Appendix J (in addition to figures developed for all metals). A figure is also presented for TCDD TEQ.

Although not COPCs for the Site, TCDD TEQ is a primary chemical of interest for the project. Based on the results of the background comparison tests, a review of the probability plots, boxplots, and distribution and intensity plot figures, data across the Site are assumed to be uncorrelated, that is, there is no discernable spatial correlation.[43] Although there may be spatial correlation of data across the Site, it has not been observed. Thus, the assumption is made for statistical testing purposes that the data are not spatially correlated.[44] This results in lower p-values and hence a greater number of statistical differences than would be the case if spatial correlation were accounted for. Ignoring correlation therefore causes conservatism, and the need to further evaluate spatial correlation is not warranted. Therefore consistent with the project *Statistical Methodology Report* (NewFields 2006), each measurement is assumed to be equally representative for that chemical at any point in the Site and calculation of the 95 percent UCL is appropriate.

The data were also reviewed for the presence of hot spots, and as discussed in Section 3.5 one location was evaluated. Because all constituents were lower than their respective BCL (or maximum background concentration) and the sampling location has been over-excavated, it was not necessary to treat the associated data at this location as a hot spot or a separate exposure area in the HHRA. No other potential hot spots were identified at the Site.

Representative exposure concentrations for soil are based on the potential exposure depth for each of the receptors. For all receptors, two different exposure depths are considered, based on the sample depth rules schematic presented in Section 3: all data (surface and subsurface) and data classified as surface soil only. These different soil exposure classifications are considered to represent all possible exposure potential for all receptors, based on the future grade and use of Site soils. Ninety-five percent UCLs are calculated for both exposure depth scenarios. To be conservative, the higher of the two values was used in the risk estimates for each COPC. The 95 percent UCL for each COPC is presented in Table 6-1 (Tables section). For indirect exposures, this concentration was used in fate and transport modeling.

[43] Although the Statistical Methodology Report states that confirmation measurements of each chemical in a given soil layer will be used to compute variograms, as noted in the text above, this was not conducted for the Site, which is a deviation from the *BRC Closure Plan* methodology.

[44] Some variability of the data is expected, if there was perfect homogeneity then only one sample would be needed to represent the Site. This natural variability is demonstrated by the background datasets for the project. As shown on the probability and boxplots in Appendix G, the data generally follow a normal distribution, and their variability are similar to the background data.

The exposure point concentrations for asbestos (USEPA 2003b, NDEP 2009b) were based on the pooled analytical sensitivity of the dataset.[45] The asbestos data and analytical sensitivities are presented in Table 6-2. Therefore, asbestos exposure point concentrations are determined differently than those for the other COPCs. The pooled analytical sensitivity is calculated as follows:

$$Pooled\ Analytical\ Sensitivity = 1/\left[\sum_i (1/analytical\ sensitivity\ \ for\ trial\ i)\right]$$

Two estimates of the asbestos concentration were evaluated, best estimate and upper bound, as defined in the draft methodology (USEPA 2003b). The best estimate concentration is similar to a central tendency estimate, while the upper bound concentration is comparable to a reasonable maximum exposure estimate. The pooled analytical sensitivity is multiplied by the number of chrysotile or amphibole structures to estimate concentration:

$$\text{Estimated Bulk Concentration } (10^6 \text{ s/gPM10}) = \text{Long fiber count} \times \text{Pooled analytical sensitivity}$$

For the best estimate, the number of fibers measured across all samples is incorporated into the calculation above. The upper bound of the asbestos concentration was also evaluated. It is calculated as the 95 percent UCL of the Poisson distribution mean, where the Poisson mean was estimated as the total number of structures detected across all samples. In Microsoft Excel, the following equation may be employed to calculate this value:

95 percent UCL of Poisson Distribution Mean = CHIINV(1-upper confidence percentile, 2 × (Long fiber count + 1))/2

This value is then multiplied by the pooled analytical sensitivity to estimate the upper bound concentration. The intent of the risk assessment methodology is to predict the risk associated with airborne asbestos. In order to quantify the airborne asbestos concentration, the estimated dust levels or particulate emission factors (PEFs) were used:

$$\text{Estimated Airborne Concentration } (\text{s/cm}^3) = \text{Estimated bulk concentration } (10^6 \text{ s/gPM10}) \times \text{Estimated dust level } (\text{ug/cm}^3)$$

[45] Unlike other analytes, although called field duplicate samples, these samples for asbestos are more accurately characterized as field split samples. That is, these samples were obtained from a split of the sample collected in the field. This split was conducted by the field sample crew prior to sending the samples to the laboratory. Therefore, only the higher of the split sample results are included in the pooled analytical sensitivity or risk calculations for asbestos.

Further explanation of the asbestos risk calculations and estimates are provided in the NDEP's *Technical Guidance for the Calculation of Asbestos-Related Risk in Soils* (2009b) and *Workbook for the Calculation of Asbestos-Related Risk in Soils* (2010).

### 6.1.2 Indoor Air

*USEPA's 2002 Vapor Intrusion Guidance*

BRC has reviewed USEPA's 2002 Vapor Intrusion Guidance (2002d), and this approach was used for the Site. The guidance recommends that a tiered approach be followed to address vapor intrusion. BRC has followed a tiered approach for each of the Eastside sub-areas, including the Site.

First, in each of the sub-area SAPs, including that for the Site, each of the chemicals (VOCs and volatile SVOCs) to be evaluated further in each sub-area (that is, a Tier 1 assessment) was identified.

Second, the existing groundwater data for wells that are located within (or adjacent to) that sub-area was compared with the USEPA 2002 Tier 2 comparison values (provided in lookup tables in the guidance document). Thus, this Tier 2 assessment was done in the NDEP-approved SAPs for each of the sub-areas.

Third, a Site-specific HHRA for vapor intrusion using surface flux data on a sample-by-sample basis was conducted, per NDEP recommendations (that is, a Tier 3 assessment; see below).

As noted in USEPA's 2002 guidance for a Tier 3 site-specific assessment: "If buildings are not available or not appropriate for sampling, for example in cases where future potential impacts need to be evaluated, … other more direct measures of potential impacts, such as emission flux chambers or soil gas surveys, may need to be conducted in areas underlain by subsurface contamination." Thus surface flux measurements are allowed under USEPA's guidance. BRC is aware of USEPA's recent *Review of the Draft 2002 Subsurface Vapor Intrusion Guidance*. Issues and recommendations identified in this documents as well as the USEPA Office of Inspector General's *Evaluation Report—Lack of Final Guidance on Vapor Intrusion Impedes Efforts to Address Indoor Air Risks* (December 14, 2009), focus primarily on Tier 1 and Tier 2 assessments, and ultimately will not affect how indoor air exposures have been evaluated for the Site.

Fourth, the various factors pertaining to vapor intrusion, including depth to groundwater (now and in the future), the nature of the soil column from ground surface to groundwater, and, water quality (i.e., the constituents likely to be present in groundwater and that might pose any vapor intrusion concerns) were evaluated.

A more detailed Site-specific evaluation of vapor intrusion potential at a comparison study area within the Eastside property was also performed. Although depth to groundwater at the Site (25 to 30 feet bgs) is shallower than at the comparison study area (55 to 60 feet bgs), VOC concentrations in groundwater are much lower at the Site than in the comparison study area (for example, chloroform concentration in groundwater of 66 to 97 µg/L at the Site versus 250 to 900 µg/L at the comparison study area). Therefore, the comparison study area presents a greater potential for vapor intrusion than the Site. The detailed evaluation of vapor intrusion risk assessments for chloroform performed at the comparison study area location showed that risks were acceptable (residential indoor cancer risks ranged from $1 \times 10^{-8}$ to $4 \times 10^{-7}$, and non-cancer HIs were well below 1.0).

*Site-Specific Tier 3 Assessment*

Concentrations of volatile constituents (VOCs and certain SVOCs) in soil and groundwater that may infiltrate buildings to be constructed at the Site through cracks in the foundations are estimated using USEPA surface emission isolation flux chamber (flux chamber) measurements collected at the Site in accordance with USEPA (1986) guidance and the Flux Chamber SOP-16 (BRC, ERM, and MWH 2008). The flux chamber is used to measure the emission rates from surfaces emitting gas species. Use of the flux chamber reduces the need for modeling surface flux rates, which reduces the uncertainty in the air representative exposure concentrations and the risk characterization. Because the flux chamber measurements were conducted outdoors on open soil, an "infiltration factor" is applied to the outdoor surface flux data to generate data supporting the inhalation of indoor air exposure pathway. The infiltration factor is based on the factors found in the American Society for Testing and Materials (ASTM) *Standard Guide for Risk Based Corrective Action* (2000). The indoor air concentrations are determined from the surface flux measurements using the following mixing equation:

$$C_a = \frac{J \times \eta}{L \times ER}$$

where:

$C_a$ = indoor air concentration (milligram per cubic meter [$mg/m^3$])

J = measured surface flux of chemical (mg/m$^2$-min)
η = foundation crack fraction (unitless)
L = enclosed space volume/infiltration area ratio (meter [m])
ER = enclosed space air exchange rate (1/min)

Default parameter values from ASTM (2000) for residential buildings were used. These default parameters are presented in the electronic indoor air calculation files in Appendix I (included on the report CD in Appendix B). As noted in Section 5.5, indoor air exposures are evaluated on a sample by sample basis, per NDEP requirements, using the surface flux data measurements. Every chemical detected in an individual surface flux location is included in the evaluation for that location.

Indoor air concentrations based on the surface flux data measurements are shown in the electronic indoor air calculation files in Appendix I (included on the report CD in Appendix B) and are summarized in Table 6-3. In all cases the maximum of the two flux chamber measurements (TO-15 full scan and TO-15 SIM) is used.

### 6.1.3 Outdoor Air

Long–term exposure to COPCs bound to dust particles is evaluated using the USEPA's PEF approach (USEPA 2002b). The PEF relates concentrations of a chemical in soil to the concentration of dust particles in the air. The Q/C (Site-Specific Dispersion Factor) values in this equation are for Las Vegas, Nevada (Appendix D of USEPA 2002b). The equation used is:

$$PEF = Q/C_{wind} \times \frac{3{,}600 \text{ sec/hr}}{0.036 \times (1 - V) \times (U_m / U_t)^3 \times F(x)}$$

where:

PEF = Particulate emission factor (m$^3$/kg)
$Q/C_{wind}$ = Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source (g/m$^2$ -s per kg/m$^3$)
V = Fraction of vegetative cover (unitless)
$U_m$ = Mean annual windspeed (m/s)
$U_t$ = Equivalent threshold value of windspeed at 7m (m/s)
F(x) = Function dependent on $U_m/U_t$ derived using USEPA (1985) (unitless)

and

$$Q/C_{wind} = A \times \exp \frac{(\ln A_{site} - B)^2}{C}$$

where

$A_{site}$ = Source Area (acre)
A, B, C = Air Dispersion Constants for LV (unitless)

The dust model and parameters utilized to generate the PEF are presented in Table 6-4.

The USEPA guidance for dust generated by construction activities (USEPA 2002b) was used for assessing short-term construction worker exposures:

$$PEF = \frac{1}{\left(\left(\frac{1}{PEF_{sc}}\right) + \left(\frac{1}{PEF_{sc_road}}\right)\right)}$$

where:

$PEF_{sc}$ = Subchronic particulate emission factor for construction activities ($m^3/kg$)
$PEF_{sc_road}$ = Subchronic particulate emission factor for unpaved road traffic ($m^3/kg$)

Input soil concentrations for the model are the exposure point concentrations as described above. The construction dust model and all relevant equations and parameters utilized to generate the construction worker PEF from this guidance are provided in Table 6-5. Site-specific surface soil moisture data were collected in January, February, and August. The average of the surface soil data is 4.31 percent. This is considered an adequate representation of the annual average; therefore, this value is used for the percent moisture in dry road surface parameter instead of the NDEP model default value.

In addition, for receptors with indoor exposures (i.e., residents, indoor commercial workers), a dilution factor is applied to obtain an indoor air concentration of dust particles, based on USEPA (2000b).

The flux chamber measurements as described in Section 6.1.2 above are used for exposures to VOCs and volatile SVOCs in outdoor air if the chemical was present in the TO-15 analyte list. If the VOC or volatile SVOC was measured in soil but not on the TO-15 analyte list, then the exposure point concentration was estimated using USEPA's volatilization factor. Outdoor

surface flux data are divided by the dispersion factor for volatiles ($Q/C_{vol}$ for Las Vegas; from USEPA 2002b) for use in the outdoor air exposure pathway. The same dispersion factor is used for all scenarios. The dispersion factor for the construction worker is not adjusted to account for soil intrusion activities. Outdoor air concentrations based on soil data for all receptors are shown in Table 6-6. Outdoor air concentrations based on the surface flux data measurements are shown in the electronic indoor air calculation files in Appendix I (included on the report CD in Appendix B) and are summarized in Table 6-3.

### 6.1.4 Homegrown Produce

Consistent with the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010) and USEPA guidance, the consumption of homegrown produce is an applicable exposure pathway for residential receptors. Representative exposure concentrations in plants were obtained using the soil 95 percent UCL for each COPC, multiplied by plant uptake factors. As per the Closure Plan, plant uptake factors were obtained from USEPA (2005b) and Baes et al. (1984). Plant uptake factors for inorganics were obtained from empirical data, where available. Plant uptake factors for organics are calculated based on the following equations (from USEPA 2005b):

Aboveground plant uptake factor:

$$log\ Br_{above} = 1.588 - 0.578\ log\ K_{ow}$$

Belowground plant uptake factor:

$$Br_{below} = \frac{RCF}{Kd_s} \times VG$$

where:

| | | |
|---|---|---|
| $Br_{above}$ | = | aboveground plant uptake factor (mg/kg plant DW/mg/kg soil) |
| $Br_{below}$ | = | belowground plant uptake factor (mg/kg plant DW/mg/kg soil) |
| $K_{ow}$ | = | octanol/water partitioning coefficient (unitless) |
| RCF | = | root concentration factor (mg/g plant DW/mg/mL soil water) |
| $Kd_s$ | = | Soil-water partition coefficient (mL water/g soil) |
| VG | = | empirical correction factor for belowground produce (unitless)(0.01 for COPCs with a log Kow greater than 4 and 1.0 for COPCs with a log Kow less than 4) |

Plant uptake factors are presented in Table 6-7. See Section 7.2.3 regarding plant uptake of perchlorate.

## 6.2 EXPOSURE ASSESSMENT

In a risk assessment, the possible exposures of populations are examined to determine if the chemicals at a site could pose a threat to the health of identified receptors. The risks associated with exposure to chemicals depend not only on the concentration of the chemicals in the media, but also on the duration and frequency of exposure to those media. For example, the risks associated with exposure to chemicals for 1 hour a day are less than those associated with exposure to the same chemicals at the same concentrations for 2 hours a day. Potential health impacts from chemicals in a medium can occur via one or more exposure pathways. The exposure assessment step of a risk assessment combines information regarding impacted media at a site with assumptions about the people who could come into contact with these media. The result is an estimation of a person's potential rate of contact with impacted media from the Site. The intake rates are evaluated in the risk characterization step to estimate the risks they could pose.

In this section, assumptions regarding people's activities, such as the frequency with which a person could come into contact with impacted media, are discussed. Finally, the daily doses at the points of potential human contact were estimated using these assumptions, the models described in Section 6.1, and the chemical concentrations reported for soil and surface flux samples collected from the Site.

### 6.2.1 Exposure Parameters

In this section, the assumptions regarding the extent of exposure are presented for each of the exposure pathways for each medium of concern at the Site. Tables 6-8 and 6-9 present each of the exposure parameters used in the risk assessment for each receptor and each pathway. Many of the assumptions regarding the extent of exposure are default factors developed by USEPA's Superfund program. Default values were modified to reflect Site-specific conditions, where possible. The exposure parameters used in the risk assessment were those defined in Tables 9-2 through 9-5 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010).

### 6.2.2 Quantification of Exposure

In this section, the concentrations of COPCs at the points of potential human exposure are combined with assumptions about the behavior of the populations potentially at risk to estimate the dose of COPCs that may be taken in by the exposed individuals. Later, in the risk characterization step of the assessment, the doses are combined with toxicity parameters for COPCs to estimate whether the calculated intake levels pose a threat to human health.

The method used to estimate the average daily dose (ADD) for non-carcinogens COPCs via each of the complete exposure pathways is based on USEPA (1989, 1992b) guidance. For carcinogens, lifetime ADD (LADD) estimates are based on chronic lifetime exposure, extrapolated over the estimated average lifetime (assumed to be 70 years). This establishes consistency with cancer slope factors (CSFs), which are based on chronic lifetime exposures. For non-carcinogens, ADD estimates are averaged over the estimated exposure period. ADDs and LADDs were calculated for each exposure scenario using the following generic equation:

$$Dose = \frac{C \times IR \times ED \times EF}{BW \times AT \times 365\ d/yr}$$

where:

| | | |
|---|---|---|
| Dose | = | ADD for non-carcinogens and LADD for carcinogens (in mg/kg-day) |
| C | = | chemical concentration in the contact medium (e.g., mg/kg soil) |
| IR | = | intake rate (e.g., mg/day soil ingestion and dermal contact [requires a conversion factor of $10^{-6}$ kg/mg]; |
| ED | = | exposure duration (years of exposure) |
| EF | = | exposure frequency (number of days per year) |
| BW | = | average body weight over the exposure period (kilograms) |
| BIO | = | relative bioavailability (unitless) |
| AF | = | absorption fraction (percent) |
| AT | = | averaging time; same as the ED for non-carcinogens and 70 years (average lifetime) for carcinogens |

Risk estimates for inhalation exposures follow USEPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)* (USEPA 2009). That is, the concentration of a chemical in air is used as the exposure metric (e.g., $mg/m^3$), rather than inhalation intake of a chemical in air based on inhalation rate and body weight (e.g., mg/kg-day). The generic equation for calculating inhalation exposures is:

$$EC = \frac{C_{air} \times ET \times ED \times EF}{AT}$$

where:

EC = exposure concentration (in $mg/m^3$)
$C_{air}$ = chemical concentration in air (in $mg/m^3$)
ET = exposure time (hours per day)
ED = exposure duration (years of exposure)
EF = exposure frequency (number of days per year)
AT = averaging time; same as the ED for non-carcinogens and 613,200 hours (i.e., 70 years; average lifetime) for carcinogens

Pathway-specific equations for calculating ADDs and LADDs are provided in Table 9-6 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010).

For conservatism, the relative oral bioavailability (BIO) of all COPCs was assumed to be 100 percent. Chemical-specific dermal absorption values from USEPA guidance (USEPA 2004e [Part E RAGS]) were used in the risk assessment. USEPA does not recommend absorption factors for VOCs based on the rationale that VOCs from the soil are volatilized on skin and exposure is accounted for via inhalation routes. In addition, RAGS Part E (USEPA 2004e) states "For inorganics, the speciation of the compound is critical to the dermal absorption and there are too little data to extrapolate a reasonable default value." Therefore, dermal absorption factors are also not used for inorganics. The NDEP and its consultants have concurred with this decision.

Exposure levels of potentially-carcinogenic and non-carcinogenic chemicals are calculated separately because different exposure assumptions apply (i.e., ADD for non-carcinogens and LADD for carcinogens). Exposure levels are estimated for each relevant exposure pathway (i.e., soil, air, and water), and for each exposure route (i.e., oral, inhalation, and dermal). Daily doses for the same route of exposure are summed. The total dose of each chemical is the sum of doses across all applicable exposure routes. As noted previously, radionuclides are consistent with background concentrations and are not addressed in this HHRA.

### 6.2.3 Asbestos

Although final USEPA guidance is unavailable at this time, USEPA recommends that site-specific risk assessments be performed for asbestos (USEPA 2004f). Risks associated with asbestos in soil are evaluated using the NDEP's *Technical Guidance for the Calculation of*

*Asbestos-Related Risk in Soils* (2009b) and *Workbook for the Calculation of Asbestos-Related Risk in Soils* (2010), and the draft methodology proposed by USEPA (2003b). This methodology is an update of the method described in *Methodology for Conducting Risk Assessments at Asbestos Superfund Sites-Part 1: Protocol* and *Part 2: Technical Background Document* (Berman and Crump 1999a, b). Because the risk assessment methodology for asbestos is unlike that for other COPCs, asbestos risks are evaluated separately from other chemical risks.

The intent of the risk assessment methodology is to predict the amount of airborne asbestos, which causes an unacceptable risk to a human receptor. Asbestos concentrations are measured in soil, and are then used to predict airborne asbestos concentrations using a dust emissions model. Asbestos data are collected from the top 2 inches of soil. While asbestos might exist below the top 2 inches of soil due to soil turnover, the concentrations in the surface soil are likely to be greater than concentrations beneath the surface, and the exposure pathway is to near-surface soils. Therefore, the "shallow" surface soils asbestos concentration estimate is used to represent the potential exposure to asbestos.

To interpret measurements of asbestos in soils, it is necessary to establish the relationship between the asbestos concentrations observed in soils and concentrations that will occur in air when such soil is disturbed by natural or anthropogenic forces. This is because asbestos is a hazard when inhaled (see, for example, Berman and Crump 2001; USEPA 2003b). Indeed, the Modified Elutriator Method (Berman and Kolk 2000), which was the method employed to perform the analyses presented in this report, was designed specifically to facilitate prediction of airborne asbestos exposures based on bulk measurements (see, for example, Berman and Chatfield 1990).

Briefly, the Modified Elutriator Method incorporates a procedure for isolating and concentrating asbestos structures as part of the respirable dust fraction of a sample, and analytical measurements are reported as the number of asbestos structures per mass of respirable dust in the sample. This turns out to be precisely the dimensions required to combine such measurements with published dust emission and dispersion models to convert them to asbestos emission and dispersion models. These models can be combined with measurements from the Modified Elutriator Method to predict airborne exposures and assess the attendant risks.

## 6.3 TOXICITY ASSESSMENT

This section describes the toxicity of the COPCs at the Site. Numerical toxicity values were developed for use in the calculation of the hazard quotients (HQs; for non-carcinogens) and risks (for carcinogens).

### 6.3.1 Toxicity Values

Toxicity values, when available, are published by the USEPA in the on-line Integrated Risk Information System [IRIS]; USEPA 2011). CSFs (in units of milligrams per kilogram per day $[mg/kg\text{-}d]^{-1}$) are chemical-specific and experimentally derived potency values that are used to calculate the risk of cancer resulting from exposure to potentially carcinogenic chemicals. Inhalation unit risks (IURs) represent the upper-bound excess lifetime cancer risk from continuous exposure to a chemical at a concentration of 1 microgram per cubic meter ($\mu g/m^3$). A higher value implies a more potent carcinogenic potential. Reference dosages (RfDs) are experimentally derived "no-effect" levels used to quantify the extent of toxic effects other than cancer due to exposure to chemicals (in units of mg/kg-d). Similarly, a reference concentration (RfC) is the derived "no-effect" concentration for a lifetime of continuous inhalation exposure (in units of milligrams per cubic meter $[mg/m^3]$). With RfDs or RfCs, a lower value implies a more potent toxicant. These criteria are generally developed by USEPA risk assessment work groups and listed in the USEPA risk assessment guidance documents and databases. Available toxicity values for all Site COPCs used in the risk assessment were obtained using the following hierarchy for selecting toxicity criteria (based on USEPA 2003c):

1. IRIS;
2. USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs);
3. National Center for Environmental Assessment (or other current USEPA sources);
4. Health Effects Assessment Summary Tables (HEAST);
5. USEPA Criteria Documents (e.g., drinking water criteria documents, drinking water Health Advisory summaries, ambient water quality criteria documents, and air quality criteria documents);
6. ATSDR toxicological profiles;
7. USEPA's Environmental Criteria and Assessment Office; and

8. Peer-reviewed scientific literature.

In addition, toxicity criteria and toxicological surrogates recommended by the NDEP are used in the risk assessment. Toxicity criteria are consistent with those used in the development of the NDEP's BCLs (NDEP 2011a), unless newer values are available from USEPA. Toxicity criteria have not been developed by BRC for elements or compounds that do not have criteria published in the above sources.

Although USEPA has developed toxicity criteria for the oral and inhalation routes of exposure, it has not developed toxicity criteria for the dermal route of exposure. USEPA has proposed a method for extrapolating oral toxicity criteria to the dermal route in the recently released *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* (USEPA 2004e). USEPA states that the adjustment of the oral toxicity factor for dermal exposures is necessary only when the oral-gastrointestinal absorption efficiency of the chemical of interest is less than 50 percent (due to the variability inherent in absorption studies). For COPCs to which dermal exposure might occur at the Site, the oral-gastrointestinal absorption efficiencies are greater than 50 percent, except for total chromium, hexavalent chromium, mercury, nickel, and vanadium. Therefore, the USEPA indicated adjustment of the oral toxicity criteria to generate dermal criteria was performed for these COPCs.

### 6.3.2 Non-Carcinogenic Health Effects

For non-carcinogenic health effects, USEPA assumes that a dose threshold exists, below which adverse effects are not expected to occur. A chronic RfD or RfC of a chemical is an estimate of a lifetime daily dose to humans that is likely to be without appreciable deleterious non-carcinogenic health effects. To derive an RfD or RfC, a series of professional judgments is made to assess the quality and relevance of the human or animal data and to identify the critical study and the most critical toxic effect. Data typically used in developing the RfD or RfC are the highest no-observable-adverse-effect-levels (NOAELs) for the critical studies and effects of the non-carcinogen. For each factor representing a specific area of uncertainty inherent in the extrapolation from the available data, an uncertainty factor is applied. Uncertainty factors generally consist of multiples of 10, although values less than 10 are sometimes used.

Four major types of uncertainty factors are typically applied to NOAELs in the derivation of RfDs or RfCs. Uncertainty factors of 10 are used to (1) account for the variability between humans, (2) extrapolate from animals to humans, (3) account for a NOAEL based on a

subchronic study instead of a chronic study, and (4) extrapolate from a lowest-observed-adverse-effect-level (LOAEL) to a NOAEL, if necessary. In addition, a modifying factor can be used to account for adequacy of the database. Typically, the modifying factor is set equal to one.

To obtain the RfD or RfC, all uncertainty factors associated with the NOAEL are multiplied together, and the NOAEL is divided by the total uncertainty factor. Therefore, each uncertainty factor adds a degree of conservatism (usually one order of magnitude) to the RfD or RfC. An understanding of the uncertainties associated with RfDs or RfCs is important in evaluating the significance of the HIs calculated in the risk characterization portion of the risk assessment. When available sub-chronic RfDs or RfCs were used to evaluate construction worker exposures. The COPCs in this assessment with USEPA-established oral/dermal and inhalation RfDs or RfCs are presented in Tables 6-10 and 6-11, for surface flux and soil COPCs, respectively.

### 6.3.3 Carcinogenic Health Effects

USEPA develops CSFs and IURs from chronic animal studies or, where possible, epidemiological data. Because animal studies use much higher doses over shorter periods of time than the exposures generally expected for humans, the data from these studies are adjusted, typically using a linearized multi-stage (LMS) mathematical model. To ensure protectiveness, CSFs/IURs are typically derived from the 95th percentile UCL of the slope, and thus the actual risks are unlikely to be higher than those predicted using the CSF/IUR, and may be considerably lower. The COPCs in this assessment with USEPA-established oral/dermal and inhalation CSFs/IURs are presented in Tables 6-10 and 6-12, for surface flux and soil COPCs, respectively.

### 6.3.4 Asbestos

Asbestos toxicity criteria were obtained from Table 8-1 of Berman and Crump's (2001) document and Tables 8-2 and 8-3 in the USEPA (2003b) guidance. The toxicity criteria vary based on fiber type, endpoint (lung cancer, mesothelioma, or combined) and percent of fibers longer than 10 micrometers (μm) and less than 0.4 μm in width. For this risk assessment the toxicity criteria were based on a combined endpoint of lung cancer and mesothelioma averaged over the smokers and non-smokers of the population, with the assumption that 50 percent of fibers are greater than 10 μm in length. The resulting unit risk factors (structures/cubic centimeter) are presented in Appendix I (included on the report CD in Appendix B). A complete discussion on issues associated with risk estimates for asbestos is presented in the NDEP's *Technical Guidance for the Calculation of Asbestos-Related Risk in Soils* (2009b).

## 6.4 RISK CHARACTERIZATION

In the last step of a risk assessment, the estimated rate at which a receptor intakes a chemical is compared with information about the toxicity of that COPC to estimate the potential risks posed by exposure to the COPC. This step is known as risk characterization. The methods used for assessing cancer risks and non-cancer adverse health effects are discussed below.

### 6.4.1 Methods for Assessing Cancer Risks

In the risk characterization, carcinogenic risk is estimated separately as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to chemicals and asbestos. Carcinogenic risks for chemicals were evaluated by multiplying the estimated average exposure rate (i.e., LADD calculated in the exposure assessment) by the chemical's CSF or IUR. The CSF converts estimated daily doses averaged over a lifetime to incremental risk of an individual developing cancer. Because cancer risks are averaged over a person's lifetime, longer-term exposure to a carcinogen results in higher risks than shorter-term exposure to the same carcinogen, if all other exposure assumptions are constant. Theoretical risks associated with low levels of exposure in humans are assumed to be directly related to an observed cancer incidence in animals associated with high levels of exposure while the IUR converts estimated exposure concentrations averaged over a lifetime to incremental risk of an individual developing cancer. According to USEPA (1989), this approach is appropriate for theoretical upper-bound ILCRs of less than $1 \times 10^{-2}$. The following equations were used to calculate COPC-specific risks and total risks:

$$Risk = EC \times IUR \quad or \quad LADD \times CSF$$

where:

LADD = lifetime average daily dose (mg/kg-d)
EC = exposure concentration ($mg/m^3$)
IUR = inhalation unit risk $(mg/m^3)^{-1}$
CSF = cancer slope factor $(mg/kg\text{-}d)^{-1}$

and

$$Total\ Carcinogenic\ Risk = \Sigma\, Individual\ Risk$$

It is assumed that cancer risks for different chemicals and from multiple exposure routes are additive, which introduces a protective bias in the result of the cancer risk assessment.

Carcinogenic risk estimates were compared to the USEPA acceptable, incremental risk range of 1 in 10,000 ($10^{-4}$) and 1 in 1 million ($10^{-6}$) and the NDEP's acceptable, incremental level of $10^{-6}$. If the estimated incremental risk falls within or below this risk range, the chemical is considered unlikely to pose an unacceptable carcinogenic risk to individuals under the given exposure conditions. A risk level of $1 \times 10^{-5}$ (1 E-5) represents an incremental probability of one in 100,000 that an individual could develop cancer from exposure to the potential carcinogen under a defined set of exposure assumptions.

### 6.4.2 Methods for Assessing Non-Cancer Health Effects

Non-cancer adverse health effects are estimated by comparing the estimated average exposure rate (i.e., ADDs estimated in the exposure assessment) with an exposure level at which no adverse health effects are expected to occur for a long period of exposure (e.g., the RfDs or RfCs). ADDs (or exposure concentrations [ECs]) and RfDs (or RfCs) are compared by dividing the ADD by the RfD (or EC by the RfC) to obtain the ADD:RfD (EC:RfC) ratio, as follows:

$$HQ = \frac{EC}{RfC} \; or \; \frac{ADD}{RfD}$$

where:

| | | |
|---|---|---|
| HQ | = | hazard quotient |
| ADD | = | average daily dose (mg/kg-d) |
| EC | = | exposure concentration ($mg/m^3$) |
| RfD | = | reference dose (mg/kg-d) |
| RfC | = | reference concentration ($mg/m^3$) |

The ADD-to-RfD (EC-to-RfC) ratio is known as an HQ. If a person's average exposure is less than the RfD or RfC (i.e., if the HQ is less than 1), the chemical is considered unlikely to pose a significant non-carcinogenic health hazard to individuals under the given exposure conditions. Unlike carcinogenic risk estimates, an HQ is not expressed as a probability. Therefore, while both cancer and non-cancer risk characterizations indicate a relative potential for adverse effects to occur from exposure to a chemical, a non-cancer adverse health effect estimate is not directly comparable with a cancer risk estimate.

If more than one pathway is evaluated, the HQs for each pathway are summed to determine whether exposure to a combination of pathways poses a health concern. This sum of the HQs is known as an HI.

$$Hazard\ Index = \Sigma Hazard\ Quotients$$

Any HI less than 1.0 indicates the exposure is unlikely to be associated with a potential health concern. If the HI is greater than 1.0, then the HQs are summed by the specific target organs affected by a particular chemical or chemicals. This is also summed across pathways and chemicals. Target organs are identified primarily by the source of the toxicity criteria (e.g., IRIS). Since a chemical may affect more than one organ, in addition to the source of the toxicity criteria Oak Ridge National Laboratory's (ORNL) Risk Assessment Information System's toxicity profiles were also searched for target organ information (ORNL 2011).

### 6.4.3 Methods for Assessing Asbestos Risks

For assessing asbestos risks, Table 8-2 (Based on Optimum Risk Coefficients) of USEPA (2003b) was used. Table 8-2 presents best estimate risks optimized based upon separation of fiber type, size and endpoint (mesothelioma/lung cancer), thereby reducing apparent variation between the studies utilized. The values in Table 8-2 are used because they are the authors' "best" estimates of potency based upon all the available data (whereas the "conservative values" presented in Table 8-3 present only the most conservative, and best "behaved" data). As described in USEPA (2003b), because the asbestos risks to male and female smokers/non-smokers are different, population averaged risks are evaluated based on Eqn. 8-1 of USEPA (2003b):

$$URF = 0.5 \times ((0.786 \times (NSM + NSF)) + ((0.214 \times (SM + SF)) \times CF$$

where:

| | | |
|---|---|---|
| URF | = | Population Averaged Unit Risk Factor (risk per fibers/cubic centimeter [$cm^3$]) |
| NSM | = | risk for male non-smokers |
| NSF | = | risk for male non-smokers |
| SM | = | risk for male smokers |
| SF | = | risk for female smokers |
| CF | = | factor to convert risk from risk per 100,000 to risk per 1,000,000 |

This equation considers male smokers, male non-smokes, female smokers, and female non-smokers. In addition, because both chrysotile and amphibole have been detected at the BMI Common Areas, both amphibole and chrysotile fibers are evaluated in the risk assessments, regardless of if either was detected within an exposure area (as calculated using the 95 percent UCL of the mean of the assumed underlying Poisson distribution).

The basic equation for assessing inhalation cancer risk for asbestos is analogous to that recommended by USEPA for other inhalation carcinogens. As shown in Equation 11 of *Risk Assessment Guidance for Superfund, Part F* (USEPA, 2009) inhalation cancer risk is the product of an IUR factor and an exposure concentration. The exposure concentration is a function of the asbestos air concentration, the length of time an individual is exposed, and the averaging time for which carcinogenic effects are evaluated for the unit risk factor. This calculation of asbestos related risk (ARR) is also consistent with application of Berman and Crump (2003) to risk calculations described in Berman (2003a,b; 2005). The risk equation used in performing an asbestos inhalation risk assessment is:

$$ARR = \frac{C_{air} \times URF \times ET \times EF \times ED}{AT}$$

where:

| | | |
|---|---|---|
| $C_{air}$ | = | air concentration of asbestos (f/cm$^3$) (fibers per centimeter cubed) |
| ET | = | exposure time (hours/day) |
| EF | = | exposure frequency (days/year) |
| ED | = | exposure duration (years) |
| AT | = | averaging time (hours) |
| URF | = | unit risk factor (risk per f/cm$^3$) |

Asbestos risk estimates are compared to the USEPA acceptable, incremental risk range for carcinogens of 1 in 10,000 ($10^{-4}$) and 1 in 1 million ($10^{-6}$) and the NDEP's acceptable, incremental level of $10^{-6}$, although the risk estimates represent the probability of death from mesothelioma or lung cancer rather than the probability of contracting cancer. If the estimated asbestos risk falls within or below this risk range, asbestos is considered unlikely to pose an unacceptable risk to individuals under the given exposure conditions. A risk level of $1 \times 10^{-5}$ (1 E-5) represents a probability of one in 100,000 that an individual could die from contracting mesothelioma or lung cancer from exposure to asbestos under a defined set of exposure assumptions.

### 6.4.4 Risk Assessment Results

The calculation of theoretical upper-bound ILCRs and non-cancer health effects are presented by receptor in Tables 6-13 through 6-16 and are discussed in Section 8.0. These tables present the theoretical upper-bound ILCRs and non-cancer health effects calculations for residential, construction worker, commercial (indoor) worker, and maintenance (outdoor) worker receptors.

The risk of death from lung cancer or mesothelioma as a consequence of exposure to asbestos on a Sitewide basis is presented in Table 6-17. All calculation spreadsheets are provided in Appendix I (included on the report CD in Appendix B).

# 7.0 UNCERTAINTY ANALYSIS

Risk estimates are values that have uncertainties associated with them. These uncertainties, which arise at every step of a risk assessment, are evaluated to provide an indication of the uncertainty associated with a risk estimate. Risk assessments are not intended to estimate the true risk to a receptor associated with exposure to chemicals in the environment. In fact, estimating the true risk is impossible because of the variability in the exposed or potentially exposed populations. There are always gaps in knowledge because a true exposure for every individual human being cannot be measured. Therefore, risk assessment is a means of estimating the probability that an adverse health effect (e.g., cancer, impaired reproduction) will occur in a receptor to assist in decision-making regarding the protection of human health. The use of conservative values for a majority of the assumptions in risk assessments helps guard against the underestimation of risks.

Risk estimates are calculated by combining Site data, assumptions about individual receptor's exposures to impacted media, and toxicity data. The uncertainties in this HHRA can be grouped into four main categories that correspond to these steps:

- Uncertainties in environmental sampling and analysis;
- Uncertainties in fate and transport modeling (discussed in Section 9);
- Uncertainties in assumptions concerning exposure scenarios; and
- Uncertainties in toxicity data and dose-response extrapolations.

General uncertainties associated with the HHRA for the Site are summarized in Table 7-1. In this table, "Low," "Moderate," and "High" are qualitative indicators as to whether the source of uncertainty will likely have a small, medium, or large effect on the risk calculations, respectively. In general, the scenarios and parameters evaluated and used in this HHRA are considered conservative based on how the Site will be developed. This is a large source of potential conservative bias in this HHRA. Additional discussion on the uncertainties associated with the HHRA is provided below.

## 7.1 ENVIRONMENTAL SAMPLING

The HHRA for the Site was based on the sampling results obtained from investigations conducted in 2008 and 2009. Errors in sampling results can arise from the field sampling, laboratory analyses, and data analyses.

The environmental sampling at the Site is one source of uncertainty in the evaluation. However, the number of sampling locations and events is large, widespread and spatially distributed, with consistent analytical results (i.e., no hot spots), and sampling was performed using approved procedures; therefore, the sampling and analytical data are sufficient to characterize the impacts and the associated potential risks.

Because of the surface soil removal undertaken for certain chemicals, the new surface layer of the Site could have different chemical concentrations than those measured prior to soil removal. Because only the trigger constituents were reanalyzed for in the post-scrape samples, the original measured surface soil data at the Site for all other chemicals was retained for further evaluation. However, it is reasonable to assume that the concentrations are now lower for some chemicals (e.g., metals, if due to contamination), because of the removal of some soil.

The laboratory data are another potential source of uncertainty. Maximum SQLs for 1,2-diphenylhydrazine, bis(2-chloroethyl) ether, hexachlorobenzene, and n-nitrosodiphenylamine exceeded one-tenth their respective residential soil BCL. These chemicals were not evaluated quantitatively in the HHRA as they were not detected in any Site samples. This may result in an underestimation of risk.

The types of analyses were chosen based on historical knowledge of the Site and BMI Common Areas. The data validation and data usability evaluations provided documentation that the HHRA database is adequate to support HHRA conclusions (Section 4 and Appendix E). Based on the data validation and data usability, the risk estimates are likely to be overestimated rather than underestimated.

Uncertainties are also introduced into the risk assessment by assumptions that are made regarding the grading plan. As described in Section 3.1, the grading plan affects the interpretation of the data in terms of assigning samples to the surface or the subsurface. This was done to avoid the situation in which current surface samples might not be included in the evaluation of exposures to future surface soils. The data were subdivided by depth intervals as described in Section 3.1, and the maximum of the UCLs for the two subsets of data was used as

the exposure point concentration. There is some uncertainty in the choice of subsetting on the concentrations of interest, and there is a potential small overestimation of risk by choosing the maximum of the two UCLs as the exposure point concentration. The effects are likely to be small given the data, since there is not much variation in the different UCLs.

## 7.2 ESTIMATES OF EXPOSURE

The selection of exposure pathways is a process, often based on best professional judgment, which attempts to identify the most probable potentially harmful exposure scenarios. In a risk assessment, it is possible that risks are not calculated for all of the exposure pathways that may occur, possibly causing some underestimation of risk.

### 7.2.1 Aggregation of Exposure Areas

For the residential scenario that is evaluated, default exposure areas are 1/8$^{th}$-acre in size. However, sampling has not been performed at the frequency of guaranteeing at least one sample per every 1/8$^{th}$-acre exposure area. Instead, sampling has been performed at the scale of approximately once every 3 acres. This is considered sufficient if the concentration distribution for COPCs appears similar across the Site. To the extent that this assumption is not valid the risk assessment might underestimate risks. However, considering the sampling protocols employed and the physical remediation activities performed, the risk estimates are considered both reasonable from this perspective and unlikely to have resulted in an underestimation of risk at the Site.

### 7.2.2 Types of Exposures Examined

In an evaluation, risks are sometimes not calculated for all of the exposure pathways that may occur, possibly causing some underestimation of risk. However, in this case, all principal potential exposure pathways were evaluated. In this assessment, risks were estimated for future on-site residents, and indoor and outdoor worker receptors. Risks for the most likely routes of exposure to these receptors were estimated. For example, risks to residents were estimated for soil ingestion, skin contact with soil, inhalation of outdoor air (including dust generation), inhalation of indoor air, and ingestion of homegrown produce. Although it is possible that other exposure routes could exist (e.g., downwind off-site residents), these exposures are expected to be lower than the risks associated with the pathways considered.

As noted in Section 2.5.3, because an NFAD is sought for unrestricted land use (i.e., residential, recreational, commercial civic, or industrial use), the Closure Plan methodology includes the

evaluation of residential receptors, but not school receptors. Because of the higher exposure potential for residential receptors versus school receptors (e.g., students), if the Site is developed as a middle or high school as planned, risks are likely overestimated rather than underestimated.

### 7.2.3 Intake Assumptions Used

The risks calculated depend largely on the assumptions used to calculate the rate of COPC intake. For this assessment, standard default values developed by USEPA are used for reasonable maximum exposures frequency and exposure duration for all receptors. These estimates are conservative values, and the possibility that they underestimate the risk is low. The uncertainties associated with particular parameters used in this risk assessment are described below.

The amount of COPCs the human body absorbs may be different from the amount of a COPC contacted, and the percentage absorbed may vary from one person to another. In this HHRA, absorption of ingested and inhaled COPCs is conservatively assumed to be 100 percent.

Current USEPA guidance (USEPA 2004e) states that "There are no default dermal absorption values presented for volatile organic compounds nor inorganic classes of compounds. The rationale for this is that in the considered soil exposure scenarios, volatile organic compounds would tend to be volatilized from the soil on skin and should be accounted for via inhalation routes in the combined exposure pathway analysis. For inorganics, the speciation of the compound is critical to the dermal absorption and there are too little data to extrapolate a reasonable default value." While USEPA guidance does not specifically state that this pathway should be dismissed, consistent with the approach utilized in current USEPA guidance, the risk estimates in this HHRA do not include a dermal absorption value for VOCs or inorganics (unless a specific value has been identified). Thus, the risks presented in this assessment could be underestimated as a result.

While there have been numerous studies in recent years detailing the presence of perchlorate in vegetable and fruit produce, the homegrown exposure pathway was not evaluated for perchlorate in the HHRA. BRC has not been able to identify an appropriate soil-to-plant uptake factor for this pathway. The studies predominantly focus on water-to-plant uptake. Dr. W. Andrew Jackson at Texas Tech University has been studying perchlorate plant uptake and does not believe that the soil-to-plant pathway for a garden scenario is realistic for perchlorate (Jackson 2010). Perchlorate is extremely soluble and in surface soil would rapidly be flushed away due to application of irrigation water (Jackson 2010). In addition, laboratory experiments have demonstrated that perchlorate may be reduced to chloride in some plants (ATSDR 2008b). Also,

concentrations of perchlorate in soils at this Site are quite low relative to risk levels of concern, so the contribution of perchlorate to risk is quite small. Adding the soil-to-plant component is unlikely to contribute significantly to the risk. Consequently, the effect on the risk assessment of excluding perchlorate from the soil-to-plant pathway is likely to be small.

Soil preparation for a backyard garden is not accounted for in the HHRA and would result in reduced soil concentrations. Las Vegas area soils are "…alkaline, clayish, caliche or hard and salty. [In addition,]…soils are lacking organic matter and nutrients" (Mills, 2000). Therefore, residential gardening cannot occur in Site soils in its existing condition. For non-native vegetation to grow, soil amendments must be added. Recommended soil preparations for the area include thoroughly blending equal amounts of organic matter with the soil as well as the addition of other soil amendments (e.g., fertilizers). As noted above, if the redevelopment for the Site includes a middle or high school, it is doubtful that the homegrown produce exposure pathway is a complete pathway under those exposure conditions.

The construction activity dust emissions did not take into account dust control measures that would reduce the amount of dust generated to below those levels used in the HHRA. The Clark County Department of Air Quality and Environmental Management has dust control permitting requirements, and an inhalable particulate matter action level of 50 $\mu g/m^3$. The construction activity dust emissions predicted and used in the HHRA exceeded this level. Therefore, dust suppression activities would need to be implemented, thus reducing dust levels and exposures.

The dispersion factor for the construction worker is not adjusted to account for soil intrusion activities. Because these activities may cause increased air concentrations than that evaluated, risks to VOCs in soil may be underestimated for this receptor. However, VOCs are primarily associated with groundwater, this potential underestimation is considered low.

## 7.3 TOXICITY ASSESSMENT

The availability and quality of toxicological data is another source of uncertainty in the risk assessment. Uncertainties associated with animal and human studies may have influenced the toxicity criteria. Carcinogenic criteria are classified according to the amount of evidence available that suggests human carcinogenicity. In the establishment of the non-carcinogenic criteria, conservative safety factors, known as uncertainty and modifying factors, are used.

### 7.3.1 COPCs Lacking Toxicological Data

Toxicity criteria have not been established for some of the chemicals detected at the Site. These chemicals were not quantitatively evaluated in the HHRA. For example, potassium is a COPC for which no USEPA toxicity criteria have been established. The health effects and levels of concern for potassium in soil are not known. While not including potassium may have resulted in a low degree of underestimation of quantitative Site risk estimates, the available toxicological information suggests that this underestimation will not likely affect the decisions made relative to Site risks.

Because of the inconclusive nature of TICs as potentially SRCs, non-cancer surrogate toxicity criteria were not applied. Non-cancer surrogate toxicity criteria were not applied to the inorganic chemicals because of the complexity of ion and metal toxicity. A quantitative estimation of risk was not conducted for these COPCs. Thus, the risks presented in this assessment could be underestimated as a result.

For the surface flux results, a few organic chemicals detected (e.g., n-heptane, 2-hexanone, cymene) do not have toxicity criteria available. Surrogate toxicity criteria were applied for these chemicals. Thus, the risks presented in this assessment could be under- or overestimated as a result.

### 7.3.2 Uncertainties in Animal and Human Studies

Extrapolation of toxicological data from animal tests is one of the largest sources of uncertainty in a risk assessment. There may be important, but unidentified, differences in uptake, metabolism, and distribution of chemicals in the body between the test species and humans. For the most part, these uncertainties are addressed through use of conservative assumptions in establishing values for RfDs, RfCs, CSFs, and IURs, which results in the likelihood that the risk is overstated.

Typically, test animals are administered high doses (e.g., maximum tolerated dose) of a chemical in a standard diet or in air. Humans are generally exposed to much lower doses in the environment, which may affect the toxicity of the chemical. In these studies, test animals, often laboratory rodents, are exposed daily to the chemical agent for various periods of time up to their 2-year lifetimes. Humans have an average 70-year lifetime and may be exposed either intermittently or regularly for an exposure period ranging from weeks to a full lifetime. Because

of these differences, it is not surprising that extrapolation error is a large source of uncertainty in a risk assessment.

### 7.3.3 Non-Carcinogenic Toxicity Criteria

In the establishment of the non-carcinogenic criteria, conservative safety factors, known as uncertainty factors, are used. Most of the chronic non-carcinogenic toxicity criteria that were located in the IRIS database have uncertainty factors of 1,000. This means that the dose corresponding to a toxicological effect level (e.g., LOAEL) is divided by 1,000 to deem a safe, or "reference," dose. The purpose of the uncertainty factor is to account for the extrapolation of toxicity data from animals to humans and to ensure the protection of sensitive individuals.

### 7.3.4 Sub-Chronic Non-Carcinogenic Toxicity Criteria

Construction worker exposures are evaluated for an exposure duration of 1 year, which is more representative of a sub-chronic exposure rather than a chronic exposure. As such, where available, sub-chronic RfDs were used to characterize non-cancer effects for the construction worker. However, for many COPCs, a sub-chronic RfD was not available and the chronic RfD was used. This likely presented an overestimation of non-cancer health risks to the construction worker.

### 7.3.5 Carcinogenic Toxicity Criteria

Uncertainty due to extrapolation of toxicological data for potential carcinogens tested in animals to human response is commonly the case for potentially carcinogenic chemicals. USEPA frequently uses the LMS model, or other non-threshold low-dose extrapolation models, to extrapolate the toxicological data to estimate human response. These low-dose extrapolation models assume that there is no threshold for carcinogenic substances; that is, exposure to even one molecule, fiber, or picocurie of a carcinogen is sufficient to cause cancer. This is a highly conservative assumption, because the body has several mechanisms to protect against cancer.

The use of the LMS model to extrapolate is a well-recognized source of significant uncertainty in the development of carcinogenic toxicity criteria and, subsequently, theoretical carcinogenic risk estimates. At high levels of exposure, there may indeed be a risk of cancer regardless of whether or not the effect occurs via a threshold mechanism. An animal bioassay cannot determine what happens at low levels of exposure, however, which are generally typical of human exposure levels.

At low levels of exposure, the probability of cancer cannot be measured but must be extrapolated from higher dosages. To do this, test animals are typically exposed to carcinogens at levels that are orders of magnitude greater than those likely to be encountered by humans in the environment. It would be difficult, if not impossible, to perform animal experiments with a large enough number of animals to directly estimate the level of risk at the low exposure levels typically encountered by humans. Thus, to estimate the risk to humans exposed at low levels, dose-response data derived from animals given high dosages are extrapolated downward using mathematical models such as the LMS model, which assumes that there is no threshold of response. The dose-response curve generated by the model is known as the maximum likelihood estimate. The slope of the 95 percent lower confidence interval (i.e., upper-bound limit) curve, which is a function of the variability in the input animal data, is taken as the CSF. CSFs are then used directly in cancer risk assessment.

The U.S. federal government, including USEPA itself, has acknowledged the limitations of the high-to-low dose extrapolation models, particularly the LMS model (USEPA 1991c). In fact, this aspect of cancer risk assessment has been criticized by many scientists (including regulatory scientists) in recent years. USEPA has recently released revised cancer risk assessment guidelines (USEPA 2005c).

Even for genotoxic (i.e., non-threshold) substances, there are two major sources of bias embedded in the LMS model: (1) its inherent conservatism at low doses and (2) the routine use of the linearized form in which the 95 percent upper confidence interval is used instead of the unbiased maximum likelihood estimate. The inherent conservatism at low doses is due in part to the fact that the LMS model ignores all of the numerous biological factors that argue against a linear dose-response relationship for genotoxic effects (e.g., DNA repair, immunosurveillance, toxicokinetic factors).

Several other factors inherent in the LMS model result in overestimated carcinogenic potency: (1) any exaggerations in the extrapolation that can be produced by some high dose responses (if they occur) are generally neglected; (2) UCLs on the actual response observed in the animal study are used rather than the actual response, resulting in upper-bound low dose extrapolations, which can greatly overestimate risk; and (3) non-genotoxic chemicals (i.e., threshold carcinogens) are modeled in the same manner as highly genotoxic chemicals.

### 7.3.6 Uncertainties with the Asbestos Risk Assessment

For the risk assessment, asbestos concentrations were presented two ways, as a best estimate and upper bound based upon the UCL of the mean of the Poisson distribution. No detections of amphibole fibers were observed. However, when zero fibers are observed, the UCL of the mean is approximately three fibers, and this value is used as the basis for the reasonable maximum exposure point concentration for the asbestos risk assessment. Considering the remediation activities that have been performed, and the observation of zero amphibole fibers, this approach might result in overestimation of amphibole related risks.

Asbestos risk estimates are highly dependent on the number of samples to increase or decrease the pooled analytical sensitivity. That is, a larger number of non-detect samples with similar individual analytical sensitivity results in a lower pooled analytical sensitivity and subsequently a lower estimated ARR, whereas a smaller number of non-detect samples results in a higher ARR. Uncertainty is, thus, reduced as more samples are collected.

## 7.4 CUMULATIVE EFFECT OF UNCERTAINTIES

Uncertainties from different sources are compounded in the HHRA. For example, if a person's daily intake rate for a chemical is compared to an RfD to determine potential health risks, the uncertainties in the concentration measurements, exposure assumptions, and toxicities are all expressed in the result. Because the exposure assumptions and toxicity criteria are considered conservative, the risk estimates calculated in this HHRA are likely to overestimate rather than underestimate potential risks.

# 8.0 SUMMARY OF RESULTS

This HHRA has evaluated potential risks to human health associated with chemicals and asbestos detected in soil at the Galleria North School Site sub-area located within the BMI Common Areas in Clark County, Nevada. All calculation spreadsheets for this HHRA are presented in Appendix I (on the report CD in Appendix B), including calculations of chemical theoretical upper-bound ILCRs and non-cancer health effects and asbestos risk calculations.

The risk estimates are based on reasonable maximum exposure scenarios, which results in estimates of the potential reasonable maximum, or high-end, risks associated with the Site. The calculated chemical theoretical upper-bound ILCRs and HIs are presented in Tables 6-13 through 6-16 for residential, construction worker, commercial (indoor) worker, and maintenance (outdoor) worker receptors, respectively. Asbestos estimated risk of death from lung cancer or mesothelioma on a Sitewide basis are presented in Table 6-17.

## 8.1 RESIDENTS

For chemical exposures, the total cumulative non-cancer HI for future residential receptors at the Site is 0.14 (including the surface flux air risk estimates[46]) (Table 6-13), with perchlorate soil exposures via the oral ingestion pathway being the primary contributors. The HI does not exceed the target HI of 1.0. Accordingly, the evaluation of target-organ HI values is moot.

The maximum theoretical upper-bound ILCR for future residential receptors at the Site is $2 \times 10^{-6}$ (including the surface flux air risk estimates see Table 6-13). The range of theoretical upper-bound ILCRs is $6 \times 10^{-7}$ to $2 \times 10^{-6}$. The theoretical upper-bound ILCR is near the risk goal of $1 \times 10^{-6}$ and is driven primarily by the indoor air theoretical upper-bound ILCR for surface flux sample GNC1-BE21 due to 1,2-dibromoethane (note that this chemical is not an SRC), as well as benzo(a)pyrene and dibenzo(a,h)anthracene soil exposures via the oral ingestion and dermal contact pathways.

The estimated risks for death from lung cancer or mesothelioma for asbestos exposures to future residential receptors were below $1 \times 10^{-6}$. For residential receptors, the best estimate and upper bound concentrations for chrysotile fibers are $1 \times 10^{-9}$ and $6 \times 10^{-9}$; and zero and $4 \times 10^{-7}$ for

[46] The minimum and maximum surface flux risk estimates are summed with the soil risk estimates to provide a range of cumulative risks. The minimum and maximum surface flux risk estimates are provided in Appendix I (included on the report CD in Appendix B) and the receptor-specific chemical risk summary tables. The risks shown are cumulative risks using the maximum surface flux risk estimate.

amphibole fibers (Table 6-17). These estimated risks are below the low end of the risk goal of $1 \times 10^{-6}$. The upper-bound estimated risk of death from lung cancer or mesothelioma is estimated based on the 95 percent UCL of the count of the number of fibers detected, assuming a Poisson distribution for the count. Note that when the observed count is zero, the 95 percent UCL is approximately three fibers. Therefore, the high-end risk estimate for deaths from lung cancer or mesothelioma is a conservative value since it is based on a 95 percent UCL of the Poisson distribution of three long amphibole structures although no long amphibole structures have been detected at the Site.

## 8.2 CONSTRUCTION WORKERS

For chemical exposures, the total cumulative non-cancer HI for construction worker receptors at the Site is 0.040 (including the surface flux air risk estimates) (Table 6-14), with perchlorate soil exposures via the oral ingestion pathway being the primary contributors. The HI does not exceed the target HI of 1.0. As a result, BRC did not evaluate target-organ HI values.

The maximum theoretical upper-bound ILCR for construction worker receptors at the Site is $2 \times 10^{-8}$ (including the surface flux air risk estimates see Table 6-14) with benzo(a)pyrene and dibenzo(a,h)anthracene soil exposures via the oral ingestion and dermal contact pathways the primary contributors. The theoretical upper-bound ILCRs are all below the low end of the risk goal of $1 \times 10^{-6}$.

The estimated risks for death from lung cancer or mesothelioma for asbestos exposures to construction workers were below $1 \times 10^{-6}$. For construction worker receptors, the best estimate and upper-bound concentrations for chrysotile fibers are $2 \times 10^{-9}$ and $1 \times 10^{-8}$, and zero and $7 \times 10^{-7}$ for amphibole fibers (Table 6-17). These estimated risks are below the low end of the risk goal of $1 \times 10^{-6}$.

## 8.3 COMMERCIAL (INDOOR) WORKERS

For chemical exposures, the total cumulative non-cancer HI for commercial (indoor) worker receptors at the Site is 0.0059 (including the surface flux air risk estimates) (Table 6-15), with vanadium and perchlorate soil exposures via the oral ingestion pathway being the primary contributors. The HI does not exceed the target HI of 1.0. As a result, BRC did not evaluate target-organ HI values.

The maximum theoretical upper-bound ILCR for commercial (indoor) worker receptors at the Site is $2 \times 10^{-7}$ (including the surface flux air risk estimates see Table 6-15) with the indoor air

theoretical upper-bound ILCR for surface flux sample GNC1-BE21 due to 1,2-dibromoethane the primary contributor, as well as benzo(a)pyrene and dibenzo(a,h)anthracene soil exposures via the oral ingestion and dermal contact pathways. The theoretical upper-bound ILCRs are all below the low end of the risk goal of $1 \times 10^{-6}$.

The estimated risks for death from lung cancer or mesothelioma for asbestos exposures to commercial (indoor) workers were below $1 \times 10^{-6}$. For commercial (indoor) worker receptors, the best estimate and upper-bound concentrations for chrysotile fibers are $3 \times 10^{-10}$ and $1 \times 10^{-9}$, and zero and $8 \times 10^{-8}$ for amphibole fibers (Table 6-17). These estimated risks are below the low end of the risk goal of $1 \times 10^{-6}$.

## 8.4 MAINTENANCE (OUTDOOR) WORKERS

For chemical exposures, the total cumulative non-cancer HI for commercial (outdoor) worker receptors at the Site is 0.0099 (including the surface flux air risk estimates) (Table 6-16), with perchlorate soil exposures via the oral ingestion pathway being the primary contributors. The HI does not exceed the target HI of 1.0. Accordingly, the evaluation of target-organ HI values is moot.

The maximum theoretical upper-bound ILCR for commercial (outdoor) worker receptors at the Site is $2 \times 10^{-7}$ (including the surface flux air risk estimates see Table 6-16) with the soil theoretical upper-bound ILCRs for dibenzo(a,h)anthracene and benzo(a)pyrene via the oral ingestion and dermal contact pathways the primary contributors. The theoretical upper-bound ILCRs are all below the low end of the risk goal of $1 \times 10^{-6}$.

The estimated risks for death from lung cancer or mesothelioma for asbestos exposures to maintenance (outdoor) workers were below $1 \times 10^{-6}$. For maintenance (outdoor) worker receptors, the best estimate and upper-bound concentrations for chrysotile fibers range from $6 \times 10^{-10}$ to $3 \times 10^{-9}$ and zero and $2 \times 10^{-7}$ for amphibole fibers (Table 6-17). These estimated risks are below the low end of the risk goal of $1 \times 10^{-6}$.

# 9.0 POTENTIAL IMPACTS TO GROUNDWATER

This section presents the evaluation of the potential impacts to groundwater of residual chemicals in soil and considering the future land use of the Site. In general, this evaluation is conducted using two basic analytical tools: (1) screening of COPCs, resulting in selection of indicator COPCs for modeling, and (2) use of both the VLEACH and SESOIL (as appropriate) vertical unsaturated zone migration models and Site-specific analytical results of soil samples collected from the Site. The SESOIL modeling was conducted for all non-volatile COPCs identified in the HHRA and selected for modeling.[47] The SESOIL modeling was selected because it can provide a consistent framework for evaluating potential groundwater impacts for the non-volatile COPCs. However, SESOIL does not simulate downward vapor-phase diffusion. Therefore, in cases where VOCs are potential COPCs selected for modeling, VLEACH is used for the volatile COPCs identified in the HHRA in the soil matrix and selected for modeling. However, since no volatile COPCs were identified in the HHRA, the VLEACH model was not used for the Site. The evaluation was conducted using the SESOIL model as distributed by Waterloo Hydrogeologic, Inc., in the model software package WHI UnSat Suite Plus 2.2.03.

## 9.1 PRELIMINARY IMPACTS TO GROUNDWATER SCREENING

A tiered process is carried out for the evaluation of potential impacts to groundwater. Consistent with Section 9.6.1 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), several criteria are utilized to evaluate whether chemicals may present a potential threat to groundwater quality prior to inclusion in quantitative unsaturated zone modeling.

Only those chemicals selected as COPCs in the HHRA (Section 5) are considered further for evaluation as a potential threat to groundwater quality. The COPCs considered in the evaluation are listed in Table K-1. Initial quantitative evaluation of the potential for residual COPC concentrations to impact groundwater quality was conducted by comparison of detected concentrations of each COPC to the NDEP (2011a) LBCLs. While this comparison is also conducted as part of the confirmation and data process summary (Table 3-4), in Section 3 this process is utilized for discussion and comparative purposes only.

[47] Although the *BRC Closure Plan* identifies the use of SESOIL for inorganic compounds, PESTAN for pesticides, and VLEACH for other organic compounds; subsequent information indicates that PESTAN is inappropriate for this type of modeling. Therefore, because SESOIL is an appropriate model for inorganics, pesticides, and other organic compounds, for consistency, SESOIL was used for all non-VOCs at the Site.

LBCLs have been developed by the NDEP (2011a) and are based on a simple, conservative soil/water partitioning and groundwater dilution model provided in the USEPA's *Soil Screening Guidance* (1996). This process is described in detail in Section 9.6.1 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010). In calculating the LBCL, a DAF is applied. A DAF of 1 is used when little or no dilution or attenuation of soil leachate concentrations is expected, and a DAF of 20 may be used when significant attenuation of the leachate is expected due to Site-specific conditions.

For the Site, the LBCLs based on a DAF of 1 were used for comparison purposes ($LBCL_{DAF1}$). Those chemicals with maximum detected concentrations less than the $LBCL_{DAF1}$ for that COPC are considered unlikely to pose a significant threat to groundwater quality, and are eliminated from further consideration. This comparison is presented in Table K-1. Of the 10 chemicals selected as COPCs in Section 5, eight do not have detected concentrations greater than their respective $LBCL_{DAF1}$. Therefore, these eight chemicals are considered unlikely to present a significant threat to future groundwater quality and are eliminated from further evaluation. Two COPCs, ammonia and perchlorate, do not have LBCLs; therefore, these COPCs are considered further.

## 9.2 SESOIL MODEL

SESOIL is designed for long-term environmental hydrologic, sediment, and pollutant fate simulations. The model is structured around three cycles: (1) the hydrologic cycle, which takes into account rainfall, infiltration, soil moisture, surface runoff, exfiltration, evapotranspiration, groundwater discharge, and capillary rise; (2) the sediment cycle, which is currently not available in the model; and (3) the pollutant cycle, which takes into account advection, diffusion, volatilization, adsorption/desorption, chemical degradation/decay, biological transformation and uptake, hydrolysis, photolysis, oxidation, and cation exchange. A complete description of the model equations and assumptions is provided in *SESOIL: A Seasonal Soil Compartment Model* (Bonazountas and Wagner 1984). Extensive modifications to the original version of SESOIL are described in Hetrick et al. (1989). The most current version of SESOIL incorporates these modifications.

Because the SESOIL model ignores a number of possible attenuating factors, it is likely that it over-predicts the actual chemical migration rate in the vadose zone. However, because of its simplicity, this approach provides a simple method to estimate the likely maximum rate at which chemicals would be transported in the vadose zone down to groundwater. All input parameters

used in the model simulations are presented in Appendix K (included on the report CD in Appendix B).

Inputs for SESOIL are broken out into the following elements:

- Climate Data (Table K-2): consists of nine monthly climatological inputs. Data for this file are accessed from the climatic dataset incorporated into WHI UnSat Suite Plus. This dataset contains monthly averages for over 200 first order weather stations throughout the U.S.
- Soil Data (Table K-3): consists of several parameters that describe the soil properties for the Site.
- Chemical Data (Table K-4): consists of several parameters used to describe the properties of the COPC.
- Application Data (Table K-5): consists of a number of inputs that describe soil layer specific data and the chemical application load.
- Initial Concentrations (Table K-6): consists of the COPC concentrations used at time zero.

Data for Las Vegas, the closest first order weather station to the Site with similar meteorological conditions, are considered representative of the Site and input into this file. Input parameters for this data file include temperature, cloud cover, relative humidity, precipitation, and albedo, which relates to the fraction of light or electromagnetic radiation reflected by a surface. Evapotranspiration is calculated by the model based on temperature, cloud cover, relative humidity, and albedo (precipitation is not included as part of this calculation). Greater evapotranspiration inhibits infiltration, leading to slower downward migration of the chemicals. The climate dataset used is shown in Table K-2, in Appendix K.

The soil model input data consist of several parameters that describe soil properties. Average values of measured Site-specific data of soil porosity, density and organic carbon content were used in the model (Table K-3, in Appendix K). For parameters without measured Site data (cation exchange coefficient, Freundlich exponent), default inputs consistent with a sand soil type were used, with the exception of soil disconnectedness index. The default sand soil disconnectedness index of 3.7 was modified to 4.53, such that the overall recharge rate to groundwater predicted by the model would be consistent with the default, pre-development recharge rate predicted in the groundwater flow model developed for the Eastside property

(DBS&A 2009). A recharge rate of 0.08 inch per year (for undeveloped areas) was estimated as part of that model.

The chemical model input data consist of several parameters used to describe the properties of the chemical of concern. USEPA Soil Screening Guidance (2002b) default chemical properties were used where available. The NDEP's BCL guidance (NDEP 2009a) was a secondary source for these parameters. Chemical parameters used in the evaluation are presented in Table K-4, in Appendix K.

The application model input data consist of a number of inputs that describe infiltration-layer-specific data and the chemical application load. The model was run without application load. For purposes of this evaluation, the soil column was divided into four infiltration layers (Table K-5, in Appendix K). The designation of each layer and the width of each infiltration layer were:

| Designation | Thickness (feet) | Boundary Depths (feet) |
|---|---|---|
| Infiltration Layer One | 10 | 0 – 10 |
| Infiltration Layer Two | 5 | 10 – 15 |
| Infiltration Layer Three | 5 | 15 – 20 |
| Infiltration Layer Four | 5 | 20 – 25 |

For the purposes of inputting the initial soil chemical concentrations, the first layer was divided into 10 individual 1-foot-thick sublayers, and the three remaining layers were divided into five individual 1-foot-thick sublayers. The initial soil chemical concentration in each sublayer for the simulation was the maximum detected concentration in each soil depth horizon corresponding to each sublayer (Table K-6, in Appendix K).

The depth to groundwater has been observed to vary from approximately 25 to 33 feet bgs in recent (July-August 2009) sampling (Figure 3). Therefore, groundwater was conservatively assumed to be at a depth of 25 feet bgs. The SESOIL model is one-dimensional, that is, it is limited to calculations and predictions within the soil column defined by the input parameters.

## 9.3 POTENTIAL IMPACTS TO CHEMICAL MIGRATION MECHANISMS FOLLOWING REDEVELOPMENT

Migration of chemicals in soil to groundwater may be affected following redevelopment. Future redevelopment will likely result in increased surface water infiltration due to sources such as buried water lines, sewer lines, irrigation lines and/or over-watering of parks and lawns. These sources have the potential to enhance the migration to groundwater of the post-remediation levels of chemicals remaining in soils. Subsequently, three surface water infiltration scenarios were evaluated.

The first scenario evaluates recharge relative to baseline, pre-development conditions. This scenario assesses the potential for surface precipitation on unimproved ground surface (titled a "baseline" scenario) to influence migration of chemicals to groundwater. This is consistent with recharge rate predicted in the groundwater flow model developed for the Eastside property (DBS&A 2009). A recharge rate of 0.08 inch per year (for undeveloped areas) was estimated as part of that model.

The second scenario evaluates recharge relative to normal post-development conditions. This scenario assesses the potential for surface water recharge in improved areas associated with commercial and residential construction, to influence migration of chemicals to groundwater. This is consistent with recharge rate predicted in the groundwater flow model developed for the Eastside property (DBS&A 2009). A recharge rate of 0.57 inch per year (for undeveloped areas) was estimated as part of that model (titled the "normal" scenario).

Last, a scenario of post-development enhanced recharge was also evaluated as part of the groundwater flow model developed for the Eastside property (DBS&A 2009), and incorporated into the vadose zone modeling. This scenario evaluates surface water recharge associated with overwatering of open space. A recharge rate of 8.672 inches per year was estimated as part of that model (titled the "enhanced" scenario).

Therefore, additional modeling runs were conducted using the SESOIL model to account for the potential increased recharge to groundwater for each of the two post-development scenarios. For SESOIL, the only modification was to increase the monthly rainfall to 1.522 centimeters per month (cm/month) for the normal post-development scenario and 5.42 cm/month for the enhanced recharge scenario. While the input of additional applied precipitation is more than the amount of post-development modeled water infiltration (DBS&A 2009), this is necessary to offset the effect of model estimated evapotranspiration (because the model only applies

infiltration as a surface rather than as a sub-surface source). The values of 1.522 and 5.42 cm/month are values selected by iterative model runs conducted to identify a precipitation rate that approximates and results in the desired recharge(s) to groundwater. The modified rainfall totals used for this modeling run are provided in Table K-2, in Appendix K.

## 9.4 MODEL UNCERTAINTY

Use of Site-specific values, where available, is recommended. A number of limitations exist for the models, including:

- Data gaps/ uncertainties in site-specific properties;
- Omission of certain chemical and physical processes; and
- Lack of an appropriate model validation opportunity.

Data gaps, uncertain and/or variable input values that may exist for the Site include:

- Site-specific meteorological data (uncertain/variable);
- Soil input parameter measurements for the different soil layers incorporated in the model (e.g., intrinsic permeability, organic carbon content [uncertain/variable]); and
- Site-specific chemical data (e.g., degradation rates [gap]).

Any interactions that may occur among the different chemicals present in the soil that may influence the migration and/or fate of the various chemicals are not taken into account in the model (e.g., chemical mobility may decrease or increase in the presence of other solvent-related chemical components). Reasonable effort has been made to obtain results that provide reasonable estimates of actual Site conditions. Uncertain input values were selected based on available scientific and regulatory information to err on the conservative side.

## 9.5 RESULTS

SESOIL results are provided in Tables K-7 through K-9 in Appendix K, and are summarized in Table 9-1. The results include maximum depth of infiltration, the maximum pore water concentrations in the vadose zone at the groundwater interface and the maximum measured groundwater concentration (observed during the latest groundwater monitoring event, July-August 2009). The SESOIL outputs provided electronically in Appendix K (included on the report CD in Appendix B) contain the results of the evaluation for each of the COPCs and scenarios.

For the inorganics selected for modeling, ammonia (1,108,000 micrograms per liter [µg/L], 638,000 µg/L, and 166,800 µg/L, respectively) and perchlorate (2,000,000, 2,000,000, and 5,880,000 µg/L, respectively) are predicted to reach groundwater at concentrations that exceed their respective residential water BCLs (730 and 18 µg/L, respectively) under all three scenarios. Of note, for perchlorate these concentrations approach or equal the COPCs solubility shortly into the simulation.

This is consistent with the physical chemical parameters selected for the inorganics (non-metals). Because for ammonia and perchlorate the adsorption to soils is very variable and uncertain, the modeling assumed very low Kd values for these constituents to maximize the downward migration to groundwater. With such low adsorption coefficients the model also predicted such rapid mass migration to groundwater that they would hit groundwater within 2 to 17 years and exceed their BCLs within a few years thereafter. However, while these chemicals are detected in shallow groundwater at the Site, the concentrations are from approximately 2 (perchlorate) to more than 4 (ammonia) orders of magnitude less than predicted (it is also noted that use of the Summers groundwater mixing model would likely do little to affect these results). Further, ammonia (89.6 µg/L) and perchlorate (148 µg/L) are detected in SPLP data collected in the soil source material, but are detected at concentrations that are significantly less than the soil moisture concentrations predicted at the groundwater interface through modeling.

The time since discontinued use of the ponds and ditches exceeds the timeframes for COPCs to reach groundwater at the concentrations predicted to exceed BCLs. Based upon the differences in the modeling predicted results and the observed measurements in groundwater, it is considered probable that processes not accounted for in the model are reducing/attenuating concentrations of COPCs as they migrate through the vadose zone towards groundwater. Based on the elapsed time since any Site vicinity use, the lack of observations of the evaluated chemicals in groundwater at the Site or concurrence between measured and predicted concentrations, and the reasonably mobile nature of the COPCs evaluated, these cumulative lines of evidence suggest that (1) the modeling environment utilized in this evaluation is likely to be overly conservative and (2) there is insufficient evidence to suggest that the concentrations of constituents detected in Site soils represent a risk to groundwater quality.

It should also be noted that potential groundwater impacts for the entire Eastside property are the subject of a separate comprehensive RAS wherein all potential impacts to groundwater will be addressed.

# 10.0 DATA QUALITY ASSESSMENT

Sample size calculations were conducted for 11 constituents (arsenic, total chromium, hexavalent chromium, cobalt, formaldehyde, radium-226, TCDD TEQ, and vanadium) for the Site. Rationale for the inclusion of these constituents in the sample size calculations is provided below:

- Arsenic – a chemical of primary concern for the overall project, often exceeding comparison levels;
- Benzo(a)pyrene – a COPC representative of SVOCs and PAHs with several detected results and a low residential BCL;
- beta-BHC – a COPC representative of organochlorine pesticides with several detected results and a low residential BCL;
- Chromium – a metal with several results in excess of background concentrations resulting in high sample variability;
- Hexavalent chromium – the metal (besides arsenic) with the most exceedances of background concentrations;
- Total Cyanide – a COPC representative of inorganics other than metals with a relatively low BCL and several detects;
- Formaldehyde – the non-dioxins/furans/PCB congeners organic chemical with the highest number of detected results;
- Lead – a metal with a single high value in comparison to other results across the Site;
- Perchlorate – an inorganic chemical that is a primary risk contributor;
- 2,3,7,8-TCDD – a chemical of primary concern for the overall project; and
- Vanadium – a metal with several results in excess of background concentrations resulting in high sample variability.

The formula used here for calculation of sample size is based on a non-parametric test (the Wilcoxon signed rank test), and on simulation studies performed by Pacific Northwest National Laboratories (PNNL 2009) that formed the basis for an approximate formula that is based on the

normal distribution. Essentially, the formula is the one that would be used if a normal-based test were being performed, but an adjustment is made (multiply by 1.16) to account for the intent to perform a non-parametric test. The formula is as follows:

$$n = 1.16\left[\frac{s^2}{\Delta^2}(z_{1-\alpha} + z_{1-\beta(\mu)})^2 + 0.5z_{1-\alpha}^2\right]$$

where,

n = number of samples
s = estimated standard deviation of concentrations/fibers
Δ = width of the gray region (the difference between the threshold value stated in the null hypothesis and the point at which β is specified)
α = significance level or Type I error tolerance
β (μ) = Type II error tolerance; and
z = quantile from the standard normal distribution

For each chemical, inputs for the calculations include an estimate of the variance from the measured data, a desired significance level, and desired power of the test that must be specified at a concentration of interest (which determines the tolerable difference from the threshold value). For arsenic, the Site mean concentration exceeds its BCL based on the target cancer risk level of $10^{-6}$. It is not appropriate to apply this calculation where the threshold value is less than the mean concentration. Therefore, the maximum shallow background concentration was used for its threshold value. The calculations provided here cover a range of Type I and Type II error tolerances, and the point at which the Type II error is specified. Results are presented in Table 10-1. In this table, various combinations of input values are used, including values of α of 5, 10, and 15 percent; values of β of 15, 20, and 25 percent; and a gray region of width 10, 20, and 30 percent of the threshold level. It is clear from Table 10-1 that the number of samples collected is adequate for the Site. That is, all calculated adequate sample numbers are less than those actually collected at the Site for use in the HHRA.

Note also that there are 25 samples collected for amphibole asbestos analysis. Amphibole was not detected in any of these samples; however, because of the number of samples collected, the ARRs are all less than $1 \times 10^{-6}$. Consequently, sufficient samples have been collected to address ARRs.

# 11.0 SUMMARY

BRC has prepared this HHRA and Closure Report for the Site. The purpose of this report is to request an NFAD by the NDEP. The NDEP acknowledges that discrete portions of the Eastside may be issued an NFAD as remedial actions are completed for selected environmental media (NDEP 2006). The portion of the Eastside for which the NFAD is being requested based on this HHRA and Closure Report is shown in red on Figure 1. The legal description of the Site is provided in Appendix L.

The HHRA evaluated the potential for adverse human health impacts that may occur as a result of potential exposures to residual concentrations of chemicals in soil, groundwater, and air following remediation, and assessed whether any additional remedial actions are necessary in order to obtain an NFAD from the NDEP to allow redevelopment of the Site to proceed. The results of the risk assessment provide risk managers with an understanding of the potential human health risks associated with background conditions and additional risks associated with past Site activities.

For human health protection, BRC's goal is to remediate the Site soils such that they are suitable for unrestricted residential uses. Human health risks are represented by estimated theoretical upper-bound cancer risks and non-cancer hazards derived in accordance with standard USEPA and NDEP methods. If the carcinogenic risks or non-cancer hazards exceed USEPA acceptable levels or NDEP risk goals, then remedial action alternatives must be considered. Findings of the HHRA are intended to support the Site closure process. The major findings of this report are the following:

- Data collected for use in the HHRA are adequate and usable for their intended purpose;
- All relevant and reasonable exposure scenarios and pathway have been evaluated;
- Residential, construction worker, commercial (indoor) worker, and maintenance (outdoor) worker cancer and non-cancer risk estimates are within or below the risk goals for the project; and
- Residual levels of chemicals in soil should not pose an unacceptable risk to groundwater quality beneath the Site.

Following the Tiered approach from the USEPA 2002 Vapor Intrusion Guidance, BRC believes that it has demonstrated that there is no likelihood of adverse vapor intrusion into any indoor

spaces that may be constructed in the Galleria North School Site sub-area. Therefore, based on the results of the HHRA, and the conclusions in this report, exposures to residual levels of chemicals in soil at the Galleria North School Site sub-area should not result in adverse health effects to all future receptors, or to groundwater quality beneath the Site. Therefore, BRC concludes that an NFAD for the Galleria North School Site sub-area is warranted and requests that the NDEP issue the NFAD (see Appendix L for the legal description of the Site).

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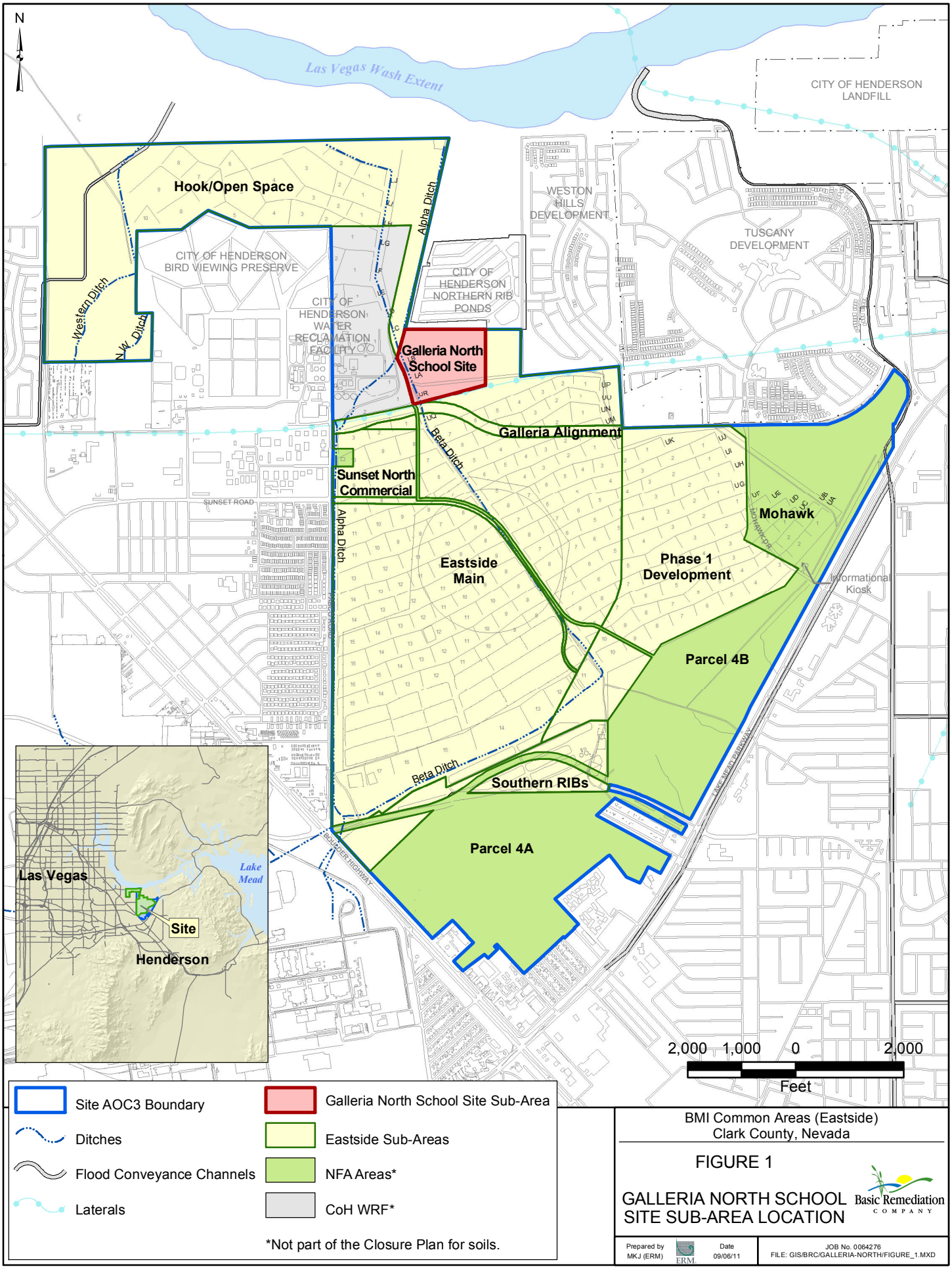
# FIGURES




BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE 1

GALLERIA NORTH SCHOOL SITE SUB-AREA LOCATION

Basic Remediation Company

| Prepared by | Date | JOB No. 0064276 |
|---|---|---|
| MKJ (ERM) | 09/06/11 | FILE: GIS/BRC/GALLERIA-NORTH/FIGURE_1.MXD |

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas

**Development Cut/Fill Areas**

- > 10 Ft Fill
- 5 to 10 Ft Fill
- 0 to 5 Ft Fill
- No Change
- 0 to 5 Ft Cut
- 5 to 10 Ft Cut
- > 10 Ft Cut

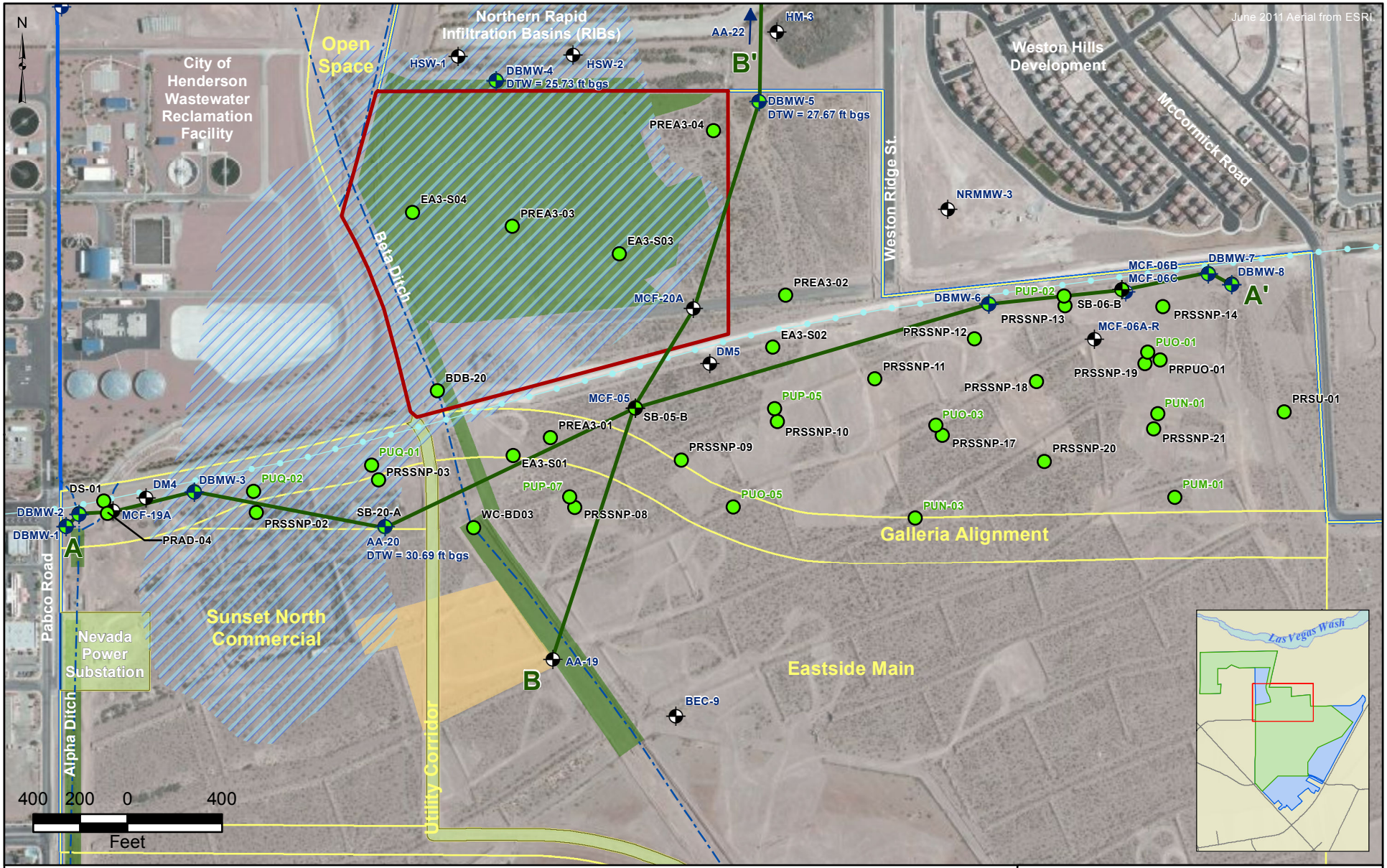
BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE 2

REDEVELOPMENT GRADING PLAN

Basic Remediation Company

| Prepared by | Date | JOB No. 0064276 |
|---|---|---|
| MKJ (ERM) | 09/06/11 | FILE: GIS/BRC/GALLERIA-NORTH/FIGURES2,6,12.MXD |




Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Interim Remedial Measure Areas
Approximate Historical Seep Area
Tamarisk Removal Area
NFA Areas
Pittman Lateral
Historical Soil Sample Location
Monitoring Wells
Alluvial Wells with Groundwater Data
Other Monitoring Wells

**PREA3-04** - Discrete Sample
**PUP-02** - Composite Sample
*Indicates multiple samples with same prefix.

BMI Common Areas (Eastside)
Clark County, Nevada

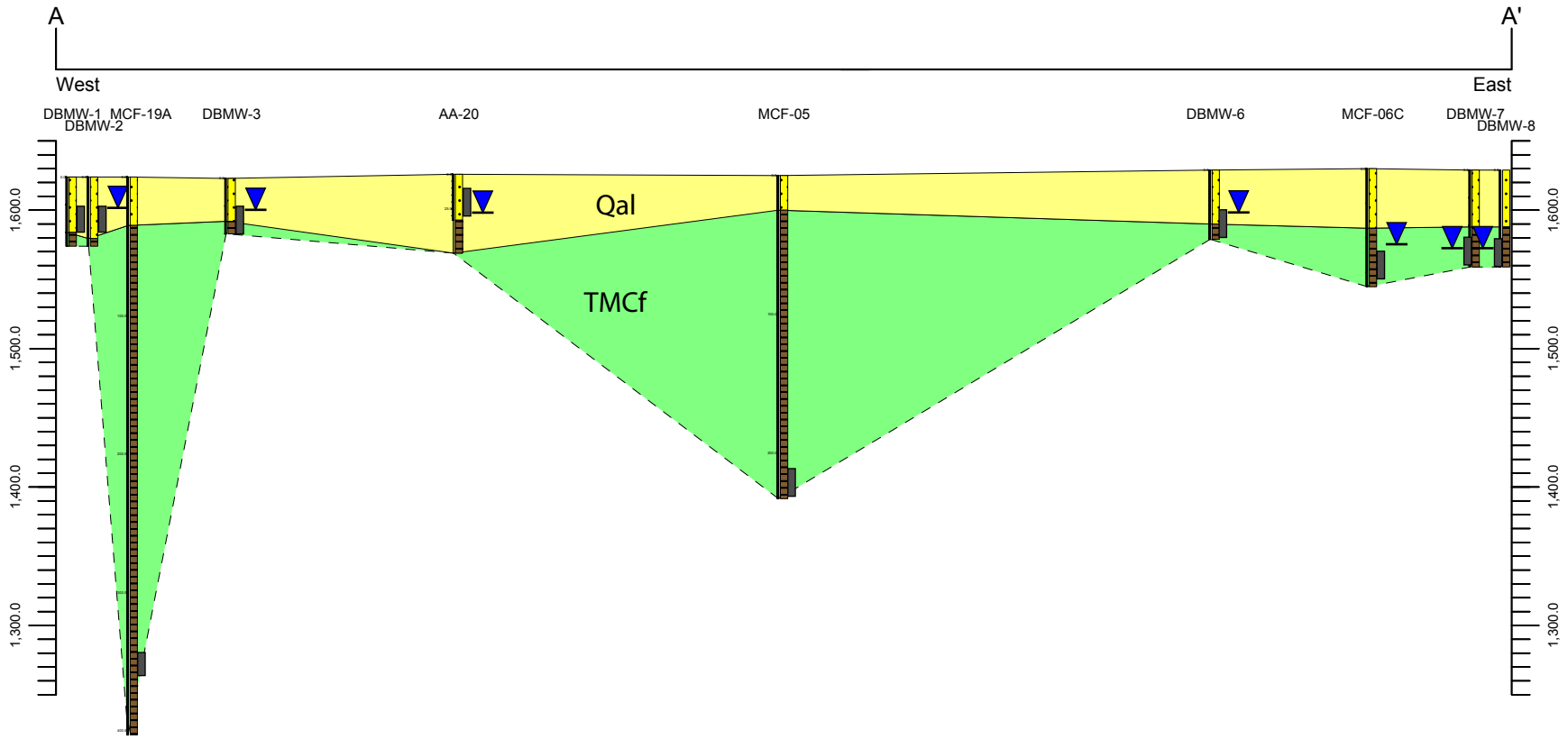
FIGURE 3

SITE PLAN WITH HISTORICAL SOIL SAMPLE LOCATIONS AND MONITORING WELLS

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/FIGURE_3.MXD

# Cross-Section A-A'




= Screen Interval
= Qal Water Level
= Qal = Quaternary alluvium
= TMCf = Tertiary Muddy Creek formation
Vertical Scale = 5x Horizonal Scale
For soil lithology details, please see the individual boring logs.
See Figure 3 for cross-section location.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE 4

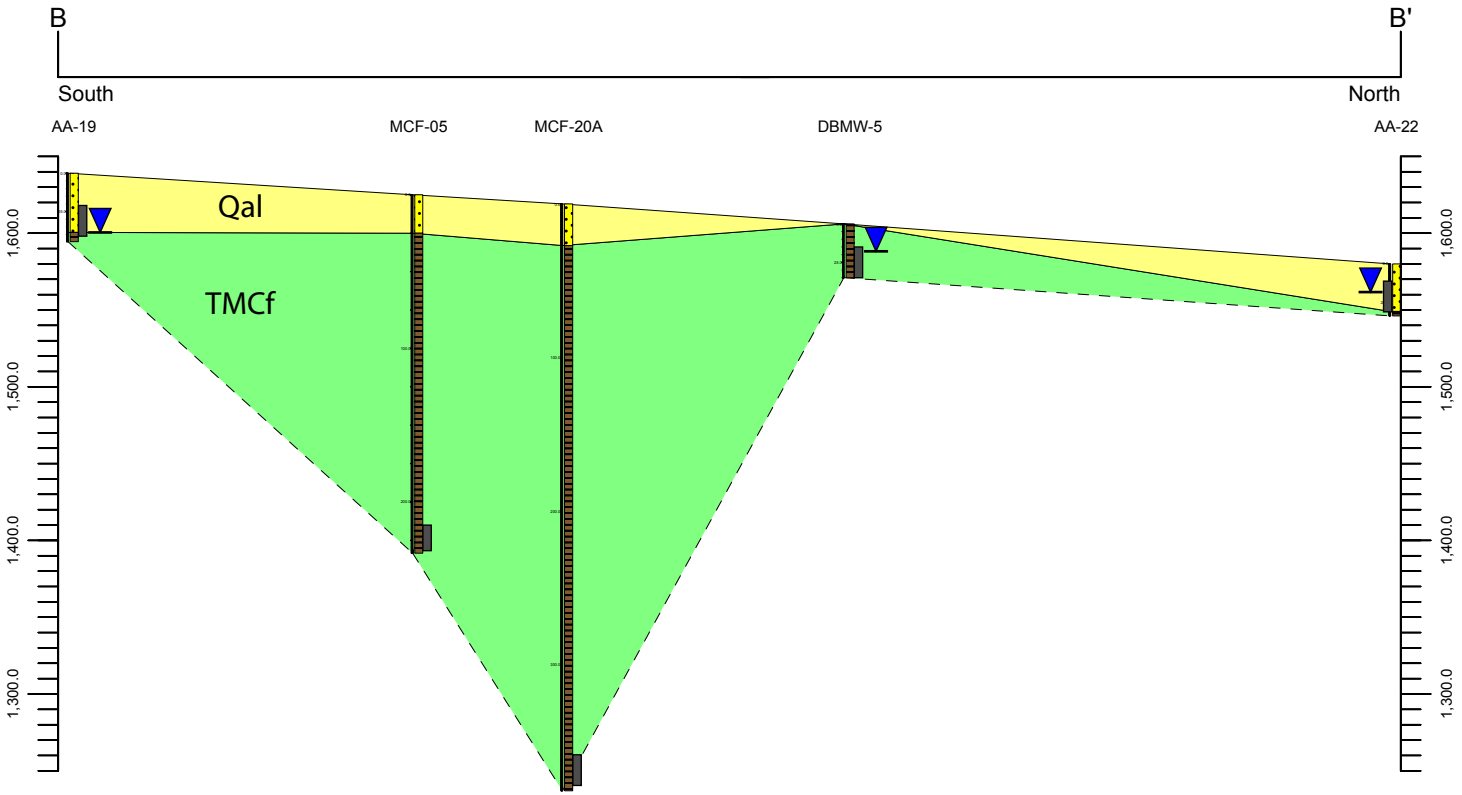
GALLERIA NORTH
SCHOOL SITE SUB-AREA
CROSS-SECTION A-A'

Basic Remediation COMPANY

| Prepared by | Date | JOB No. |
|---|---|---|
| MKJ (ERM) | 09/06/11 | 0064276 |

FILE: GIS/BRC/GALLERIA-NORTH/FIGURE4.AI

# Cross-Section B-B'




= Screen Interval
= Qal Water Level
= Qal = Quaternary alluvium
= TMCf = Tertiary Muddy Creek formation
Vertical Scale = 5x Horizonal Scale
For soil lithology details, please see the individual boring logs.
See Figure 3 for cross-section location.

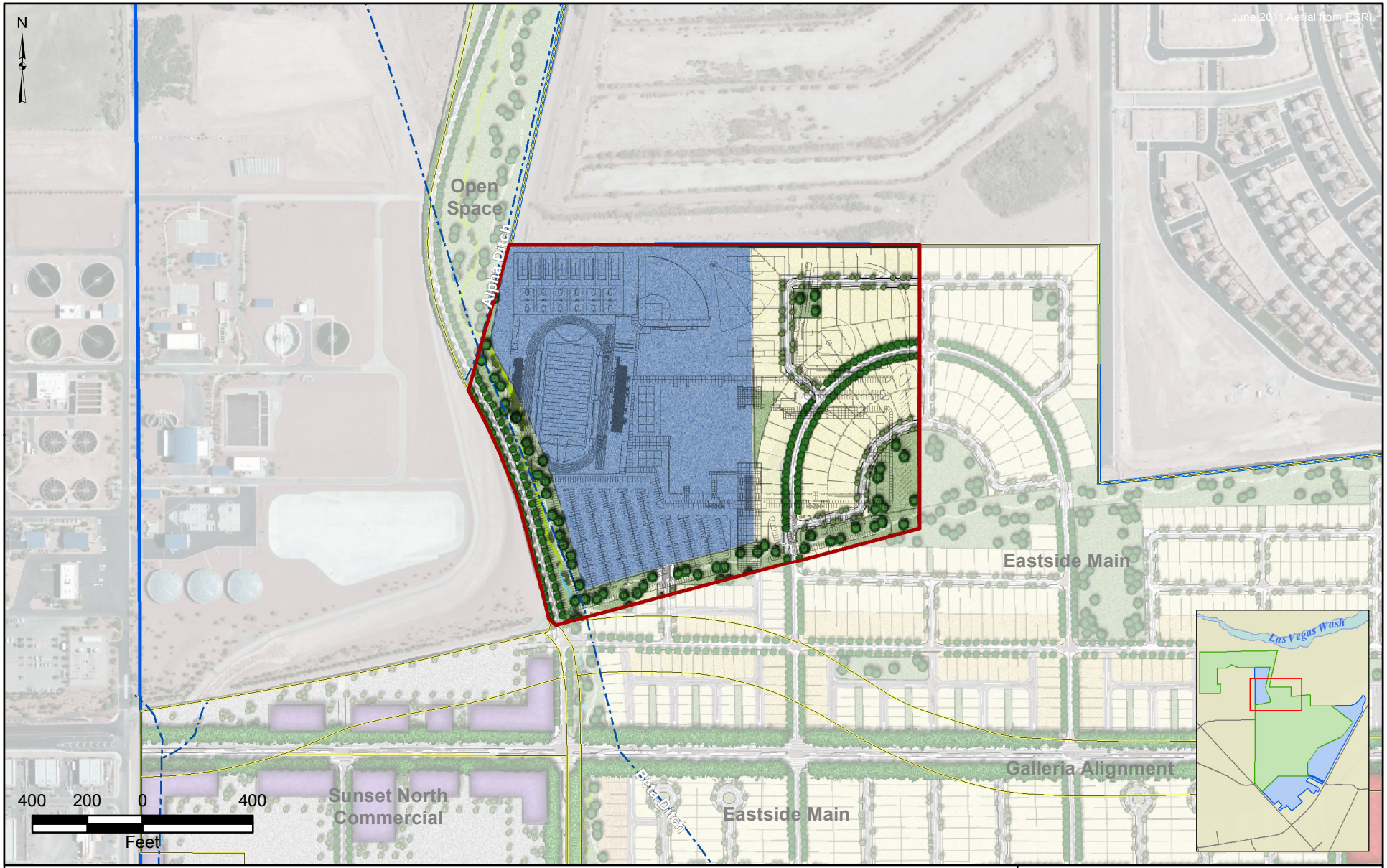
BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE 5

GALLERIA NORTH
SCHOOL SITE SUB-AREA
CROSS-SECTION B-B'

Basic Remediation COMPANY

| Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 FILE: GIS/BRC/GALLERIA-NORTH/FIGURE5.AI |
|---|---|---|




Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas

**Current Development Plan**

High Density Residential
Medium Density Residential
Low Density Residential
Commercial
Schools
Retail/Commercial
Parks & Trails
Roads/Parking

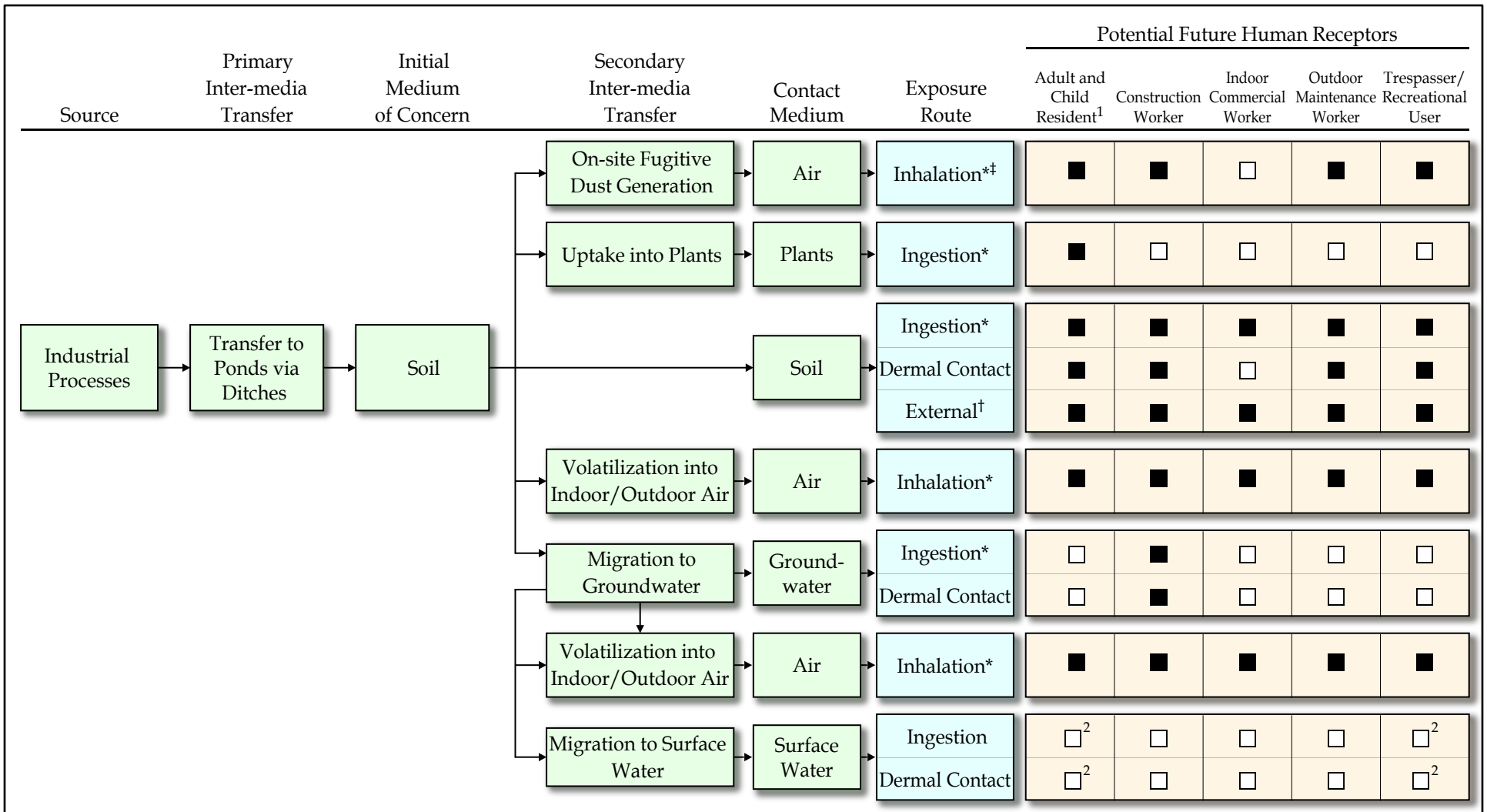
BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE 6

CURRENT DEVELOPMENT PLAN

Basic Remediation Company

Prepared by MKJ (ERM) | ERM | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/FIGURES2,6,12.MXD




□ - Incomplete or insignificant exposure pathway.

■ - Complete or potentially complete exposure pathway.

Note: All potential exposure pathways are shown; however, a particular pathway shown as complete may be incomplete depending on the COPCs evaluated in the human health risk assessment.

[1]Although the current development plan is for a school, a residential receptor, as discussed in the Closure Plan, is considered representative and health protective for potential future school receptors.

[2]Potentially complete exposure pathway following discharge to Las Vegas Wash and Lake Mead.

*Includes radionuclide exposures.

†Only radionuclide exposures.

‡Includes asbestos exposures.

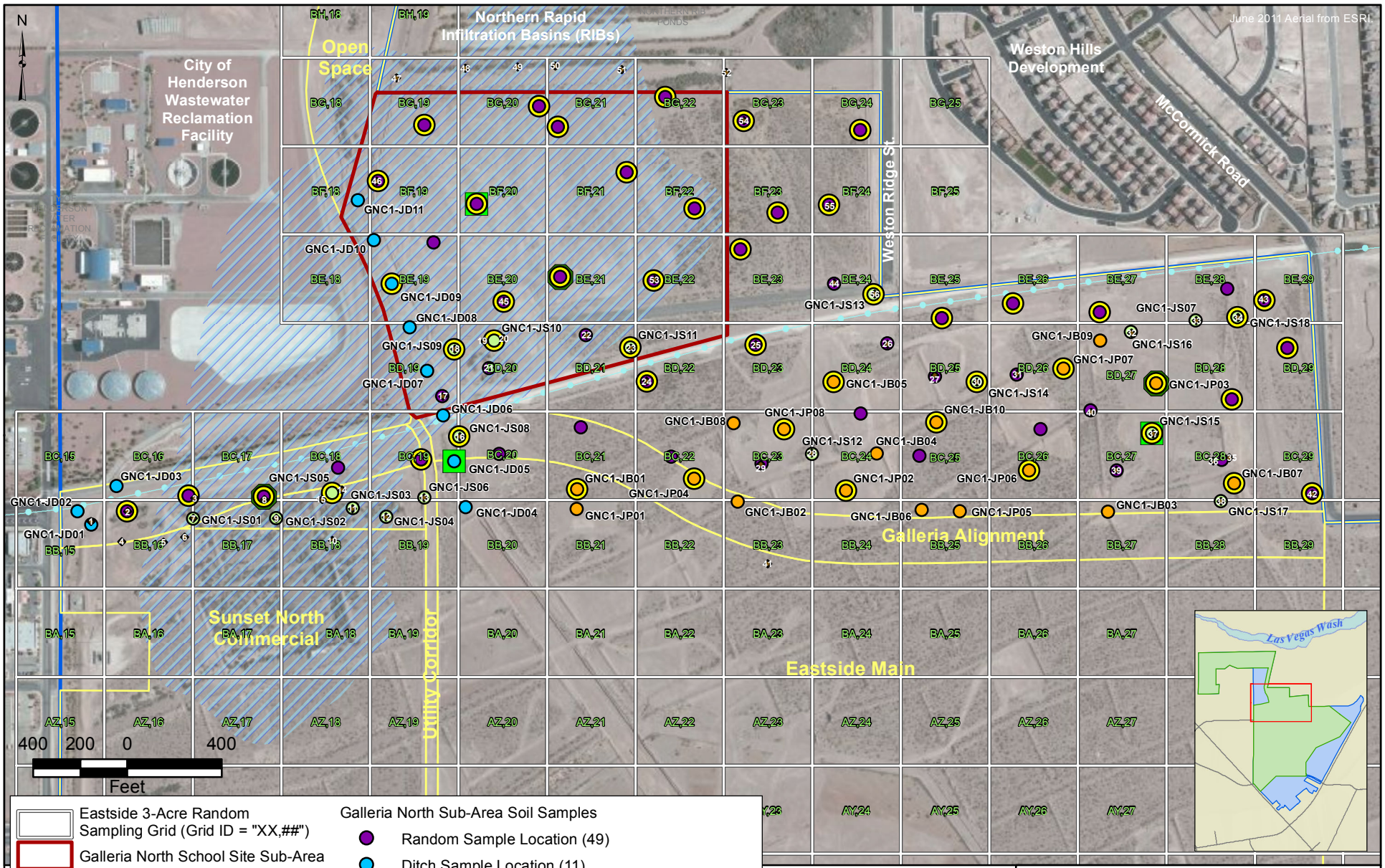
BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE 7

CONCEPTUAL SITE MODEL DIAGRAM FOR POTENTIAL HUMAN EXPOSURES

Basic Remediation COMPANY

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/FIGURE7.AI




Note: Sample ID's are shown for ditch, debris, berm, and pond sample locations. Sample ID's for random samples correspond to the grid cell ID.

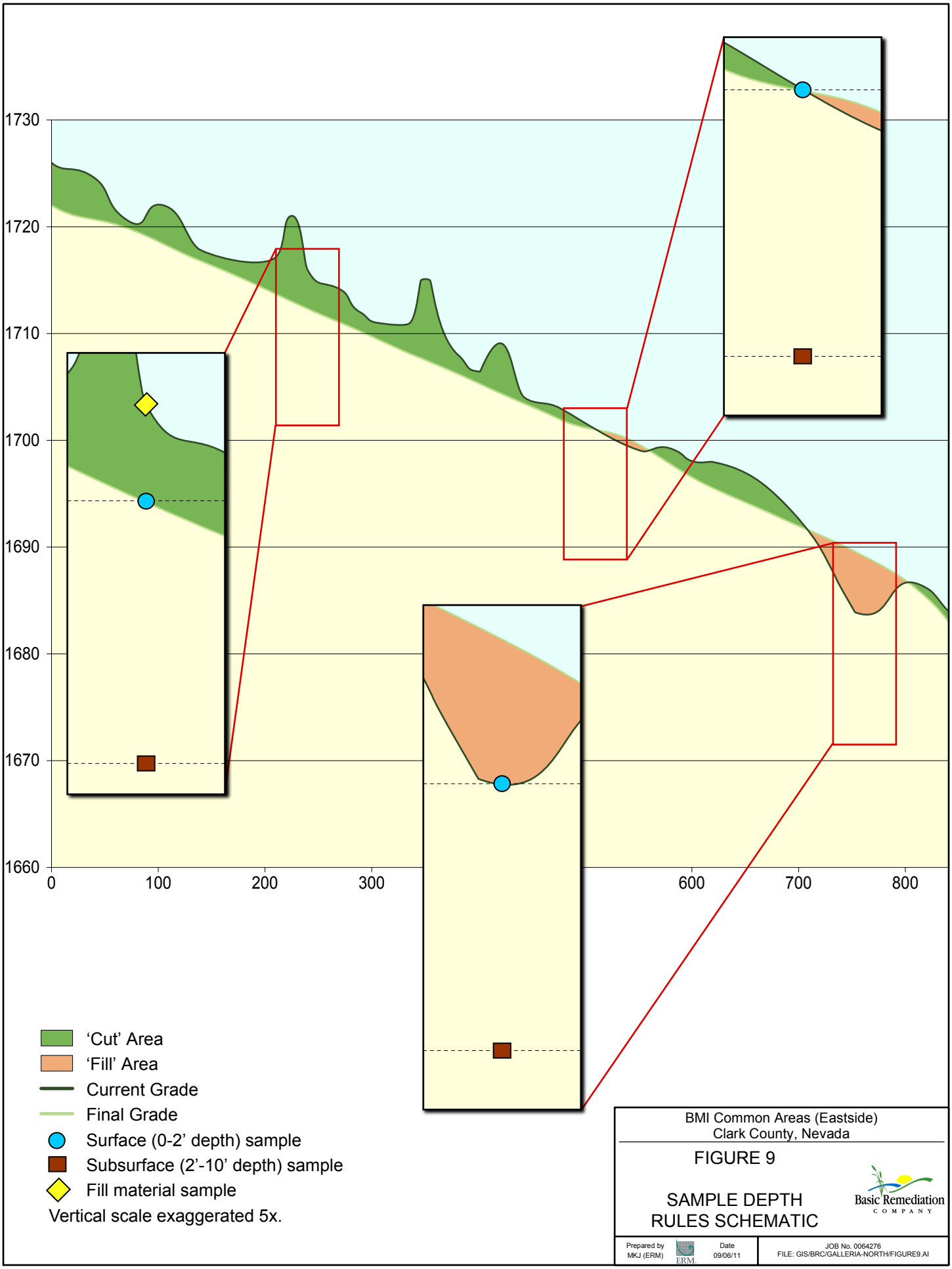
BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE 8

INITIAL SOIL AND SOIL VAPOR FLUX SAMPLING LOCATIONS

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/FIGURE_8.MXD



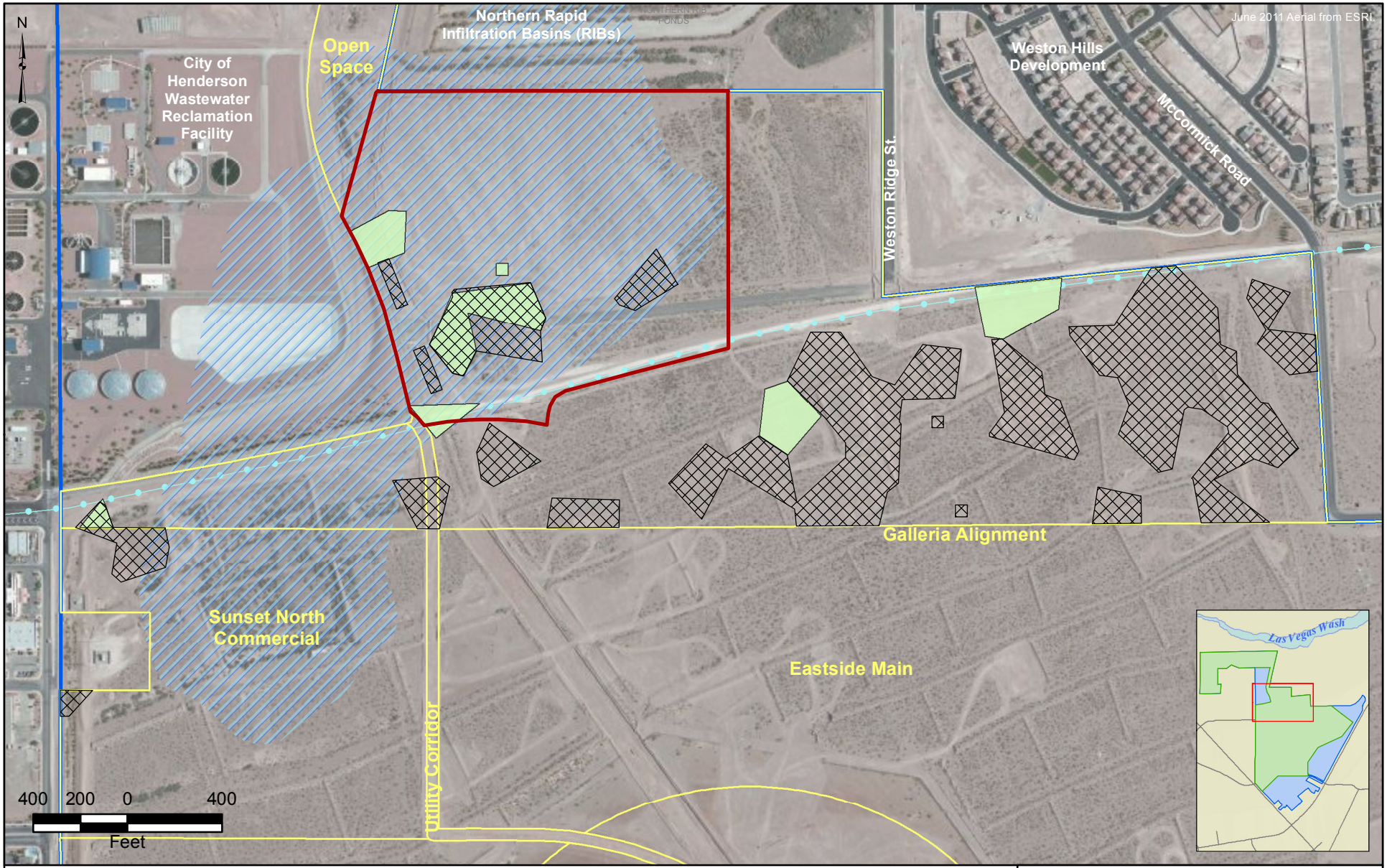

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE 9

SAMPLE DEPTH
RULES SCHEMATIC

Basic Remediation Company

| Prepared by | Date | JOB No. 0064276 |
|---|---|---|
| MKJ (ERM) | 09/06/11 | FILE: GIS/BRC/GALLERIA-NORTH/FIGURE9.AI |




Galleria North-School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Approximate Historical Seep Area

2009 Remediation Areas

2010 Remediation Areas

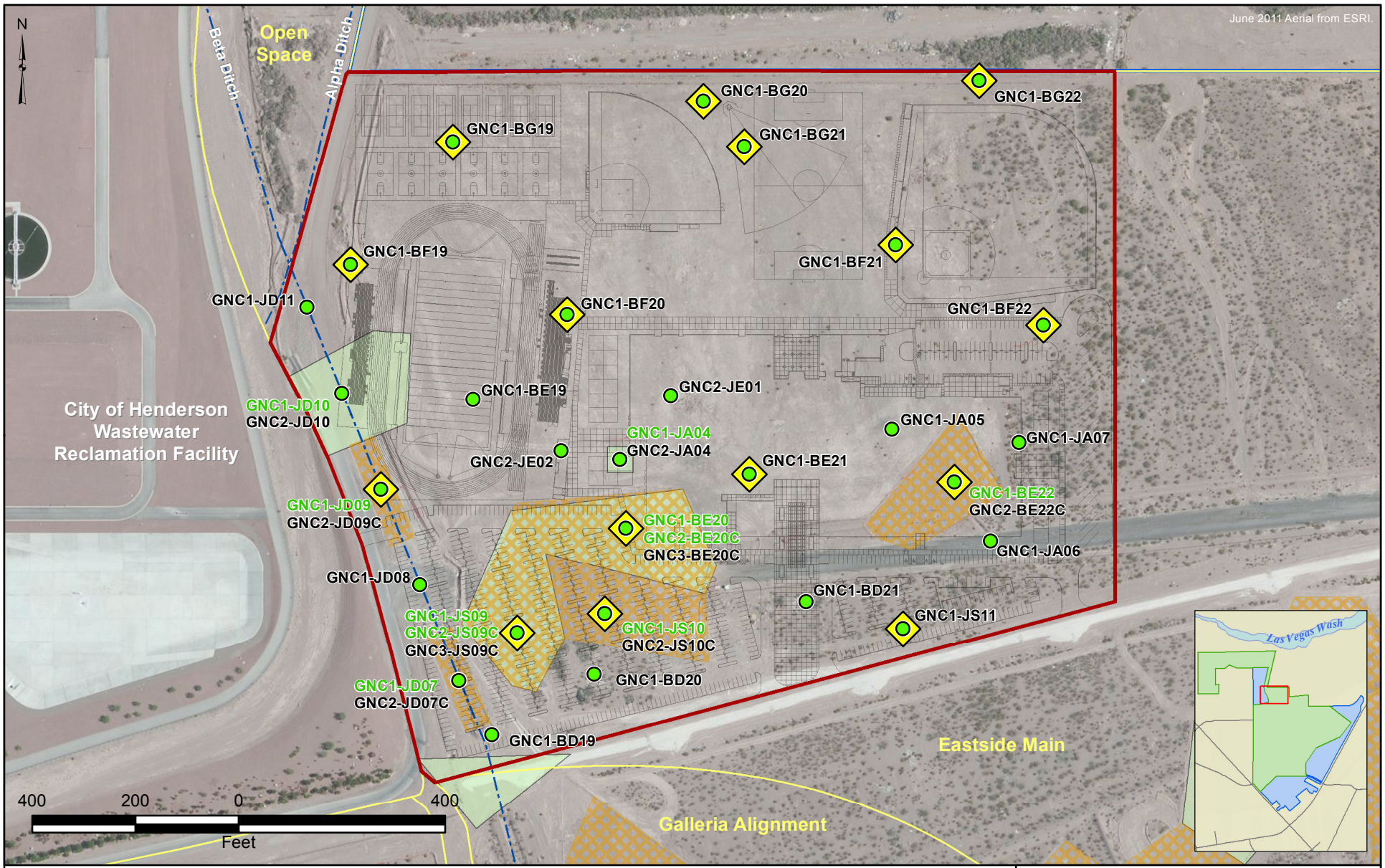
BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE 10

GALLERIA NORTH
SCHOOL SITE SUB-AREA
SOIL REMEDIATION AREAS

Basic Remediation Company

| Prepared by | Date | JOB No. 0064276 |
|---|---|---|
| MKJ (ERM) | 09/06/11 | FILE: GIS/BRC/GALLERIA-NORTH/FIGURE_10.MXD |




Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
2009 Remediation Areas
2010 Remediation Areas

Soil Sample Location[1]
Surface Flux Sample Location

**GNC2-JD07C** - Existing Sample Location
GNC1-JD07 - Scraped Sample Location

(1) Although soil removal would affect the concentrations of all analytes, confirmatory sampling only analyzed for the constituent suites that triggered the soil removal. Therefore, in the absence of post-scrape data, the pre-scrape data are used for all other analytes in the human health risk assessment (see text).

BMI Common Areas (Eastside)
Clark County, Nevada

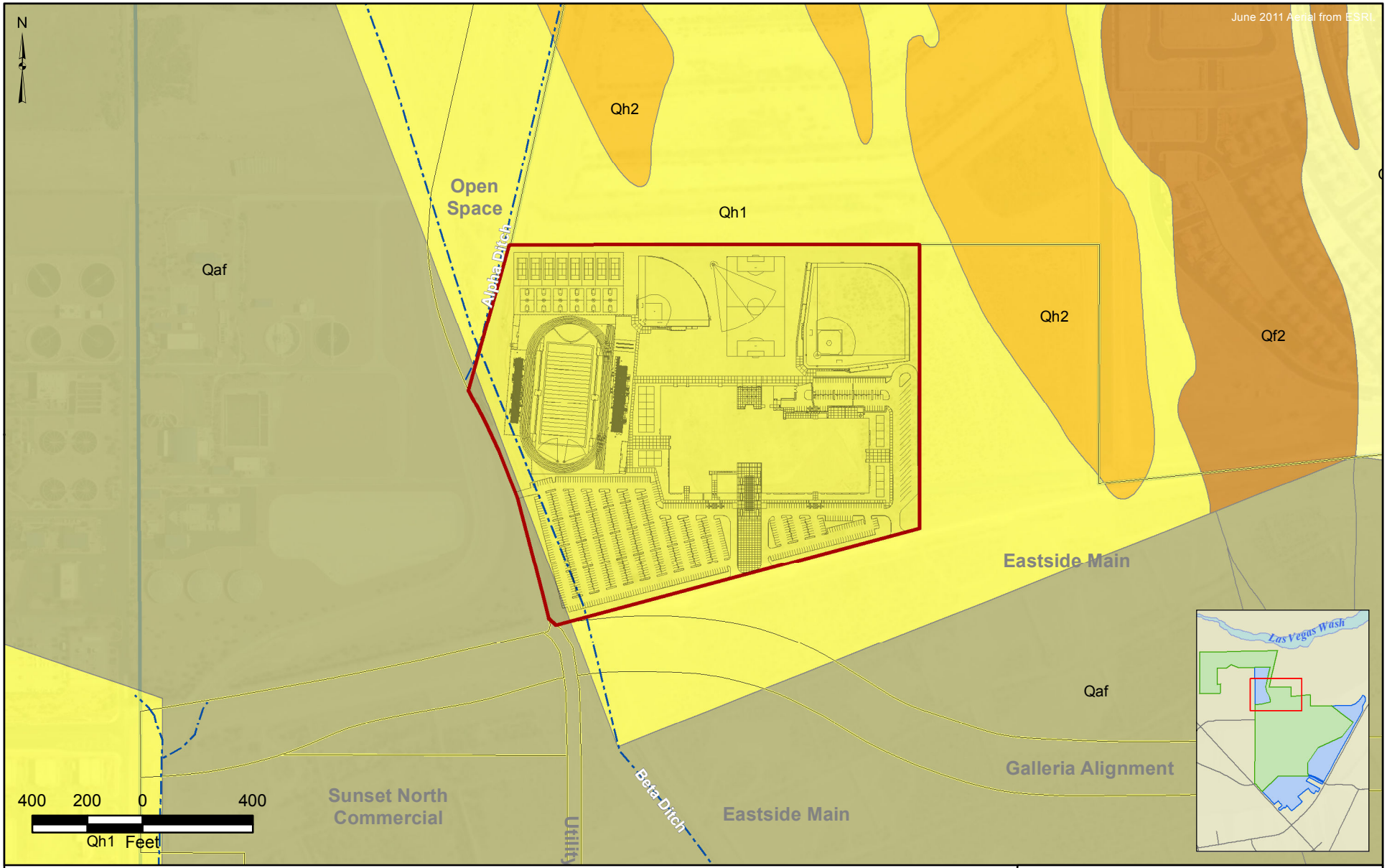
FIGURE 11

# FINAL SOIL AND SOIL VAPOR FLUX SAMPLING LOCATIONS

Basic Remediation Company

Prepared by MKJ (ERM) | ERM | Date 09/06/11

JOB No. 0064276
FILE: GIS/BRC/GALLERIA-NORTH/FIGURE11.MXD




Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas

**Lithology**

Qa-Mixed
Qaf-Disturbed
Qh1-McCullough
Qh2-McCullough
Qf2-McCullough/River

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE 12

GALLERIA NORTH SCHOOL SITE SUB-AREA LITHOLOGIES

Basic Remediation COMPANY

Prepared by MKJ (ERM) | ERM | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/FIGURES5,6,12.MXD

# TABLES

**TABLE 3-1**
**SAMPLE-SPECIFIC COLLECTION DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample Location | Sample Type | Grading Plan | | Sample Depth 1 | Sample Depth 2 | Sample Depth 3 |
|---|---|---|---|---|---|---|
| Initial Sampling Event | | | | | | |
| GNC1-BD19 | Random | -- | 0 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BD20 | Random | Fill | +2 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BD21 | Random | Fill | +1 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BE19 | Random | Fill | +2 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BE20 | Random with Flux | Fill | +1 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BE21 | Random with Flux | Fill | +1 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BE22 | Random with Flux | -- | 0 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BF19 | Random with Flux | Cut | -1 | 0 (Fill/Surface) | 11 (Subsurface) | -- |
| GNC1-BF20 | Random with Flux | Fill | +1 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BF21 | Random with Flux | Fill | +1 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BF22 | Random with Flux | -- | 0 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BG19 | Random with Flux | Fill | +1 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BG20 | Random with Flux | -- | 0 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BG21 | Random with Flux | Fill | +1 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-BG22 | Random with Flux | -- | 0 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-JD07 | Ditch | Fill | +2 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-JD08 | Ditch | -- | 0 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-JD09 | Ditch with Flux | -- | 0 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-JD10 | Ditch | Cut | -1 | 0 (Fill/Surface) | 11 (Subsurface) | -- |
| GNC1-JD11 | Ditch | Cut | -1 | 0 (Fill/Surface) | 11 (Subsurface) | -- |
| GNC1-JS09 | Debris with Flux | Fill | +1 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-JS10 | Debris with Flux | Fill | +3 | 0 (Surface) | 10 (Subsurface) | -- |
| GNC1-JS11 | Debris with Flux | -- | 0 | 0 (Surface) | 10 (Subsurface) | -- |
| Confirmation/Supplemental Sampling Events | | | | | | |
| GNC1-JA04 | Supplemental | -- | 0 | 0 (Surface) | -- | -- |
| GNC1-JA05 | Supplemental | -- | 0 | 0 (Surface) | -- | -- |
| GNC1-JA06 | Supplemental | -- | 0 | 0 (Surface) | -- | -- |
| GNC1-JA07 | Supplemental | -- | 0 | 0 (Surface) | -- | -- |
| GNC2-BE20C | Confirm | Fill | +1 | 0 (Surface) | -- | -- |
| GNC2-BE22C | Confirm | -- | 0 | 0 (Surface) | -- | -- |
| GNC2-JA04 | Confirm | -- | 0 | 0 (Surface) | -- | -- |
| GNC2-JD07C | Confirm | Fill | +2 | 0 (Surface) | -- | -- |

**TABLE 3-1**
**SAMPLE-SPECIFIC COLLECTION DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample Location | Sample Type | Grading Plan | | Sample Depth 1 | Sample Depth 2 | Sample Depth 3 |
|---|---|---|---|---|---|---|
| GNC2-JD09C | Confirm | -- | 0 | 0 (Surface) | -- | -- |
| Confirmation/Supplemental Sampling Events | | | | | | |
| GNC2-JD10 | Confirm | Cut | -1 | 0 (Surface) | -- | -- |
| GNC2-JE01 | Supplemental | -- | 0 | 0 (Surface) | -- | -- |
| GNC2-JE02 | Supplemental | -- | 0 | 0 (Surface) | -- | -- |
| GNC2-JS09C | Confirm | Fill | +1 | 0 (Surface) | -- | -- |
| GNC2-JS10C | Confirm | Fill | +3 | 0 (Surface) | -- | -- |
| GNC3-BE20C | Confirm | Fill | +1 | 0 (Surface) | -- | -- |
| GNC3-JS09C | Confirm | Fill | +1 | 0 (Surface) | -- | -- |

Note: Because sample collection will be over a two to three foot depth interval, sample locations with an anticipated cut depth less than three feet only sampled at the surface and one post-grade subsurface depth.
Yellow shaded location (GNC1-BF20) indicates deep soil sample collected for physical parameter analyses.
Green shaded location (GNC1-BE21) indicates subsurface soil sample also included synthetic precipitation leaching procedure (SPLP) sampling and analysis.
Depths are in feet bgs (current grade).

**TABLE 3-2**
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Preparation Method | Analytical Method | Compound List | CAS Number | Sample Depth (from Table 3-1) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Depth 1 | Depth 2/3 | Deep |
| **Ions** | **EPA 300.0** | **EPA 300.0** | Bromide | 24959-67-9 | ✓ | ✓ | (d) |
| | | | Chlorate | 14866-68-3 | ✓ | ✓ | (d) |
| | | | Chloride | 16887-00-6 | ✓ | ✓ | (d) |
| | | | Fluoride | 16984-48-8 | ✓ | ✓ | (d) |
| | | | Nitrate (as N) | 14797-55-8 | ✓ | ✓ | (d) |
| | | | Nitrite (as N) | 14797-65-0 | ✓ | ✓ | (d) |
| | | | Orthophosphate | 14265-44-2 | ✓ | ✓ | (d) |
| | | | Sulfate | 14808-79-8 | ✓ | ✓ | (d) |
| | **EPA 314.0** | **EPA 314.0** | Perchlorate | 14797-73-0 | ✓ | ✓ | (d) |
| **Chlorinated Compounds** | **EPA 551.1** | **EPA 551.1** | Chloral | 75-87-6 | (e) | (e) | (d) |
| | | | Dichloroacetaldehyde | 79-02-7 | (e) | (e) | (d) |
| **Polychlorinated Dibenzodioxins/ Dibenzofurans** | **EPA 8290** | **EPA 8290** | 1,2,3,4,6,7,8,9-Octachlorodibenzofuran | 39001-02-0 | ✓ | (b) | (b) |
| | | | 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin | 3268-87-9 | ✓ | (b) | (b) |
| | | | 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | ✓ | (b) | (b) |
| | | | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | ✓ | (b) | (b) |
| | | | 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | ✓ | (b) | (b) |
| | | | 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | ✓ | (b) | (b) |
| | | | 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | ✓ | (b) | (b) |
| | | | 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | ✓ | (b) | (b) |
| | | | 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | ✓ | (b) | (b) |
| | | | 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | ✓ | (b) | (b) |
| | | | 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | ✓ | (b) | (b) |
| | | | 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | ✓ | (b) | (b) |
| | | | 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | ✓ | (b) | (b) |
| | | | 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | ✓ | (b) | (b) |
| | | | 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | ✓ | (b) | (b) |
| | | | 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | ✓ | (b) | (b) |
| | | | 2,3,7,8-Tetrachlororodibenzo-p-dioxin | 1746-01-6 | ✓ | (b) | (b) |
| **Asbestos** | **Elutrator** | **Elutriator/TEM** | Asbestos | 1332-21-4 | ✓ | (c) | (c) |
| **General Chemistry Parameters** | **EPA 350.1** | **EPA 350.2** | Ammonia (as N) | 7664-41-7 | ✓ | ✓ | (d) |
| | **EPA 9012A** | **EPA 9010/9014** | Cyanide (Total) | 57-12-5 | ✓ | ✓ | (d) |
| | **NA** | **EPA 9045C** | pH in soil | pH | ✓ | ✓ | ✓ |
| | **EPA 376.1/376.2** | **EPA 376.1/376.2** | Sulfide | 18496-25-8 | ✓ | ✓ | (d) |
| | **Mod. EPA 415.1** | **Mod. EPA 415.1** | Total inorganic carbon | 7440-44-0 | ✓ | ✓ | (d) |
| | **EPA 351.2** | **EPA 351.2** | Total Kjeldahl nitrogen (TKN) | TKN | ✓ | ✓ | (d) |
| | **EPA 9060** | **EPA 415.1** | Total organic carbon (TOC) | 7440-44-0 | ✓ | ✓ | ✓ |

**TABLE 3-2**
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Preparation Method | Analytical Method | Compound List | CAS Number | Sample Depth (from Table 3-1) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Depth 1 | Depth 2/3 | Deep |
| **Metals** | **EPA 3050M** | **EPA 6020/6010B** | Aluminum | 7429-90-5 | ✓ | ✓ | (d) |
| | | | Antimony | 7440-36-0 | ✓ | ✓ | (d) |
| | | | Arsenic | 7440-38-2 | ✓ | ✓ | (d) |
| | | | Barium | 7440-39-3 | ✓ | ✓ | (d) |
| | | | Beryllium | 7440-41-7 | ✓ | ✓ | (d) |
| | | | Boron | 7440-42-8 | ✓ | ✓ | (d) |
| | | | Cadmium | 7440-43-9 | ✓ | ✓ | (d) |
| | | | Calcium | 7440-70-2 | ✓ | ✓ | (d) |
| | | | Chromium | 7440-47-3 | ✓ | ✓ | (d) |
| | | | Cobalt | 7440-48-4 | ✓ | ✓ | (d) |
| | | | Copper | 7440-50-8 | ✓ | ✓ | (d) |
| | | | Iron | 7439-89-6 | ✓ | ✓ | (d) |
| | | | Lead | 7439-92-1 | ✓ | ✓ | (d) |
| | | | Lithium | 1313-13-9 | ✓ | ✓ | (d) |
| | | | Magnesium | 7439-95-4 | ✓ | ✓ | (d) |
| | | | Manganese | 7439-96-5 | ✓ | ✓ | (d) |
| | | | Molybdenum | 7439-98-7 | ✓ | ✓ | (d) |
| | | | Nickel | 7440-02-0 | ✓ | ✓ | (d) |
| | | | Niobium | 7440-03-1 | (e) | (e) | (d) |
| | | | Palladium | 7440-05-3 | (e) | (e) | (d) |
| | | | Phosphorus | 7723-14-0 | (e) | (e) | (d) |
| | | | Platinum | 7440-06-4 | (e) | (e) | (d) |
| | | | Potassium | 7440-09-7 | ✓ | ✓ | (d) |
| | | | Selenium | 7782-49-2 | ✓ | ✓ | (d) |
| | | | Silicon | 7440-21-3 | (e) | (e) | (d) |
| | | | Silver | 7440-22-4 | ✓ | ✓ | (d) |
| | | | Sodium | 7440-23-5 | ✓ | ✓ | (d) |
| | | | Strontium | 7440-24-6 | ✓ | ✓ | (d) |
| | | | Sulfur | 7704-34-9 | (e) | (e) | (d) |
| | | | Thallium | 7440-28-0 | ✓ | ✓ | (d) |
| | | | Tin | 7440-31-5 | ✓ | ✓ | (d) |
| | | | Titanium | 7440-32-6 | ✓ | ✓ | (d) |
| | | | Tungsten | 7440-33-7 | ✓ | ✓ | (d) |
| | | | Uranium | 7440-61-1 | ✓ | ✓ | (d) |
| | | | Vanadium | 7440-62-2 | ✓ | ✓ | (d) |
| | | | Zinc | 7440-66-6 | ✓ | ✓ | (d) |
| | | | Zirconium | 7440-67-7 | (e) | (e) | (d) |

**TABLE 3-2**
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Preparation Method | Analytical Method | Compound List | CAS Number | Sample Depth (from Table 3-1) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Depth 1 | Depth 2/3 | Deep |
| **Metals (continued)** | **EPA 3060A** | **EPA 7196A** | Chromium (VI) | 18540-29-9 | ✓ | ✓ | (d) |
| | **EPA 7471A** | **EPA 7470/7471A** | Mercury | 7439-97-6 | ✓ | ✓ | (d) |
| **Organophosphorous Pesticides** | **EPA 8141A** | **EPA 8141A** | Azinphos-ethyl | 264-27-19 | (a) | (a) | (a) |
| | | | Azinphos-methyl | 86-50-0 | (a) | (a) | (a) |
| | | | Carbophenothion | 786-19-6 | (a) | (a) | (a) |
| | | | Chlorpyrifos | 2921-88-2 | (a) | (a) | (a) |
| | | | Coumaphos | 56-72-4 | (a) | (a) | (a) |
| | | | Demeton-O | 298-03-3 | (a) | (a) | (a) |
| | | | Demeton-S | 126-75-0 | (a) | (a) | (a) |
| | | | Diazinon | 333-41-5 | (a) | (a) | (a) |
| | | | Dichlorvos | 62-73-7 | (a) | (a) | (a) |
| | | | Dimethoate | 60-51-5 | (a) | (a) | (a) |
| | | | Disulfoton | 298-04-4 | (a) | (a) | (a) |
| | | | EPN | 2104-64-5 | (a) | (a) | (a) |
| | | | Ethoprop | 13194-48-4 | (a) | (a) | (a) |
| | | | Ethyl parathion | 56-38-2 | (a) | (a) | (a) |
| | | | Fampphur | 52-85-7 | (a) | (a) | (a) |
| | | | Fenthion | 55-38-9 | (a) | (a) | (a) |
| | | | Malathion | 121-75-5 | (a) | (a) | (a) |
| | | | Methyl carbophenothion | 953-17-3 | (a) | (a) | (a) |
| | | | Methyl parathion | 298-00-0 | (a) | (a) | (a) |
| | | | Mevinphos | 7786-34-7 | (a) | (a) | (a) |
| | | | Naled | 300-76-5 | (a) | (a) | (a) |
| | | | O,O,O-Triethyl phosphorothioate (TEPP) | 297-97-2 | (a) | (a) | (a) |
| | | | Phorate | 298-02-2 | (a) | (a) | (a) |
| | | | Phosmet | 732-11-6 | (a) | (a) | (a) |
| | | | Ronnel | 299-84-3 | (a) | (a) | (a) |
| | | | Stirophos (Tetrachlorovinphos) | 22248-79-9 | (a) | (a) | (a) |
| | | | Sulfotep | 3689-24-5 | (a) | (a) | (a) |
| **Chlorinated Herbicides** | **EPA 8151A** | **EPA 8151A** | 2,4,5-T | 93-76-5 | (a) | (a) | (a) |
| | | | 2,4,5-TP (Silvex) | 93-72-1 | (a) | (a) | (a) |
| | | | 2,4-D | 94-75-7 | (a) | (a) | (a) |
| | | | 2,4-DB | 94-82-6 | (a) | (a) | (a) |
| | | | Dalapon | 75-99-0 | (a) | (a) | (a) |
| | | | Dicamba | 1918-00-9 | (a) | (a) | (a) |

**TABLE 3-2**
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Preparation Method | Analytical Method | Compound List | CAS Number | Sample Depth (from Table 3-1) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Depth 1 | Depth 2/3 | Deep |
| **Chlorinated Herbicides (continued)** | **EPA 8151A** | **EPA 8151A** | Dichloroprop | 120-36-5 | (a) | (a) | (a) |
| | | | Dinoseb | 88-85-7 | (a) | (a) | (a) |
| | | | MCPA | 94-74-6 | (a) | (a) | (a) |
| | | | MCPP | 93-65-2 | (a) | (a) | (a) |
| **Organic Acids** | **HPLC** | **HPLC** | 4-Chlorobenzene sulfonic acid | 98-66-8 | (a) | (a) | (a) |
| | | | Benzenesulfonic acid | 98-11-3 | (a) | (a) | (a) |
| | | | O,O-Diethylphosphorodithioic acid | 298-06-6 | (a) | (a) | (a) |
| | | | O,O-Dimethylphosphorodithioic acid | 756-80-9 | (a) | (a) | (a) |
| **Nonhalogenated Organics** | **EPA 8015B** | **EPA 8015B** | Ethylene glycol | 107-21-1 | (a) | (a) | (a) |
| | | | Ethylene glycol monobutyl ether | 111-76-2 | (a) | (a) | (a) |
| | | | Methanol | 67-56-1 | (a) | (a) | (a) |
| | | | Propylene glycol | 57-55-6 | (a) | (a) | (a) |
| **Organochlorine Pesticides** | **EPA 3550B** | **EPA 8081A** | 2,4-DDD | 53-19-0 | ✓ | ✓ | (d) |
| | | | 2,4-DDE | 3424-82-6 | ✓ | ✓ | (d) |
| | | | 4,4-DDD | 72-54-8 | ✓ | ✓ | (d) |
| | | | 4,4-DDE | 72-55-9 | ✓ | ✓ | (d) |
| | | | 4,4-DDT | 50-29-3 | ✓ | ✓ | (d) |
| | | | Aldrin | 309-00-2 | ✓ | ✓ | (d) |
| | | | alpha-BHC | 319-84-6 | ✓ | ✓ | (d) |
| | | | alpha-Chlordane | 5103-71-9 | ✓ | ✓ | (d) |
| | | | beta-BHC | 319-85-7 | ✓ | ✓ | (d) |
| | | | Chlordane | 57-74-9 | ✓ | ✓ | (d) |
| | | | delta-BHC | 319-86-8 | ✓ | ✓ | (d) |
| | | | Dieldrin | 60-57-1 | ✓ | ✓ | (d) |
| | | | Endosulfan I | 959-98-8 | ✓ | ✓ | (d) |
| | | | Endosulfan II | 33213-65-9 | ✓ | ✓ | (d) |
| | | | Endosulfan sulfate | 1031-07-8 | ✓ | ✓ | (d) |
| | | | Endrin | 72-20-8 | ✓ | ✓ | (d) |
| | | | Endrin aldehyde | 7421-93-4 | ✓ | ✓ | (d) |
| | | | Endrin ketone | 53494-70-5 | ✓ | ✓ | (d) |
| | | | gamma-BHC (Lindane) | 58-89-9 | ✓ | ✓ | (d) |
| | | | gamma-Chlordane | 5103-74-2 | ✓ | ✓ | (d) |
| | | | Heptachlor | 76-44-8 | ✓ | ✓ | (d) |
| | | | Heptachlor epoxide | 1024-57-3 | ✓ | ✓ | (d) |
| | | | Methoxychlor | 72-43-5 | ✓ | ✓ | (d) |
| | | | Toxaphene | 8001-35-2 | ✓ | ✓ | (d) |

**TABLE 3-2**
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Preparation Method | Analytical Method | Compound List | CAS Number | Sample Depth (from Table 3-1) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Depth 1 | Depth 2/3 | Deep |
| **Polychlorinated Biphenyls** | **EPA 3510C** | **EPA 8082** | Aroclor 1016 | 12674-11-2 | ✓ | (b) | (b) |
| | | | Aroclor 1221 | 11104-28-2 | ✓ | (b) | (b) |
| | | | Aroclor 1232 | 11141-16-5 | ✓ | (b) | (b) |
| | | | Aroclor 1242 | 53469-21-9 | ✓ | (b) | (b) |
| | | | Aroclor 1248 | 12672-29-6 | ✓ | (b) | (b) |
| | | | Aroclor 1254 | 11097-69-1 | ✓ | (b) | (b) |
| | | | Aroclor 1260 | 11096-82-5 | ✓ | (b) | (b) |
| | | **EPA 1668** | PCB-77 | 32598-13-3 | ✓ | (b) | (b) |
| | | | PCB-81 | 70362-50-4 | ✓ | (b) | (b) |
| | | | PCB-105 | 32598-14-4 | ✓ | (b) | (b) |
| | | | PCB-114 | 74472-37-0 | ✓ | (b) | (b) |
| | | | PCB-118 | 31508-00-6 | ✓ | (b) | (b) |
| | | | PCB-123 | 65510-44-3 | ✓ | (b) | (b) |
| | | | PCB-126 | 57465-28-8 | ✓ | (b) | (b) |
| | | | PCB-156 | 38380-08-4 | ✓ | (b) | (b) |
| | | | PCB-157 | 69782-90-7 | ✓ | (b) | (b) |
| | | | PCB-167 | 52663-72-6 | ✓ | (b) | (b) |
| | | | PCB-169 | 32774-16-6 | ✓ | (b) | (b) |
| | | | PCB-189 | 39635-31-9 | ✓ | (b) | (b) |
| | | | PCB-209 | 2051-24-3 | ✓ | (b) | (b) |
| **Polynuclear Aromatic Hydrocarbons** | **EPA 3550** | **EPA 8310 or EPA 8270SIM** | Acenaphthene | 83-32-9 | ✓ | ✓ | (d) |
| | | | Acenaphthylene | 208-96-8 | ✓ | ✓ | (d) |
| | | | Anthracene | 120-12-7 | ✓ | ✓ | (d) |
| | | | Benzo(a)anthracene | 56-55-3 | ✓ | ✓ | (d) |
| | | | Benzo(a)pyrene | 50-32-8 | ✓ | ✓ | (d) |
| | | | Benzo(b)fluoranthene | 205-99-2 | ✓ | ✓ | (d) |
| | | | Benzo(g,h,i)perylene | 191-24-2 | ✓ | ✓ | (d) |
| | | | Benzo(k)fluoranthene | 207-08-9 | ✓ | ✓ | (d) |
| | | | Chrysene | 218-01-9 | ✓ | ✓ | (d) |
| | | | Dibenzo(a,h)anthracene | 53-70-3 | ✓ | ✓ | (d) |
| | | | Indeno(1,2,3-cd)pyrene | 193-39-5 | ✓ | ✓ | (d) |
| | | | Phenanthrene | 85-01-8 | ✓ | ✓ | (d) |
| | | | Pyrene | 129-00-0 | ✓ | ✓ | (d) |
| **Radionuclides** | **HASL 3003** | **EPA 903.0 / 903.1** | Radium-226 | 13982-63-3 | ✓ | ✓ | (d) |
| | | **EPA 904.0** | Radium-228 | 15262-20-1 | ✓ | ✓ | (d) |

**TABLE 3-2**
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Preparation Method | Analytical Method | Compound List | CAS Number | Sample Depth (from Table 3-1) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Depth 1 | Depth 2/3 | Deep |
| **Radionuclides (continued)** | **HASL 300 (Total Dissolution)** | **HASL A-01-R** | Thorium-228 | 7440-29-1 | ✓ | ✓ | (d) |
| | | | Thorium-230 | 14274-82-9 | ✓ | ✓ | (d) |
| | | | Thorium-232 | 14269-63-7 | ✓ | ✓ | (d) |
| | **HASL 300 (Total Dissolution)** | | Uranium-233/234 | 13966-29-5 | ✓ | ✓ | (d) |
| | | | Uranium-235/236 | 15117-96-1 | ✓ | ✓ | (d) |
| | | | Uranium-238 | 7440-61-1 | ✓ | ✓ | (d) |
| **Aldehydes** | **EPA 8315A** | **EPA 8315A** | Acetaldehyde | 75-07-0 | ✓ | ✓ | (d) |
| | | | Chloroacetaldehyde | 107-20-0 | (e) | (e) | (d) |
| | | | Dichloroacetaldehyde | 79-02-7 | (e) | (e) | (d) |
| | | | Formaldehyde | 50-00-0 | ✓ | ✓ | (d) |
| | | | Trichloroacetaldehyde | 75-87-6 | (e) | (e) | (d) |
| **Semivolatile Organic Compounds** | **EPA 3550B** | **EPA 8270C** | 1,2,4,5-Tetrachlorobenzene | 95-94-3 | ✓ | ✓ | (d) |
| | | | 1,2-Diphenylhydrazine | 122-66-7 | ✓ | ✓ | (d) |
| | | | 1,4-Dioxane | 123-91-1 | ✓ | ✓ | (d) |
| | | | 2,2'/4,4'-Dichlorobenzil | 3457-46-3 | ✓ | ✓ | (d) |
| | | | 2,4,5-Trichlorophenol | 95-95-4 | ✓ | ✓ | (d) |
| | | | 2,4,6-Trichlorophenol | 88-06-2 | ✓ | ✓ | (d) |
| | | | 2,4-Dichlorophenol | 120-83-2 | ✓ | ✓ | (d) |
| | | | 2,4-Dimethylphenol | 105-67-9 | ✓ | ✓ | (d) |
| | | | 2,4-Dinitrophenol | 51-28-5 | ✓ | ✓ | (d) |
| | | | 2,4-Dinitrotoluene | 121-14-2 | ✓ | ✓ | (d) |
| | | | 2,6-Dinitrotoluene | 606-20-2 | ✓ | ✓ | (d) |
| | | | 2-Chloronaphthalene | 91-58-7 | ✓ | ✓ | (d) |
| | | | 2-Chlorophenol | 95-57-8 | ✓ | ✓ | (d) |
| | | | 2-Methylnaphthalene | 91-57-6 | ✓ | ✓ | (d) |
| | | | 2-Nitroaniline | 88-74-4 | ✓ | ✓ | (d) |
| | | | 2-Nitrophenol | 88-75-5 | ✓ | ✓ | (d) |
| | | | 3,3-Dichlorobenzidine | 91-94-1 | ✓ | ✓ | (d) |
| | | | 3-Nitroaniline | 99-09-2 | ✓ | ✓ | (d) |
| | | | 4,4'-Dichlorobenzil | 3457-46-3 | ✓ | ✓ | (d) |
| | | | 4-Bromophenyl phenyl ether | 101-55-3 | ✓ | ✓ | (d) |
| | | | 4-Chloro-3-methylphenol | 59-50-7 | ✓ | ✓ | (d) |
| | | | 4-Chlorophenyl phenyl ether | 7005-72-3 | ✓ | ✓ | (d) |
| | | | 4-Chlorothioanisole | 123-09-1 | ✓ | ✓ | (d) |
| | | | 4-Chlorothiophenol | 106-54-7 | ✓ | ✓ | (d) |

**TABLE 3-2**
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Preparation Method | Analytical Method | Compound List | CAS Number | Sample Depth (from Table 3-1) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Depth 1 | Depth 2/3 | Deep |
| **Semivolatile Organic Compounds (continued)** | **EPA 3550B** | **EPA 8270C** | 4-Nitroaniline | 100-01-6 | ✓ | ✓ | (d) |
| | | | 4-Nitrophenol | 100-02-7 | ✓ | ✓ | (d) |
| | | | Acetophenone | 98-86-2 | ✓ | ✓ | (d) |
| | | | Aniline | 62-53-3 | ✓ | ✓ | (d) |
| | | | Azobenzene | 103-33-3 | ✓ | ✓ | (d) |
| | | | Benzoic acid | 65-85-0 | ✓ | ✓ | (d) |
| | | | Benzyl alcohol | 100-51-6 | ✓ | ✓ | (d) |
| | | | bis(2-Chloroethoxy)methane | 111-91-1 | ✓ | ✓ | (d) |
| | | | bis(2-Chloroethyl) ether | 111-44-4 | ✓ | ✓ | (d) |
| | | | bis(2-Chloroisopropyl) ether | 108-60-1 | ✓ | ✓ | (d) |
| | | | bis(2-Ethylhexyl) phthalate | 117-81-7 | ✓ | ✓ | (d) |
| | | | bis(Chloromethyl) ether | 542-88-1 | ✓ | ✓ | (d) |
| | | | bis(p-Chlorophenyl) sulfone | 80-07-9 | ✓ | ✓ | (d) |
| | | | bis(p-Chlorophenyl)disulfide | 1142-19-4 | ✓ | ✓ | (d) |
| | | | Butylbenzyl phthalate | 85-68-7 | ✓ | ✓ | (d) |
| | | | Carbazole | 86-74-8 | ✓ | ✓ | (d) |
| | | | Dibenzofuran | 132-64-9 | ✓ | ✓ | (d) |
| | | | Dichloromethyl ether | 542-88-1 | ✓ | ✓ | (d) |
| | | | Diethyl phthalate | 84-66-2 | ✓ | ✓ | (d) |
| | | | Dimethyl phthalate | 131-11-3 | ✓ | ✓ | (d) |
| | | | Di-n-butyl phthalate | 84-74-2 | ✓ | ✓ | (d) |
| | | | Di-n-octyl phthalate | 117-84-0 | ✓ | ✓ | (d) |
| | | | Diphenyl disulfide | 882-33-7 | ✓ | ✓ | (d) |
| | | | Diphenyl sulfide | 139-66-2 | ✓ | ✓ | (d) |
| | | | Diphenyl sulfone | 127-63-9 | ✓ | ✓ | (d) |
| | | | Fluoranthene | 206-44-0 | ✓ | ✓ | (d) |
| | | | Fluorene | 86-73-7 | ✓ | ✓ | (d) |
| | | | Hexachlorobenzene | 118-74-1 | ✓ | ✓ | (d) |
| | | | Hexachlorobutadiene | 87-68-3 | ✓ | ✓ | (d) |
| | | | Hexachlorocyclopentadiene | 77-47-4 | ✓ | ✓ | (d) |
| | | | Hexachloroethane | 67-72-1 | ✓ | ✓ | (d) |
| | | | Hydroxymethyl phthalimide | 118-29-6 | ✓ | ✓ | (d) |
| | | | Isophorone | 78-59-1 | ✓ | ✓ | (d) |
| | | | m,p-Cresol | 106-44-5 | ✓ | ✓ | (d) |
| | | | Naphthalene | 91-20-3 | ✓ | ✓ | (d) |
| | | | Nitrobenzene | 98-95-3 | ✓ | ✓ | (d) |

**TABLE 3-2**
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Preparation Method | Analytical Method | Compound List | CAS Number | Sample Depth (from Table 3-1) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Depth 1 | Depth 2/3 | Deep |
| **Semivolatile Organic Compounds (continued)** | **EPA 3550B** | **EPA 8270C** | N-nitrosodi-n-propylamine | 621-64-7 | ✓ | ✓ | (d) |
| | | | N-nitrosodiphenylamine | 86-30-6 | ✓ | ✓ | (d) |
| | | | o-Cresol | 95-48-7 | ✓ | ✓ | (d) |
| | | | Octachlorostyrene | 29082-74-4 | ✓ | ✓ | (d) |
| | | | p-Chloroaniline (4-Chloroaniline) | 106-47-8 | ✓ | ✓ | (d) |
| | | | p-Chlorobenzenethiol | 106-54-7 | ✓ | ✓ | (d) |
| | | | Pentachlorobenzene | 608-93-5 | ✓ | ✓ | (d) |
| | | | Pentachlorophenol | 87-86-5 | ✓ | ✓ | (d) |
| | | | Phenol | 108-95-2 | ✓ | ✓ | (d) |
| | | | Phthalic acid | 88-99-3 | ✓ | ✓ | (d) |
| | | | Pyridine | 110-86-1 | ✓ | ✓ | (d) |
| | | | Thiophenol | 108-98-5 | ✓ | ✓ | (d) |
| | | | Tentatively Identified Compounds (TICs) | | ✓ | ✓ | (d) |
| **Volatile Organic Compounds** | **EPA 5030B/ EPA 5035** | **EPA 8260B** | 1,1,1,2-Tetrachloroethane | 630-20-6 | ✓ | ✓ | (d) |
| | | | 1,1,1-Trichloroethane | 71-55-6 | ✓ | ✓ | (d) |
| | | | 1,1,2,2-Tetrachloroethane | 79-34-5 | ✓ | ✓ | (d) |
| | | | 1,1,2-Trichloroethane | 79-00-5 | ✓ | ✓ | (d) |
| | | | 1,1-Dichloroethane | 75-34-3 | ✓ | ✓ | (d) |
| | | | 1,1-Dichloroethene | 75-35-4 | ✓ | ✓ | (d) |
| | | | 1,1-Dichloropropene | 563-58-6 | ✓ | ✓ | (d) |
| | | | 1,2,3-Trichlorobenzene | 87-61-6 | ✓ | ✓ | (d) |
| | | | 1,2,3-Trichloropropane | 96-18-4 | ✓ | ✓ | (d) |
| | | | 1,2,4-Trichlorobenzene | 120-82-1 | ✓ | ✓ | (d) |
| | | | 1,2,4-Trimethylbenzene | 95-63-6 | ✓ | ✓ | (d) |
| | | | 1,2-Dichlorobenzene | 95-50-1 | ✓ | ✓ | (d) |
| | | | 1,2-Dichloroethane | 107-06-2 | ✓ | ✓ | (d) |
| | | | 1,2-Dichloroethene | 540-59-0 | ✓ | ✓ | (d) |
| | | | 1,2-Dichloropropane | 78-87-5 | ✓ | ✓ | (d) |
| | | | 1,3,5-Trichlorobenzene | 108-70-3 | ✓ | ✓ | (d) |
| | | | 1,3,5-Trimethylbenzene | 108-67-8 | ✓ | ✓ | (d) |
| | | | 1,3-Dichlorobenzene | 541-73-1 | ✓ | ✓ | (d) |
| | | | 1,3-Dichloropropene | 542-75-6 | ✓ | ✓ | (d) |
| | | | 1,3-Dichloropropane | 142-28-9 | ✓ | ✓ | (d) |
| | | | 1,4-Dichlorobenzene | 106-46-7 | ✓ | ✓ | (d) |
| | | | 2,2-Dichloropropane | 594-20-7 | ✓ | ✓ | (d) |
| | | | 2,2-Dimethylpentane | 590-35-2 | ✓ | ✓ | (d) |
| | | | 2,2,3-Trimethylbutane | 464-06-2 | ✓ | ✓ | (d) |

**TABLE 3-2**
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Preparation Method | Analytical Method | Compound List | CAS Number | Sample Depth (from Table 3-1) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Depth 1 | Depth 2/3 | Deep |
| **Volatile Organic Compounds (continued)** | **EPA 5030B/ EPA 5035** | **EPA 8260B** | 2,3-Dimethylpentane | 565-59-3 | ✓ | ✓ | (d) |
| | | | 2,4-Dimethylpentane | 108-08-7 | ✓ | ✓ | (d) |
| | | | 2-Chlorotoluene | 95-49-8 | ✓ | ✓ | (d) |
| | | | 2-Hexanone | 591-78-6 | ✓ | ✓ | (d) |
| | | | 2-Methylhexane | 591-76-4 | ✓ | ✓ | (d) |
| | | | 2-Nitropropane | 79-46-9 | ✓ | ✓ | (d) |
| | | | 3,3-Dimethylpentane | 562-49-2 | ✓ | ✓ | (d) |
| | | | 3-Ethylpentane | 617-78-7 | ✓ | ✓ | (d) |
| | | | 3-Methylhexane | 589-34-4 | ✓ | ✓ | (d) |
| | | | 4-Chlorobenzene | 108-90-7 | ✓ | ✓ | (d) |
| | | | 4-Chlorotoluene | 106-43-4 | ✓ | ✓ | (d) |
| | | | 4-Methyl-2-pentanone (MIBK) | 108-10-1 | ✓ | ✓ | (d) |
| | | | Acetone | 67-64-1 | ✓ | ✓ | (d) |
| | | | Acetonitrile | 75-05-8 | ✓ | ✓ | (d) |
| | | | Benzene | 71-43-2 | ✓ | ✓ | (d) |
| | | | Bromobenzene | 108-86-1 | ✓ | ✓ | (d) |
| | | | Bromodichloromethane | 75-27-4 | ✓ | ✓ | (d) |
| | | | Bromoform | 75-25-2 | ✓ | ✓ | (d) |
| | | | Bromomethane | 74-83-9 | ✓ | ✓ | (d) |
| | | | Carbon disulfide | 75-15-0 | ✓ | ✓ | (d) |
| | | | Carbon tetrachloride | 56-23-5 | ✓ | ✓ | (d) |
| | | | Chlorobenzene | 108-90-7 | ✓ | ✓ | (d) |
| | | | Chlorobromomethane | 74-97-5 | ✓ | ✓ | (d) |
| | | | Chlorodibromomethane | 124-48-1 | ✓ | ✓ | (d) |
| | | | Chloroethane | 75-00-3 | ✓ | ✓ | (d) |
| | | | Chloroform | 67-66-3 | ✓ | ✓ | (d) |
| | | | Chloromethane | 74-87-3 | ✓ | ✓ | (d) |
| | | | cis-1,2-Dichloroethene | 156-59-2 | ✓ | ✓ | (d) |
| | | | cis-1,3-Dichloropropene | 10061-01-5 | ✓ | ✓ | (d) |
| | | | Cymene (Isopropyltoluene) | 99-87-6 | ✓ | ✓ | (d) |
| | | | Dibromochloroethane | 73506-94-2 | ✓ | ✓ | (d) |
| | | | Dibromochloromethane | 124-48-1 | ✓ | ✓ | (d) |
| | | | Dibromochloropropane | 96-12-8 | ✓ | ✓ | (d) |
| | | | Dibromomethane | 74-95-3 | ✓ | ✓ | (d) |
| | | | Dichloromethane (Methylene chloride) | 75-09-2 | ✓ | ✓ | (d) |
| | | | Dimethyldisulfide | 624-92-0 | ✓ | ✓ | (d) |
| | | | Ethanol | 64-17-5 | ✓ | ✓ | (d) |

**TABLE 3-2**
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Preparation Method | Analytical Method | Compound List | CAS Number | Sample Depth (from Table 3-1) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Depth 1 | Depth 2/3 | Deep |
| **Volatile Organic Compounds (continued)** | **EPA 5030B/ EPA 5035** | **EPA 8260B** | Ethylbenzene | 100-41-4 | ✓ | ✓ | (d) |
| | | | Freon-11 | 75-69-4 | ✓ | ✓ | (d) |
| | | | Freon-113 | 76-13-1 | ✓ | ✓ | (d) |
| | | | Freon-12 | 75-71-8 | ✓ | ✓ | (d) |
| | | | Heptane | 142-82-5 | ✓ | ✓ | (d) |
| | | | Isoheptane | 31394-54-4 | ✓ | ✓ | (d) |
| | | | Isopropylbenzene | 98-82-8 | ✓ | ✓ | (d) |
| | | | m,p-Xylene | mp-XYL | ✓ | ✓ | (d) |
| | | | Methyl ethyl ketone (2-Butanone) | 78-93-3 | ✓ | ✓ | (d) |
| | | | Methyl iodide | 74-88-4 | ✓ | ✓ | (d) |
| | | | MTBE (Methyl tert-butyl ether) | 1634-04-4 | ✓ | ✓ | (d) |
| | | | n-Butyl benzene | 104-51-8 | ✓ | ✓ | (d) |
| | | | n-Propylbenzene | 103-65-1 | ✓ | ✓ | (d) |
| | | | Nonanal | 124-19-6 | ✓ | ✓ | (d) |
| | | | o-Xylene | 95-47-6 | ✓ | ✓ | (d) |
| | | | sec-Butylbenzene | 135-98-8 | ✓ | ✓ | (d) |
| | | | Styrene | 100-42-5 | ✓ | ✓ | (d) |
| | | | tert-Butyl benzene | 98-06-6 | ✓ | ✓ | (d) |
| | | | Tetrachloroethene | 127-18-4 | ✓ | ✓ | (d) |
| | | | Toluene | 108-88-3 | ✓ | ✓ | (d) |
| | | | trans-1,2-Dichloroethene | 156-60-5 | ✓ | ✓ | (d) |
| | | | trans-1,3-Dichloropropene | 10061-02-6 | ✓ | ✓ | (d) |
| | | | Trichloroethene | 79-01-6 | ✓ | ✓ | (d) |
| | | | Vinyl acetate | 108-05-4 | ✓ | ✓ | (d) |
| | | | Vinyl chloride | 75-01-4 | ✓ | ✓ | (d) |
| | | | Xylenes (total) | 1330-20-7 | ✓ | ✓ | (d) |
| | | | Tentatively Identified Compounds (TICs) | | ✓ | ✓ | (d) |
| **Flashpoint** | **NA** | **EPA 1010** | Flammables | NA | (a) | (a) | (a) |
| **Total Petroleum Hydrocarbons** | **EPA 3550 EPA 3550 EPA 1664A** | **EPA 8015** | Diesel | 64742-46-7 | (a) | (a) | (a) |
| | | | Gasoline | 8006-61-9 | (a) | (a) | (a) |
| | | | Grease | 68153-81-1 | (a) | (a) | (a) |
| | | | Mineral Spirits | NA | (a) | (a) | (a) |
| **White Phosphorus** | **EPA 7580M** | **EPA 7580M** | White phosphorus | 12185-10-3 | (a) | (a) | (a) |
| **Methyl Mercury** | **EPA 1630** | **EPA 1630** | Methyl mercury | 22967-92-6 | (a) | (a) | (a) |

**TABLE 3-2**
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Preparation Method | Analytical Method | Compound List | CAS Number | Sample Depth (from Table 3-1) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Depth 1 | Depth 2/3 | Deep |
| **Soil Physical Parameters** | **NA** | **ASTM D2937/ MOSA1Ch .13** | Dry bulk density | NA | (d) | ✓ | ✓ |
| | | **ASTM D2435/ MOSA1Ch .18** | Total porosity | NA | (d) | ✓ | ✓ |
| | | **ASTM D5084** | Soil permeability/saturated hydraulic cond. | NA | (d) | ✓ | ✓ |
| | | **ASTM D854** | Specific gravity of soils | NA | (d) | ✓ | ✓ |
| | | **SW846 Method 9081** | Cation exchange capacity | NA | (d) | ✓ | ✓ |
| | | **ASTM D2216/D4643/D2974** | Volumetric water content | NA | (d) | ✓ | ✓ |
| | | **ASTM D422** | Grain size analysis by sieve and hydrometer | NA | (d) | ✓ | ✓ |
| | | **EPA 415.1/ASTM 2947** | Fractional organic carbon content | NA | (d) | ✓ | ✓ |

**Notes:**

Laboratory limits are subject to matrix interferences and may not always be achieved in all samples.

The laboratory was instructed to report the top 25 Tentatively Identified Compounds (TICs) under method 8260B and 8270C.

NA = Not applicable.

a - Removed based on rationale provided in the text.

b - Dioxins/furans and PCBs analyzed for in fill and surface soil samples only.

c - Asbestos analyzed for in current grade surface soil samples only.

d - Soil physical parameters collected from at-depth samples only; from one sample location (see Table 3-1).

e - Removed based on Revisions to the Analyte List Technical Memorandum approved by NDEP on 10/16/2008. Note this was done subsequent to the initial confirmation sampling conducted in June 2008.

**TABLE 3-3**
**FINAL CONFIRMATION SOIL SAMPLE LOCATIONS AND ANALYSES**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample Location | Sample Depth | Sample Type | Scraped? | Asbestos | Alde-hydes | Dioxins | Gen Chem | Metals | OCPs | PAHs | Aroclors | PCBs | Rads | SVOCs | VOCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GNC1-BD19 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-BD20 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-BD21 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-BE19 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-BE20 | 0 | Initial | YES | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC2-BE20C | 0 | Confirmation | YES | X | | X | | X | | | | X | | | |
| GNC3-BE20C | 0 | Confirmation | | X | | | | | | | | | | | |
| GNC1-BE21 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | | | | | | X |
| GNC1-BE22 | 0 | Initial | YES | X | X | X | X | X | X | X | X | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC2-BE22C | 0 | Confirmation | | | | X | | | | | | X | | | |
| GNC1-BF19 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 11 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-BF20 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-BF21 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-BF22 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-BG19 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-BG20 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-BG21 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-BG22 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-JA04 | 0 | Suppl | YES | | | X | | X | | X | | | | | |
| GNC2-JA04 | 0 | Confirmation | | | | X | | X | | | | X | | | |
| GNC1-JA05 | 0 | Suppl | | | | X | | | | | | X | | | |
| GNC1-JA06 | 0 | Suppl | | | | X | | | | | | X | | | |

**TABLE 3-3**
**FINAL CONFIRMATION SOIL SAMPLE LOCATIONS AND ANALYSES**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample Location | Sample Depth | Sample Type | Scraped? | Asbestos | Alde-hydes | Dioxins | Gen Chem | Metals | OCPs | PAHs | Aroclors | PCBs | Rads | SVOCs | VOCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GNC1-JA07 | 0 | Suppl | | | | X | | | | | | X | | | |
| GNC1-JD07 | 0 | Initial | YES | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC2-JD07C | 0 | Confirmation | | | | X | | | | | | X | | | |
| GNC1-JD08 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC1-JD09 | 0 | Initial | YES | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC2-JD09C | 0 | Confirmation | | | | | | | | X | | | | X | |
| GNC1-JD10 | 0 | Initial | YES | X | X | X | X | X | X | X | | X | X | X | X |
| | 11 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC2-JD10 | 0 | Confirmation | | X | | | | | | | | | | | |
| GNC1-JD11 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 11 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC2-JE01 | 0 | Suppl | | | | X | | | | | | X | | | |
| GNC2-JE02 | 0 | Suppl | | | | X | | | | | | X | | | |
| GNC1-JS09 | 0 | Initial | YES | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC2-JS09C | 0 | Confirmation | YES | X | | X | | X | | | | X | | | |
| GNC3-JS09C | 0 | Confirmation | | X | | | | | | | | | | | |
| GNC1-JS10 | 0 | Initial | YES | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |
| GNC2-JS10C | 0 | Confirmation | | | | X | | X | | | | X | | | |
| GNC1-JS11 | 0 | Initial | | X | X | X | X | X | X | X | | X | X | X | X |
| | 10 | Initial | | | X | | X | X | X | X | | | X | X | X |

= Location removed. As noted in the text, post-scrape analyses associated with follow-up rounds of remediation focused on the analytes triggering that additional remediation, and did not include the full suite analyses of the original analytical program. Therefore, analytical results from the original SAP dataset were retained for all analytes except those that were re-run after additional scraping.

**TABLE 3-4**
**FINAL HUMAN HEALTH RISK ASSESSMENT SOIL DATASET RESULTS SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Compound List | Units | Total Count | Detect Freq. | Censored (Non-Detect) Data | | | | | | | Detected Data[1] | | | | | | | Residential Soil BCL | Count of Detects > BCL | LBCL (DAF 1) | Count of Detects > DAF 1 | LBCL (DAF 20) | Count of Detects > DAF 20 | Max. Bkgrnd[2] | Count of Detects > Bkgrnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max | | | | | | | | |
| **Asbestos[3]** | Amphibole | Structures | 25 | 0% | 25 | -- | -- | -- | -- | -- | -- | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Chrysotile | Structures | 25 | 4.0% | 24 | -- | -- | -- | -- | -- | -- | 1 | 1 | -- | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | -- | -- |
| **Aldehydes** | Acetaldehyde | mg/kg | 51 | 2.0% | 50 | 0.306 | 0.31 | 0.32 | 0.33 | 0.32 | 0.503 | 1 | 0.338 | -- | 0.34 | 0.34 | -- | 0.338 | 13.9 | 0 | -- | -- | -- | -- | -- | -- |
| | Formaldehyde | mg/kg | 51 | 58.8% | 21 | 0.208 | 0.21 | 0.21 | 0.24 | 0.25 | 0.385 | 30 | 0.205 | 0.23 | 0.29 | 0.37 | 0.49 | 0.887 | 10.6 | 0 | -- | -- | -- | -- | -- | -- |
| **Dioxins/Furans** | 1,2,3,4,6,7,8-Heptachlorodibenzofuran[4] | pg/g | 35 | 97.1% | 1 | 5.1 | -- | 5.1 | 5.1 | -- | 5.1 | 34 | 3.6 | 16 | 33 | 63 | 110 | 200 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[4] | pg/g | 35 | 74.3% | 9 | 1.2 | 2 | 3.8 | 3.6 | 5 | 5.1 | 26 | 2.7 | 4.5 | 13 | 82 | 41 | 1600 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,3,4,7,8,9-Heptachlorodibenzofuran[4] | pg/g | 35 | 88.6% | 4 | 1.2 | 2.1 | 4.9 | 4 | 5.1 | 5.1 | 31 | 2.6 | 8.5 | 13 | 26 | 48 | 76 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,3,4,7,8-Hexachlorodibenzofuran[4] | pg/g | 35 | 88.6% | 4 | 1.5 | 2.4 | 4.9 | 4.1 | 5.1 | 5.1 | 31 | 3.9 | 9.3 | 20 | 29 | 51 | 85 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[4] | pg/g | 35 | 5.7% | 33 | 0.075 | 0.44 | 1.7 | 2.6 | 5.1 | 5.8 | 2 | 2.6 | -- | 3 | 3 | -- | 3.3 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,3,6,7,8-Hexachlorodibenzofuran[4] | pg/g | 35 | 85.7% | 5 | 0.89 | 2.9 | 4.9 | 4.2 | 5.1 | 5.1 | 30 | 3 | 6.8 | 13 | 20 | 36 | 57 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[4] | pg/g | 35 | 37.1% | 22 | 0.23 | 0.63 | 1.1 | 2.4 | 4.9 | 5.3 | 13 | 2.9 | 3.2 | 3.5 | 5.4 | 5.8 | 22 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,3,7,8,9-Hexachlorodibenzofuran[4] | pg/g | 35 | 37.1% | 22 | 0.41 | 0.95 | 1.9 | 2.7 | 4.9 | 5.3 | 13 | 2.7 | 4.1 | 5.4 | 5.4 | 6.5 | 9 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[4] | pg/g | 35 | 34.3% | 23 | 0.26 | 0.63 | 1.4 | 2.5 | 4.9 | 5.3 | 12 | 3.1 | 3.3 | 4.1 | 4.7 | 5 | 12 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,3,7,8-Pentachlorodibenzofuran[4] | pg/g | 35 | 88.6% | 4 | 0.76 | 1.8 | 4.9 | 3.9 | 5.1 | 5.1 | 31 | 2.8 | 5.4 | 13 | 18 | 31 | 48 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,3,7,8-Pentachlorodibenzo-p-dioxin[4] | pg/g | 35 | 11.4% | 31 | 0.1 | 0.57 | 2.1 | 2.6 | 5 | 5.5 | 4 | 3.3 | 3.3 | 3.5 | 3.5 | 3.6 | 3.6 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 2,3,4,6,7,8-Hexachlorodibenzofuran[4] | pg/g | 35 | 51.4% | 17 | 0.5 | 1.3 | 2.5 | 2.8 | 5 | 5.3 | 18 | 2.7 | 4.1 | 8.2 | 8.6 | 13 | 18 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 2,3,4,7,8-Pentachlorodibenzofuran[4] | pg/g | 35 | 65.7% | 12 | 0.39 | 1.6 | 3.7 | 3.3 | 5.1 | 5.3 | 23 | 3.3 | 5 | 9.9 | 12 | 18 | 26 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 2,3,7,8-Tetrachlorodibenzofuran[4] | pg/g | 35 | 97.1% | 1 | 0.5 | -- | 0.5 | 0.5 | -- | 0.5 | 34 | 0.54 | 3.2 | 7.8 | 11 | 17 | 57 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 2,3,7,8-Tetrachlorodibenzo-p-dioxin[4] | pg/g | 35 | 31.4% | 24 | 0.051 | 0.24 | 0.34 | 0.54 | 0.98 | 1.1 | 11 | 0.66 | 0.73 | 0.84 | 0.87 | 1 | 1.2 | -- | -- | -- | -- | -- | -- | -- | -- |
| | Octachlorodibenzodioxin[4] | pg/g | 35 | 80.0% | 7 | 4.3 | 7.2 | 10 | 11 | 18 | 20 | 28 | 5.4 | 15 | 42 | 500 | 210 | 11000 | -- | -- | -- | -- | -- | -- | -- | -- |
| | Octachlorodibenzofuran[4] | pg/g | 35 | 97.1% | 1 | 10 | -- | 10 | 10 | -- | 10 | 34 | 10 | 59 | 92 | 210 | 400 | 840 | -- | -- | -- | -- | -- | -- | -- | -- |
| | TCDD TEQ | pg/g | 35 | --[4] | -- | -- | -- | -- | -- | -- | -- | 35 | 0.58 | 5.9 | 8.3 | 16 | 27 | 47 | 50 | 0 | -- | -- | -- | -- | -- | -- |
| **General Chemistry/ Ions** | Ammonia (as N) | mg/kg | 49 | 20.4% | 39 | 0.79 | 0.81 | 0.82 | 1.1 | 0.83 | 5.5 | 10 | 0.89 | 1.1 | 2.3 | 2.9 | 3.9 | 8.2 | -- | -- | -- | -- | -- | -- | -- | -- |
| | Bromide | mg/kg | 51 | 13.7% | 44 | 0.26 | 0.27 | 0.27 | 0.27 | 0.28 | 0.29 | 7 | 0.39 | 0.44 | 0.78 | 0.83 | 1.1 | 1.3 | -- | -- | -- | -- | -- | -- | -- | -- |
| | Chlorate | mg/kg | 51 | 51.0% | 25 | 0.48 | 0.49 | 0.49 | 0.49 | 0.5 | 0.52 | 26 | 0.6 | 1.1 | 2.3 | 5.5 | 6.1 | 41.3 | -- | -- | -- | -- | -- | -- | -- | -- |
| | Chloride | mg/kg | 51 | 100% | 0 | -- | -- | -- | -- | -- | -- | 51 | 3.3 | 46 | 110 | 330 | 450 | 2830 | -- | -- | -- | -- | -- | -- | -- | -- |
| | Cyanide, Total | mg/kg | 51 | 19.6% | 41 | 0.083 | 0.52 | 0.52 | 0.45 | 0.53 | 0.57 | 10 | 0.54 | 0.59 | 0.67 | 1.2 | 0.88 | 5.8 | 1220 | 0 | 2 | 1 | 40 | 0 | -- | -- |
| | Fluoride | mg/kg | 51 | 76.5% | 12 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.11 | 39 | 0.15 | 0.56 | 0.77 | 0.86 | 1.1 | 2.1 | 3670 | 0 | -- | -- | -- | -- | -- | -- |
| | Nitrate | mg/kg | 51 | 100% | 0 | -- | -- | -- | -- | -- | -- | 51 | 1.3 | 4.1 | 6 | 17 | 16 | 121 | 100000 | 0 | -- | -- | -- | -- | -- | -- |
| | Nitrite | mg/kg | 51 | 17.6% | 42 | 0.033 | 0.035 | 0.035 | 0.23 | 0.035 | 3.4 | 9 | 0.087 | 0.18 | 0.76 | 0.82 | 1.4 | 2.1 | 7820 | 0 | -- | -- | -- | -- | -- | -- |
| | Orthophosphate as P | mg/kg | 51 | 37.3% | 32 | 0.51 | 0.53 | 0.53 | 1.6 | 0.56 | 5.7 | 19 | 0.74 | 2.1 | 6 | 6.3 | 11 | 14.4 | -- | -- | -- | -- | -- | -- | -- | -- |
| | Perchlorate | mg/kg | 50 | 100% | 0 | -- | -- | -- | -- | -- | -- | 50 | 0.0172 | 0.3 | 0.7 | 3.3 | 3.3 | 28.6 | 54.8 | 0 | -- | -- | -- | -- | -- | -- |
| | Sulfate | mg/kg | 51 | 100% | 0 | -- | -- | -- | -- | -- | -- | 51 | 48.4 | 790 | 2100 | 3600 | 5800 | 17300 | -- | -- | -- | -- | -- | -- | -- | -- |
| | Sulfide | mg/kg | 51 | 0% | 51 | 1.8 | 1.8 | 1.9 | 1.9 | 1.9 | 2 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Total Kjeldahl Nitrogen (TKN) | mg/kg | 51 | 100% | 0 | -- | -- | -- | -- | -- | -- | 51 | 44.4 | 72 | 110 | 240 | 300 | 1660 | -- | -- | -- | -- | -- | -- | -- | -- |
| **Metals** | Aluminum | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 6210 | 9500 | 11000 | 10000 | 11000 | 14700 | 77200 | 0 | 75 | 53 | 1500 | 53 | 15500 | 0 |
| | Antimony | mg/kg | 53 | 0% | 53 | 0.225 | 0.32 | 0.32 | 0.46 | 0.32 | 2.7 | 0 | -- | -- | -- | -- | -- | -- | 31.3 | -- | 0.3 | -- | 6 | -- | 0.61 | 0 |
| | Arsenic | mg/kg | 53 | 96.2% | 2 | 5 | -- | 5.1 | 5.1 | -- | 5.1 | 51 | 2.6 | 3.8 | 4.7 | 4.8 | 5.5 | 8.8 | 0.39 | 51 | 1 | 51 | 20 | 0 | 27.6 | 0 |
| | Barium | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 142 | 280 | 330 | 330 | 380 | 613 | 15300 | 0 | 82 | 53 | 1640 | 0 | 1350 | 0 |
| | Beryllium | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 0.4 | 0.58 | 0.63 | 0.65 | 0.68 | 1.1 | 155 | 0 | 3 | 0 | 60 | 0 | 0.89 | 3 |
| | Boron | mg/kg | 53 | 13.2% | 46 | 16.5 | 17 | 17 | 20 | 17 | 53 | 7 | 17.2 | 18 | 21 | 26 | 39 | 47.1 | 15600 | 0 | 23.4 | 2 | 467 | 0 | 57 | 0 |
| | Cadmium | mg/kg | 53 | 73.6% | 14 | 0.1 | 0.1 | 0.1 | 0.15 | 0.26 | 0.27 | 39 | 0.11 | 0.12 | 0.14 | 0.17 | 0.18 | 0.44 | 38.9 | 0 | 0.4 | 1 | 8 | 0 | 0.26 | 5 |
| | Calcium | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 15400 | 24000 | 29000 | 31000 | 35000 | 103000 | -- | -- | -- | -- | -- | -- | 82800 | 1 |
| | Chromium | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 7.3 | 14 | 16 | 17 | 19 | 62.8 | 100000 | 0 | 2 | 53 | 40 | 1 | 24.2 | 3 |
| | Chromium (VI) | mg/kg | 53 | 60.4% | 21 | 0.1 | 0.1 | 0.1 | 0.1 | 0.11 | 0.11 | 32 | 0.11 | 0.15 | 0.19 | 0.27 | 0.3 | 1.8 | 229 | 0 | 2 | 0 | 40 | 0 | 1.6 | 1 |
| | Cobalt | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 5.2 | 8.8 | 9.6 | 9.7 | 11 | 12.8 | 23.4 | 0 | 33 | 0 | 660 | 0 | 16.3 | 0 |
| | Copper | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 13.3 | 18 | 20 | 20 | 22 | 32.5 | 2910 | 0 | 35.2 | 0 | 704 | 0 | 36.2 | 0 |
| | Iron | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 10200 | 17000 | 19000 | 19000 | 20000 | 27300 | 54800 | 0 | 7.56 | 53 | 151.2 | 53 | 22500 | 3 |
| | Lead | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 7 | 12 | 16 | 23 | 21 | 272 | 400 | 0 | -- | -- | -- | -- | 53 | 2 |
| | Lithium | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 11.8 | 14 | 15 | 15 | 16 | 20.9 | 156 | 0 | -- | -- | -- | -- | 124 | 0 |
| | Magnesium | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 7670 | 10000 | 11000 | 11000 | 12000 | 28500 | 100000 | 0 | 649 | 53 | 13000 | 5 | 17500 | 1 |
| | Manganese | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 295 | 480 | 540 | 540 | 610 | 808 | 1820 | 0 | 3.26 | 53 | 65.2 | 53 | 2070 | 0 |

**TABLE 3-4**
**FINAL HUMAN HEALTH RISK ASSESSMENT SOIL DATASET RESULTS SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Compound List | Units | Total Count | Detect Freq. | Censored (Non-Detect) Data | | | | | | | Detected Data[1] | | | | | | | Residential Soil BCL | Count of Detects > BCL | LBCL (DAF 1) | Count of Detects > DAF 1 | LBCL (DAF 20) | Count of Detects > DAF 20 | Max. Bkgrnd[2] | Count of Detects > Bkgrnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max | | | | | | | | |
| **Metals** | Mercury | mg/kg | 53 | 30.2% | 37 | 0.005 | 0.005 | 0.035 | 0.024 | 0.035 | 0.0373 | 16 | 0.0366 | 0.038 | 0.052 | 0.058 | 0.071 | 0.122 | 23.5 | 0 | 0.105 | 1 | 2.09 | 0 | 0.11 | 1 |
| | Molybdenum | mg/kg | 53 | 84.9% | 8 | 0.47 | 2.5 | 2.6 | 2.3 | 2.6 | 2.7 | 45 | 0.58 | 0.75 | 0.93 | 1 | 1.1 | 3.2 | 391 | 0 | 3.64 | 0 | 72.7 | 0 | 2.3 | 1 |
| | Nickel | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 13 | 16 | 17 | 17 | 19 | 28.2 | 1540 | 0 | 7 | 53 | 140 | 0 | 30 | 0 |
| | Potassium | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 1380 | 1900 | 2300 | 2300 | 2700 | 3710 | -- | -- | -- | -- | -- | -- | 12600 | 0 |
| | Selenium | mg/kg | 53 | 1.9% | 52 | 0.4 | 0.4 | 0.4 | 0.69 | 0.4 | 2.7 | 1 | 0.47 | -- | 0.47 | 0.47 | -- | 0.47 | 391 | 0 | 0.3 | 1 | 6 | 0 | 0.6 | 0 |
| | Silver | mg/kg | 53 | 71.7% | 15 | 0.04 | 0.11 | 0.11 | 0.1 | 0.11 | 0.11 | 38 | 0.083 | 0.12 | 0.13 | 0.13 | 0.14 | 0.28 | 391 | 0 | 2 | 0 | 40 | 0 | 2.2 | 0 |
| | Sodium | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 247 | 520 | 830 | 940 | 1200 | 4420 | -- | -- | -- | -- | -- | -- | 4210 | 1 |
| | Strontium | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 189 | 270 | 310 | 330 | 390 | 623 | 46900 | 0 | -- | -- | -- | -- | 808 | 0 |
| | Thallium | mg/kg | 53 | 0% | 53 | 0.105 | 0.75 | 0.75 | 0.67 | 0.75 | 0.75 | 0 | -- | -- | -- | -- | -- | -- | 5.48 | -- | 0.4 | -- | 8 | -- | 2 | 0 |
| | Tin | mg/kg | 53 | 15.1% | 45 | 0.75 | 0.75 | 0.75 | 0.8 | 0.75 | 1.1 | 8 | 1 | 1.1 | 1.5 | 3 | 3.9 | 10.4 | 46900 | 0 | -- | -- | -- | -- | 1 | 6 |
| | Titanium | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 435 | 670 | 800 | 810 | 950 | 1350 | 100000 | 0 | 150000 | 0 | 3000000 | 0 | 1010 | 9 |
| | Tungsten | mg/kg | 53 | 5.7% | 50 | 0.185 | 1.3 | 1.3 | 1.2 | 1.3 | 2.6 | 3 | 1.4 | 1.4 | 2.9 | 2.5 | 3.2 | 3.2 | 587 | 0 | 41.2 | 0 | 823 | 0 | 3.6 | 0 |
| | Uranium | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 0.59 | 0.86 | 1.1 | 1.1 | 1.3 | 2.5 | 235 | 0 | 13.5 | 0 | 270 | 0 | 4.3 | 0 |
| | Vanadium | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 28.2 | 50 | 56 | 56 | 63 | 82.7 | 391 | 0 | 300 | 0 | 6000 | 0 | 73.3 | 1 |
| | Zinc | mg/kg | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 33.6 | 46 | 52 | 57 | 59 | 155 | 23500 | 0 | 620 | 0 | 12400 | 0 | 121 | 2 |
| **Organochlorine Pesticides** | 2,4-DDD | mg/kg | 51 | 0% | 51 | 0.00031 | 0.00032 | 0.00032 | 0.00035 | 0.00032 | 0.0016 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 2,4-DDE | mg/kg | 51 | 21.6% | 40 | 0.00021 | 0.00021 | 0.00021 | 0.00023 | 0.00021 | 0.001 | 11 | 0.002 | 0.0025 | 0.0034 | 0.0051 | 0.0071 | 0.015 | -- | -- | -- | -- | -- | -- | -- | -- |
| | 4,4-DDD | mg/kg | 51 | 2.0% | 50 | 0.00009 | 0.000093 | 0.000094 | 0.0001 | 0.000095 | 0.00046 | 1 | 0.0044 | -- | 0.0044 | 0.0044 | -- | 0.0044 | 2.44 | 0 | 0.8 | 0 | 16 | 0 | -- | -- |
| | 4,4-DDE | mg/kg | 51 | 43.1% | 29 | 0.0002 | 0.0002 | 0.0002 | 0.00023 | 0.00021 | 0.00099 | 22 | 0.0018 | 0.0031 | 0.0063 | 0.0078 | 0.0082 | 0.031 | 1.72 | 0 | 3 | 0 | 60 | 0 | -- | -- |
| | 4,4-DDT | mg/kg | 51 | 39.2% | 31 | 0.00021 | 0.00021 | 0.00021 | 0.00024 | 0.00022 | 0.001 | 20 | 0.0018 | 0.0023 | 0.003 | 0.0049 | 0.0042 | 0.016 | 1.72 | 0 | 2 | 0 | 40 | 0 | -- | -- |
| | Aldrin | mg/kg | 51 | 0% | 51 | 0.000096 | 0.000099 | 0.0001 | 0.00011 | 0.0001 | 0.00049 | 0 | -- | -- | -- | -- | -- | -- | 0.0286 | -- | 0.02 | -- | 0.4 | -- | -- | -- |
| | alpha-BHC | mg/kg | 51 | 2.0% | 50 | 0.00028 | 0.00029 | 0.0003 | 0.00032 | 0.0003 | 0.0014 | 1 | 0.0022 | -- | 0.0022 | 0.0022 | -- | 0.0022 | 0.0902 | 0 | 0.00003 | 1 | 0.0006 | 1 | -- | -- |
| | alpha-Chlordane | mg/kg | 51 | 3.9% | 49 | 0.00021 | 0.00022 | 0.00022 | 0.00024 | 0.00022 | 0.0011 | 2 | 0.0022 | -- | 0.004 | 0.004 | -- | 0.0057 | -- | -- | -- | -- | -- | -- | -- | -- |
| | beta-BHC | mg/kg | 51 | 35.3% | 33 | 0.00019 | 0.0002 | 0.0002 | 0.00022 | 0.0002 | 0.00096 | 18 | 0.0022 | 0.0036 | 0.0048 | 0.0068 | 0.01 | 0.019 | 0.316 | 0 | 0.0001 | 18 | 0.002 | 18 | -- | -- |
| | Chlordane | mg/kg | 51 | 3.9% | 49 | 0.0024 | 0.0024 | 0.0025 | 0.0027 | 0.0025 | 0.012 | 2 | 0.02 | -- | 0.032 | 0.032 | -- | 0.043 | 1.62 | 0 | 0.5 | 0 | 10 | 0 | -- | -- |
| | delta-BHC | mg/kg | 51 | 0% | 51 | 0.00017 | 0.00017 | 0.00018 | 0.00019 | 0.00018 | 0.00086 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Dieldrin | mg/kg | 51 | 0% | 51 | 0.000092 | 0.000095 | 0.000096 | 0.0001 | 0.000097 | 0.00047 | 0 | -- | -- | -- | -- | -- | -- | 0.0304 | -- | 0.0002 | -- | 0.004 | -- | -- | -- |
| | Endosulfan I | mg/kg | 51 | 0% | 51 | 0.00011 | 0.00011 | 0.00011 | 0.00012 | 0.00011 | 0.00054 | 0 | -- | -- | -- | -- | -- | -- | 367 | -- | 0.9 | -- | 18 | -- | -- | -- |
| | Endosulfan II | mg/kg | 51 | 0% | 51 | 0.000094 | 0.000097 | 0.000098 | 0.00011 | 0.000099 | 0.00048 | 0 | -- | -- | -- | -- | -- | -- | 367 | -- | 0.9 | -- | 18 | -- | -- | -- |
| | Endosulfan sulfate | mg/kg | 51 | 2.0% | 50 | 0.00026 | 0.00027 | 0.00028 | 0.0003 | 0.00028 | 0.0013 | 1 | 0.019 | -- | 0.019 | 0.019 | -- | 0.019 | -- | -- | -- | -- | -- | -- | -- | -- |
| | Endrin | mg/kg | 51 | 2.0% | 50 | 0.000084 | 0.000087 | 0.000087 | 0.000095 | 0.000088 | 0.00043 | 1 | 0.0021 | -- | 0.0021 | 0.0021 | -- | 0.0021 | 18.3 | 0 | 0.05 | 0 | 1 | 0 | -- | -- |
| | Endrin aldehyde | mg/kg | 51 | 2.0% | 50 | 0.00018 | 0.00019 | 0.00019 | 0.00021 | 0.00019 | 0.00092 | 1 | 0.015 | -- | 0.015 | 0.015 | -- | 0.015 | -- | -- | -- | -- | -- | -- | -- | -- |
| | Endrin ketone | mg/kg | 51 | 0% | 51 | 0.00016 | 0.00017 | 0.00017 | 0.00018 | 0.00017 | 0.00084 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | gamma-BHC (Lindane) | mg/kg | 51 | 0% | 51 | 0.00012 | 0.00013 | 0.00013 | 0.00014 | 0.00013 | 0.00063 | 0 | -- | -- | -- | -- | -- | -- | 0.437 | -- | 0.0005 | -- | 0.01 | -- | -- | -- |
| | gamma-Chlordane | mg/kg | 51 | 5.9% | 48 | 0.000084 | 0.000087 | 0.000088 | 0.000095 | 0.000088 | 0.00043 | 3 | 0.0022 | 0.0022 | 0.0028 | 0.004 | 0.007 | 0.007 | -- | -- | -- | -- | -- | -- | -- | -- |
| | Heptachlor | mg/kg | 51 | 0% | 51 | 0.00017 | 0.00018 | 0.00018 | 0.00019 | 0.00018 | 0.00088 | 0 | -- | -- | -- | -- | -- | -- | 0.108 | -- | 1 | -- | 20 | -- | -- | -- |
| | Heptachlor epoxide | mg/kg | 51 | 0% | 51 | 0.00013 | 0.00014 | 0.00014 | 0.00015 | 0.00014 | 0.00067 | 0 | -- | -- | -- | -- | -- | -- | 0.0535 | -- | 0.03 | -- | 0.6 | -- | -- | -- |
| | Methoxychlor | mg/kg | 51 | 11.8% | 45 | 0.00032 | 0.00033 | 0.00033 | 0.00036 | 0.00034 | 0.0016 | 6 | 0.0023 | 0.0031 | 0.012 | 0.012 | 0.018 | 0.025 | 306 | 0 | 8 | 0 | 160 | 0 | -- | -- |
| | Toxaphene | mg/kg | 51 | 0% | 51 | 0.0059 | 0.0061 | 0.0061 | 0.0066 | 0.0062 | 0.03 | 0 | -- | -- | -- | -- | -- | -- | 0.442 | -- | 2 | -- | 40 | -- | -- | -- |
| **Polynuclear Aromatic Hydrocarbons** | Acenaphthene | mg/kg | 50 | 2.0% | 49 | 0.00169 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00183 | 1 | 0.00209 | -- | 0.0021 | 0.0021 | -- | 0.00209 | 4690 | 0 | 29 | 0 | 580 | 0 | -- | -- |
| | Acenaphthylene | mg/kg | 50 | 2.0% | 49 | 0.00169 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00183 | 1 | 0.00206 | -- | 0.0021 | 0.0021 | -- | 0.00206 | 147 | 0 | -- | -- | -- | -- | -- | -- |
| | Anthracene | mg/kg | 50 | 16.0% | 42 | 0.00169 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00183 | 8 | 0.0019 | 0.0021 | 0.0028 | 0.003 | 0.0033 | 0.00599 | 23500 | 0 | 590 | 0 | 11800 | 0 | -- | -- |
| | Benzo(a)anthracene | mg/kg | 50 | 16.0% | 42 | 0.00169 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00183 | 8 | 0.00225 | 0.0035 | 0.0042 | 0.012 | 0.015 | 0.0576 | 0.622 | 0 | 0.08 | 0 | 1.6 | 0 | -- | -- |
| | Benzo(a)pyrene | mg/kg | 50 | 34.0% | 33 | 0.00169 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00182 | 17 | 0.00185 | 0.0027 | 0.0043 | 0.0098 | 0.0096 | 0.0585 | 0.0622 | 0 | 0.4 | 0 | 8 | 0 | -- | -- |
| | Benzo(b)fluoranthene | mg/kg | 50 | 38.0% | 31 | 0.0017 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00183 | 19 | 0.0022 | 0.0039 | 0.008 | 0.019 | 0.011 | 0.129 | 0.622 | 0 | 0.2 | 0 | 4 | 0 | -- | -- |
| | Benzo(g,h,i)perylene | mg/kg | 50 | 12.0% | 44 | 0.00169 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00183 | 6 | 0.00224 | 0.003 | 0.004 | 0.0089 | 0.015 | 0.0295 | 2350 | 0 | -- | -- | -- | -- | -- | -- |
| | Benzo(k)fluoranthene | mg/kg | 50 | 12.0% | 44 | 0.00169 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00182 | 6 | 0.00229 | 0.0025 | 0.0033 | 0.0038 | 0.0053 | 0.00658 | 6.21 | 0 | 2 | 0 | 40 | 0 | -- | -- |
| | Chrysene | mg/kg | 50 | 34.0% | 33 | 0.00169 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00182 | 17 | 0.00231 | 0.0035 | 0.0061 | 0.016 | 0.02 | 0.0904 | 62.1 | 0 | 8 | 0 | 160 | 0 | -- | -- |
| | Dibenzo(a,h)anthracene | mg/kg | 50 | 8.0% | 46 | 0.00169 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00182 | 4 | 0.00208 | 0.0023 | 0.0082 | 0.019 | 0.047 | 0.0587 | 0.0622 | 0 | 0.08 | 0 | 1.6 | 0 | -- | -- |
| | Indeno(1,2,3-cd)pyrene | mg/kg | 50 | 10.0% | 45 | 0.00169 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00183 | 5 | 0.00195 | 0.0023 | 0.0042 | 0.0092 | 0.019 | 0.0311 | 0.622 | 0 | 0.7 | 0 | 14 | 0 | -- | -- |
| | Phenanthrene | mg/kg | 50 | 34.0% | 33 | 0.0017 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00183 | 17 | 0.0022 | 0.0029 | 0.004 | 0.009 | 0.014 | 0.0343 | 24.5 | 0 | -- | -- | -- | -- | -- | -- |
| | Pyrene | mg/kg | 50 | 40.0% | 30 | 0.0017 | 0.0017 | 0.0018 | 0.0018 | 0.0018 | 0.00182 | 20 | 0.00248 | 0.0044 | 0.0078 | 0.019 | 0.018 | 0.12 | 2350 | 0 | 210 | 0 | 4200 | 0 | -- | -- |

**TABLE 3-4**
**FINAL HUMAN HEALTH RISK ASSESSMENT SOIL DATASET RESULTS SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Compound List | Units | Total Count | Detect Freq. | Censored (Non-Detect) Data | | | | | | | Detected Data[1] | | | | | | | Residential Soil BCL | Count of Detects > BCL | LBCL (DAF 1) | Count of Detects > DAF 1 | LBCL (DAF 20) | Count of Detects > DAF 20 | Max. Bkgrnd[2] | Count of Detects > Bkgrnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max | | | | | | | | |
| **Polychlorinated Biphenyls** | PCB 105[4] | pg/g | 35 | 97.1% | 1 | 2.1 | -- | 2.1 | 2.1 | -- | 2.1 | 34 | 2.2 | 12 | 38 | 77 | 76 | 590 | -- | -- | -- | -- | -- | -- | -- | -- |
| | PCB 114[4] | pg/g | 35 | 71.4% | 10 | 1.9 | 2 | 2.1 | 2.1 | 2.1 | 2.1 | 25 | 2.1 | 3.7 | 5.9 | 8.4 | 10 | 24 | -- | -- | -- | -- | -- | -- | -- | -- |
| | PCB 118[4] | pg/g | 35 | 100% | 0 | -- | -- | -- | -- | -- | -- | 35 | 4.7 | 20 | 72 | 140 | 130 | 1200 | -- | -- | -- | -- | -- | -- | -- | -- |
| | PCB 123[4] | pg/g | 35 | 2.9% | 34 | 1.9 | 2.1 | 3 | 7.3 | 7 | 35 | 1 | 6.8 | -- | 6.8 | 6.8 | -- | 6.8 | -- | -- | -- | -- | -- | -- | -- | -- |
| | PCB 126[4] | pg/g | 35 | 60.0% | 14 | 1.9 | 2 | 2.1 | 2.1 | 2.1 | 2.1 | 21 | 2.2 | 3.1 | 4.8 | 5.4 | 6.8 | 11 | -- | -- | -- | -- | -- | -- | -- | -- |
| | PCB 156[4] | pg/g | 35 | 91.4% | 3 | 2 | 2 | 2.1 | 2.1 | 2.1 | 2.1 | 32 | 2.6 | 6.7 | 21 | 29 | 31 | 160 | -- | -- | -- | -- | -- | -- | -- | -- |
| | PCB 157[4] | pg/g | 35 | 65.7% | 12 | 1.9 | 2 | 2.1 | 2.1 | 2.1 | 2.1 | 23 | 2.4 | 4.1 | 5.5 | 9 | 8.1 | 39 | -- | -- | -- | -- | -- | -- | -- | -- |
| | PCB 167[4] | pg/g | 35 | 74.3% | 9 | 1.9 | 2 | 2.1 | 2.1 | 2.1 | 2.1 | 26 | 2.1 | 7.4 | 12 | 14 | 15 | 65 | -- | -- | -- | -- | -- | -- | -- | -- |
| | PCB 169[4] | pg/g | 35 | 11.4% | 31 | 1.9 | 2.1 | 2.1 | 2.1 | 2.1 | 2.3 | 4 | 2.2 | 2.2 | 2.6 | 3.4 | 5.4 | 6.2 | -- | -- | -- | -- | -- | -- | -- | -- |
| | PCB 189[4] | pg/g | 35 | 68.6% | 11 | 1.9 | 2 | 2.1 | 2.1 | 2.1 | 2.1 | 24 | 2.8 | 5 | 8.3 | 8.8 | 13 | 19 | -- | -- | -- | -- | -- | -- | -- | -- |
| | PCB 209[4] | pg/g | 35 | 100% | 0 | -- | -- | -- | -- | -- | -- | 35 | 30 | 310 | 800 | 1300 | 2100 | 6300 | -- | -- | -- | -- | -- | -- | -- | -- |
| | PCB 77[4] | pg/g | 35 | 5.7% | 33 | 2 | 3.3 | 10 | 14 | 20 | 52 | 2 | 2.1 | -- | 4.8 | 4.8 | -- | 7.4 | -- | -- | -- | -- | -- | -- | -- | -- |
| | PCB 81[4] | pg/g | 35 | 5.7% | 33 | 1.9 | 2.1 | 3.3 | 5.5 | 5.9 | 32 | 2 | 3.4 | -- | 5.4 | 5.4 | -- | 7.4 | -- | -- | -- | -- | -- | -- | -- | -- |
| **Radionuclides** | Radium-226 | pCi/g | 50 | 98.0% | 1 | -- | -- | -- | -- | -- | -- | 49 | 0.497 | 0.99 | 1.1 | 1.2 | 1.5 | 2.51 | 0.0071 | 49 | 0.016 | 49 | 0.32 | 49 | 2.75 | 0 |
| | Radium-228 | pCi/g | 50 | 92.0% | 4 | -- | -- | -- | -- | -- | -- | 46 | 0.405 | 0.94 | 1.3 | 1.3 | 1.5 | 2.41 | 0.013 | 46 | 0.016 | 46 | 0.32 | 46 | 2.94 | 0 |
| | Thorium-228 | pCi/g | 50 | 98.0% | 1 | -- | -- | -- | -- | -- | -- | 49 | 0.421 | 1.2 | 1.5 | 1.4 | 1.7 | 2.31 | 0.0078 | 49 | 0.0023 | 49 | 0.045 | 49 | 3.37 | 0 |
| | Thorium-230 | pCi/g | 50 | 92.0% | 4 | -- | -- | -- | -- | -- | -- | 46 | 0.537 | 0.91 | 1.0 | 1.1 | 1.2 | 2.11 | 3.2 | 0 | 0.00084 | 46 | 0.017 | 46 | 3.64 | 0 |
| | Thorium-232 | pCi/g | 50 | 100% | 0 | -- | -- | -- | -- | -- | -- | 50 | 0.509 | 1.1 | 1.4 | 1.4 | 1.6 | 2.32 | 2.8 | 0 | 0.0029 | 50 | 0.058 | 50 | 2.8 | 0 |
| | Uranium-233/234 | pCi/g | 50 | 74.0% | 13 | -- | -- | -- | -- | -- | -- | 37 | 0.13 | 0.82 | 1.0 | 0.99 | 1.1 | 1.79 | 4.2 | 0 | -- | -- | -- | -- | 4.78 | 0 |
| | Uranium-235/236 | pCi/g | 50 | 10.0% | 45 | -- | -- | -- | -- | -- | -- | 5 | -0.0987 | 0.038 | 0.068 | 0.099 | 0.12 | 1 | 0.11 | 5 | -- | -- | -- | -- | 0.241 | 2 |
| | Uranium-238 | pCi/g | 50 | 74.0% | 13 | -- | -- | -- | -- | -- | -- | 37 | -0.0422 | 0.82 | 1.0 | 0.96 | 1.2 | 1.58 | 0.46 | 35 | -- | -- | -- | -- | 4.01 | 0 |
| **Semivolatile Organic Compounds** | 1,2,4,5-Tetrachlorobenzene | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 18.3 | -- | -- | -- | -- | -- | -- | -- |
| | 1,2-Diphenylhydrazine | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 0.608 | -- | -- | -- | -- | -- | -- | -- |
| | 1,4-Dioxane | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 44.2 | -- | -- | -- | -- | -- | -- | -- |
| | 2,2'-Dichlorobenzil | mg/kg | 49 | 0% | 49 | 0.112 | 0.11 | 0.12 | 0.12 | 0.12 | 0.121 | 0 | -- | -- | -- | -- | -- | -- | 23.5 | -- | 0.0003 | -- | 0.006 | -- | -- | -- |
| | 2,4,5-Trichlorophenol | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 6110 | -- | 14 | -- | 280 | -- | -- | -- |
| | 2,4,6-Trichlorophenol | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 44.2 | -- | 0.008 | -- | 0.16 | -- | -- | -- |
| | 2,4-Dichlorophenol | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 183 | -- | 0.05 | -- | 1 | -- | -- | -- |
| | 2,4-Dimethylphenol | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 1220 | -- | 0.4 | -- | 8 | -- | -- | -- |
| | 2,4-Dinitrophenol | mg/kg | 49 | 0% | 49 | 0.129 | 0.13 | 0.13 | 0.13 | 0.14 | 0.139 | 0 | -- | -- | -- | -- | -- | -- | 122 | -- | 0.01 | -- | 0.2 | -- | -- | -- |
| | 2,4-Dinitrotoluene | mg/kg | 49 | 0% | 49 | 0.0338 | 0.035 | 0.035 | 0.035 | 0.035 | 0.0366 | 0 | -- | -- | -- | -- | -- | -- | 1.57 | -- | 0.00004 | -- | 0.0008 | -- | -- | -- |
| | 2,6-Dinitrotoluene | mg/kg | 49 | 0% | 49 | 0.0338 | 0.035 | 0.035 | 0.035 | 0.035 | 0.0366 | 0 | -- | -- | -- | -- | -- | -- | 61.1 | -- | 0.00003 | -- | 0.0006 | -- | -- | -- |
| | 2-Chloronaphthalene | mg/kg | 49 | 0% | 49 | 0.0118 | 0.012 | 0.012 | 0.012 | 0.012 | 0.0128 | 0 | -- | -- | -- | -- | -- | -- | 6260 | -- | -- | -- | -- | -- | -- | -- |
| | 2-Chlorophenol | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 391 | -- | 0.2 | -- | 4 | -- | -- | -- |
| | 2-Methylnaphthalene | mg/kg | 49 | 0% | 49 | 0.00677 | 0.0069 | 0.007 | 0.007 | 0.0071 | 0.00733 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 2-Nitroaniline | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 183 | -- | -- | -- | -- | -- | -- | -- |
| | 2-Nitrophenol | mg/kg | 49 | 0% | 49 | 0.0338 | 0.035 | 0.035 | 0.035 | 0.035 | 0.0366 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 3,3-Dichlorobenzidine | mg/kg | 49 | 0% | 49 | 0.102 | 0.1 | 0.11 | 0.11 | 0.11 | 0.11 | 0 | -- | -- | -- | -- | -- | -- | 1.08 | -- | 0.0003 | -- | 0.006 | -- | -- | -- |
| | 3-Nitroaniline | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 4-Bromophenyl phenyl ether | mg/kg | 49 | 0% | 49 | 0.0338 | 0.035 | 0.035 | 0.035 | 0.035 | 0.0366 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 4-Chloro-3-methylphenol | mg/kg | 49 | 0% | 49 | 0.0338 | 0.035 | 0.035 | 0.035 | 0.035 | 0.0366 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 4-Chlorophenyl phenyl ether | mg/kg | 49 | 0% | 49 | 0.0338 | 0.035 | 0.035 | 0.035 | 0.035 | 0.0366 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 4-Chlorothioanisole | mg/kg | 49 | 0% | 49 | 0.112 | 0.11 | 0.12 | 0.12 | 0.12 | 0.121 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 4-Nitroaniline | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 4-Nitrophenol | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 489 | -- | -- | -- | -- | -- | -- | -- |
| | Acetophenone | mg/kg | 49 | 0% | 49 | 0.0338 | 0.035 | 0.035 | 0.035 | 0.035 | 0.0366 | 0 | -- | -- | -- | -- | -- | -- | 1740 | -- | -- | -- | -- | -- | -- | -- |
| | Aniline | mg/kg | 49 | 0% | 49 | 0.118 | 0.12 | 0.12 | 0.12 | 0.12 | 0.128 | 0 | -- | -- | -- | -- | -- | -- | 85.3 | -- | -- | -- | -- | -- | -- | -- |
| | Benzenethiol | mg/kg | 49 | 0% | 49 | 0.112 | 0.11 | 0.12 | 0.12 | 0.12 | 0.121 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Benzoic acid | mg/kg | 49 | 2.0% | 48 | 0.169 | 0.17 | 0.18 | 0.18 | 0.18 | 0.183 | 1 | 0.32 | -- | 0.32 | 0.32 | -- | 0.32 | 100000 | 0 | 20 | 0 | 400 | 0 | -- | -- |
| | Benzyl alcohol | mg/kg | 49 | 0% | 49 | 0.102 | 0.1 | 0.11 | 0.11 | 0.11 | 0.11 | 0 | -- | -- | -- | -- | -- | -- | 30600 | -- | -- | -- | -- | -- | -- | -- |
| | bis(2-Chloroethoxy)methane | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | bis(2-Chloroethyl) ether | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 0.244 | -- | 0.00002 | -- | 0.0004 | -- | -- | -- |

**TABLE 3-4**
**FINAL HUMAN HEALTH RISK ASSESSMENT SOIL DATASET RESULTS SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Compound List | Units | Total Count | Detect Freq. | Censored (Non-Detect) Data | | | | | | | Detected Data[1] | | | | | | | Residential Soil BCL | Count of Detects > BCL | LBCL (DAF 1) | Count of Detects > DAF 1 | LBCL (DAF 20) | Count of Detects > DAF 20 | Max. Bkgrnd[2] | Count of Detects > Bkgrnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max | | | | | | | | |
| **Semivolatile Organic Compounds** | bis(2-Chloroisopropyl) ether | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 3.38 | -- | -- | -- | -- | -- | -- | -- |
| | bis(2-Ethylhexyl) phthalate | mg/kg | 49 | 8.2% | 45 | 0.0677 | 0.07 | 0.07 | 0.072 | 0.071 | 0.11 | 4 | 0.077 | 0.086 | 0.24 | 0.4 | 0.87 | 1.04 | 34.7 | 0 | 180 | 0 | 3600 | 0 | -- | -- |
| | bis(p-Chlorophenyl) sulfone | mg/kg | 49 | 0% | 49 | 0.112 | 0.11 | 0.12 | 0.12 | 0.12 | 0.121 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | bis(p-Chlorophenyl)disulfide | mg/kg | 49 | 0% | 49 | 0.112 | 0.11 | 0.12 | 0.12 | 0.12 | 0.121 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Butylbenzyl phthalate | mg/kg | 49 | 2.0% | 48 | 0.0677 | 0.07 | 0.07 | 0.07 | 0.071 | 0.0733 | 1 | 126 | -- | 130 | 130 | -- | 126 | 240 | 0 | 810 | 0 | 16200 | 0 | -- | -- |
| | Carbazole | mg/kg | 49 | 0% | 49 | 0.0102 | 0.01 | 0.011 | 0.011 | 0.011 | 0.011 | 0 | -- | -- | -- | -- | -- | -- | 24.3 | -- | 0.03 | -- | 0.6 | -- | -- | -- |
| | Dibenzofuran | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 156 | -- | -- | -- | -- | -- | -- | -- |
| | Dichloromethyl ether | mg/kg | 49 | 0% | 49 | 0.112 | 0.11 | 0.12 | 0.12 | 0.12 | 0.121 | 0 | -- | -- | -- | -- | -- | -- | 0.000242 | -- | -- | -- | -- | -- | -- | -- |
| | Diethyl phthalate | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 48900 | -- | -- | -- | -- | -- | -- | -- |
| | Dimethyl phthalate | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 100000 | -- | -- | -- | -- | -- | -- | -- |
| | Di-n-butyl phthalate | mg/kg | 49 | 2.0% | 48 | 0.0338 | 0.035 | 0.035 | 0.035 | 0.035 | 0.0366 | 1 | 0.115 | -- | 0.12 | 0.12 | -- | 0.115 | 6110 | 0 | 270 | 0 | 5400 | 0 | -- | -- |
| | Di-n-octyl phthalate | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Diphenyl disulfide | mg/kg | 49 | 0% | 49 | 0.112 | 0.11 | 0.12 | 0.12 | 0.12 | 0.121 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Diphenyl sulfide | mg/kg | 49 | 0% | 49 | 0.112 | 0.11 | 0.12 | 0.12 | 0.12 | 0.121 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Diphenyl sulfone | mg/kg | 49 | 0% | 49 | 0.112 | 0.11 | 0.12 | 0.12 | 0.12 | 0.121 | 0 | -- | -- | -- | -- | -- | -- | 183 | -- | -- | -- | -- | -- | -- | -- |
| | Diphenylamine | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Fluoranthene | mg/kg | 49 | 12.2% | 43 | 0.0102 | 0.01 | 0.011 | 0.011 | 0.011 | 0.011 | 6 | 0.0127 | 0.014 | 0.047 | 0.05 | 0.071 | 0.127 | 2290 | 0 | 210 | 0 | 4200 | 0 | -- | -- |
| | Fluorene | mg/kg | 49 | 0% | 49 | 0.0102 | 0.01 | 0.011 | 0.011 | 0.011 | 0.011 | 0 | -- | -- | -- | -- | -- | -- | 3130 | -- | 28 | -- | 560 | -- | -- | -- |
| | Hexachlorobenzene | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 0.304 | -- | 0.1 | -- | 2 | -- | -- | -- |
| | Hexachlorobutadiene | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 6.24 | -- | 0.1 | -- | 2 | -- | -- | -- |
| | Hexachlorocyclopentadiene | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 366 | -- | 20 | -- | 400 | -- | -- | -- |
| | Hexachloroethane | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 34.7 | -- | 0.02 | -- | 0.4 | -- | -- | -- |
| | Hydroxymethyl phthalimide | mg/kg | 49 | 0% | 49 | 0.112 | 0.11 | 0.12 | 0.12 | 0.12 | 0.121 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Isophorone | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 512 | -- | 0.03 | -- | 0.6 | -- | -- | -- |
| | m,p-Cresols | mg/kg | 49 | 0% | 49 | 0.135 | 0.14 | 0.14 | 0.14 | 0.14 | 0.147 | 0 | -- | -- | -- | -- | -- | -- | 306 | -- | -- | -- | -- | -- | -- | -- |
| | Naphthalene | mg/kg | 49 | 0% | 49 | 0.0102 | 0.01 | 0.011 | 0.011 | 0.011 | 0.011 | 0 | -- | -- | -- | -- | -- | -- | 3.1 | -- | 4 | -- | 80 | -- | -- | -- |
| | Nitrobenzene | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 2.69 | -- | 0.007 | -- | 0.14 | -- | -- | -- |
| | N-nitrosodi-n-propylamine | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 0.0695 | -- | 0.000002 | -- | 0.00004 | -- | -- | -- |
| | o-Cresol | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 3060 | -- | 0.8 | -- | 16 | -- | -- | -- |
| | Octachlorostyrene | mg/kg | 49 | 0% | 49 | 0.112 | 0.11 | 0.12 | 0.12 | 0.12 | 0.121 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | p-Chloroaniline | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 244 | -- | 0.03 | -- | 0.6 | -- | -- | -- |
| | p-Chlorobenzenethiol | mg/kg | 49 | 0% | 49 | 0.112 | 0.11 | 0.12 | 0.12 | 0.12 | 0.121 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Pentachlorobenzene | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 48.9 | -- | -- | -- | -- | -- | -- | -- |
| | Pentachlorophenol | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 2.98 | -- | 0.001 | -- | 0.02 | -- | -- | -- |
| | Phenol | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 18300 | -- | 5 | -- | 100 | -- | -- | -- |
| | Phthalic acid | mg/kg | 49 | 2.0% | 48 | 0.112 | 0.12 | 0.12 | 0.12 | 0.12 | 0.121 | 1 | 0.387 | -- | 0.39 | 0.39 | -- | 0.387 | 100000 | 0 | -- | -- | -- | -- | -- | -- |
| | Pyridine | mg/kg | 49 | 0% | 49 | 0.0677 | 0.069 | 0.07 | 0.07 | 0.071 | 0.0733 | 0 | -- | -- | -- | -- | -- | -- | 61.1 | -- | -- | -- | -- | -- | -- | -- |
| **Volatile Organic Compounds** | 1,1,1,2-Tetrachloroethane | mg/kg | 51 | 0% | 51 | 0.00018 | 0.00018 | 0.00019 | 0.00019 | 0.00019 | 0.0002 | 0 | -- | -- | -- | -- | -- | -- | 3.69 | -- | -- | -- | -- | -- | -- | -- |
| | 1,1,1-Trichloroethane | mg/kg | 51 | 0% | 51 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.00012 | 0 | -- | -- | -- | -- | -- | -- | 1390 | -- | 0.1 | -- | 2 | -- | -- | -- |
| | 1,1,2,2-Tetrachloroethane | mg/kg | 51 | 0% | 51 | 0.000079 | 0.000081 | 0.000082 | 0.000082 | 0.000083 | 0.000088 | 0 | -- | -- | -- | -- | -- | -- | 0.472 | -- | 0.0002 | -- | 0.004 | -- | -- | -- |
| | 1,1,2-Trichloroethane | mg/kg | 51 | 0% | 51 | 0.000068 | 0.00007 | 0.000071 | 0.000071 | 0.000071 | 0.000076 | 0 | -- | -- | -- | -- | -- | -- | 1.05 | -- | 0.0009 | -- | 0.018 | -- | -- | -- |
| | 1,1-Dichloroethane | mg/kg | 51 | 0% | 51 | 0.000071 | 0.000073 | 0.000074 | 0.000074 | 0.000074 | 0.000079 | 0 | -- | -- | -- | -- | -- | -- | 4.19 | -- | 1 | -- | 20 | -- | -- | -- |
| | 1,1-Dichloroethene | mg/kg | 51 | 0% | 51 | 0.00012 | 0.00012 | 0.00013 | 0.00013 | 0.00013 | 0.00014 | 0 | -- | -- | -- | -- | -- | -- | 285 | -- | 0.003 | -- | 0.06 | -- | -- | -- |
| | 1,1-Dichloropropene | mg/kg | 51 | 0% | 51 | 0.000088 | 0.00009 | 0.000092 | 0.000092 | 0.000092 | 0.000098 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,3-Trichlorobenzene | mg/kg | 51 | 0% | 51 | 0.00039 | 0.0004 | 0.00041 | 0.00041 | 0.00041 | 0.00044 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,3-Trichloropropane | mg/kg | 51 | 0% | 51 | 0.00025 | 0.00026 | 0.00026 | 0.00026 | 0.00027 | 0.00028 | 0 | -- | -- | -- | -- | -- | -- | 0.32 | -- | -- | -- | -- | -- | -- | -- |
| | 1,2,4-Trichlorobenzene | mg/kg | 51 | 0% | 51 | 0.00033 | 0.00034 | 0.00035 | 0.00035 | 0.00035 | 0.00037 | 0 | -- | -- | -- | -- | -- | -- | 143 | -- | 0.3 | -- | 6 | -- | -- | -- |
| | 1,2,4-Trimethylbenzene | mg/kg | 51 | 33.3% | 34 | 0.00014 | 0.00041 | 0.00055 | 0.0005 | 0.00059 | 0.00073 | 17 | 0.00069 | 0.0007 | 0.00077 | 0.00089 | 0.001 | 0.0017 | 144 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,2-Dichlorobenzene | mg/kg | 51 | 0% | 51 | 0.00012 | 0.00013 | 0.00013 | 0.00013 | 0.00013 | 0.00014 | 0 | -- | -- | -- | -- | -- | -- | 373 | -- | 0.9 | -- | 18 | -- | -- | -- |
| | 1,2-Dichloroethane | mg/kg | 51 | 0% | 51 | 0.000067 | 0.000069 | 0.000069 | 0.00007 | 0.00007 | 0.000075 | 0 | -- | -- | -- | -- | -- | -- | 0.433 | -- | 0.001 | -- | 0.02 | -- | -- | -- |
| | 1,2-Dichloroethene | mg/kg | 51 | 0% | 51 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.00012 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,2-Dichloropropane | mg/kg | 51 | 0% | 51 | 0.00011 | 0.00011 | 0.00012 | 0.00012 | 0.00012 | 0.00012 | 0 | -- | -- | -- | -- | -- | -- | 0.82 | -- | 0.001 | -- | 0.02 | -- | -- | -- |

**TABLE 3-4**
**FINAL HUMAN HEALTH RISK ASSESSMENT SOIL DATASET RESULTS SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Compound List | Units | Total Count | Detect Freq. | Censored (Non-Detect) Data | | | | | | | Detected Data[1] | | | | | | | Residential Soil BCL | Count of Detects > BCL | LBCL (DAF 1) | Count of Detects > DAF 1 | LBCL (DAF 20) | Count of Detects > DAF 20 | Max. Bkgrnd[2] | Count of Detects > Bkgrnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max | | | | | | | | |
| **Volatile Organic Compounds** | 1,3,5-Trichlorobenzene | mg/kg | 51 | 0% | 51 | 0.00037 | 0.00038 | 0.00039 | 0.00039 | 0.00039 | 0.00042 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 1,3,5-Trimethylbenzene | mg/kg | 51 | 2.0% | 50 | 0.000098 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.00011 | 1 | 0.00012 | -- | 0.00012 | 0.00012 | -- | 0.00012 | 49.8 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,3-Dichlorobenzene | mg/kg | 51 | 0% | 51 | 0.00013 | 0.00014 | 0.00014 | 0.00014 | 0.00014 | 0.00015 | 0 | -- | -- | -- | -- | -- | -- | 235 | -- | -- | -- | -- | -- | -- | -- |
| | 1,3-Dichloropropane | mg/kg | 51 | 0% | 51 | 0.000051 | 0.000053 | 0.000054 | 0.000054 | 0.000054 | 0.000058 | 0 | -- | -- | -- | -- | -- | -- | 1130 | -- | 0.001 | -- | 0.02 | -- | -- | -- |
| | 1,4-Dichlorobenzene | mg/kg | 51 | 0% | 51 | 0.00014 | 0.00014 | 0.00014 | 0.00014 | 0.00014 | 0.00015 | 0 | -- | -- | -- | -- | -- | -- | 2.59 | -- | 0.1 | -- | 2 | -- | -- | -- |
| | 2,2,3-Trimethylbutane | mg/kg | 51 | 0% | 51 | 0.00021 | 0.00022 | 0.00022 | 0.00022 | 0.00022 | 0.00024 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 2,2-Dichloropropane | mg/kg | 51 | 0% | 51 | 0.00023 | 0.00024 | 0.00024 | 0.00024 | 0.00025 | 0.00026 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 2,2-Dimethylpentane | mg/kg | 51 | 0% | 51 | 0.00028 | 0.00029 | 0.00029 | 0.00029 | 0.00029 | 0.00031 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 2,3-Dimethylpentane | mg/kg | 51 | 0% | 51 | 0.00023 | 0.00023 | 0.00024 | 0.00024 | 0.00024 | 0.00025 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 2,4-Dimethylpentane | mg/kg | 51 | 0% | 51 | 0.00019 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.00022 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 2-Chlorotoluene | mg/kg | 51 | 0% | 51 | 0.00025 | 0.00026 | 0.00026 | 0.00026 | 0.00026 | 0.00028 | 0 | -- | -- | -- | -- | -- | -- | 511 | -- | -- | -- | -- | -- | -- | -- |
| | 2-Hexanone | mg/kg | 51 | 0% | 51 | 0.00024 | 0.00025 | 0.00025 | 0.00025 | 0.00025 | 0.00027 | 0 | -- | -- | -- | -- | -- | -- | 460 | -- | -- | -- | -- | -- | -- | -- |
| | 2-Methylhexane | mg/kg | 51 | 0% | 51 | 0.0002 | 0.00021 | 0.00021 | 0.00021 | 0.00022 | 0.00023 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 2-Nitropropane | mg/kg | 51 | 0% | 51 | 0.00061 | 0.00063 | 0.00063 | 0.00063 | 0.00064 | 0.00068 | 0 | -- | -- | -- | -- | -- | -- | 0.0681 | -- | -- | -- | -- | -- | -- | -- |
| | 3,3-Dimethylpentane | mg/kg | 51 | 0% | 51 | 0.0002 | 0.00021 | 0.00021 | 0.00021 | 0.00022 | 0.00023 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 3-Ethylpentane | mg/kg | 51 | 0% | 51 | 0.00021 | 0.00022 | 0.00022 | 0.00022 | 0.00022 | 0.00024 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 3-Methylhexane | mg/kg | 51 | 0% | 51 | 0.00014 | 0.00015 | 0.00015 | 0.00015 | 0.00015 | 0.00016 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 4-Chlorotoluene | mg/kg | 51 | 0% | 51 | 0.00017 | 0.00018 | 0.00018 | 0.00018 | 0.00018 | 0.00019 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 4-Methyl-2-pentanone (MIBK) | mg/kg | 51 | 0% | 51 | 0.00029 | 0.0003 | 0.0003 | 0.0003 | 0.00031 | 0.00033 | 0 | -- | -- | -- | -- | -- | -- | 5800 | -- | -- | -- | -- | -- | -- | -- |
| | Acetone | mg/kg | 51 | 2.0% | 50 | 0.0018 | 0.0053 | 0.011 | 0.011 | 0.018 | 0.021 | 1 | 0.017 | -- | 0.017 | 0.017 | -- | 0.017 | 60000 | 0 | 0.8 | 0 | 16 | 0 | -- | -- |
| | Acetonitrile | mg/kg | 51 | 0% | 51 | 0.0055 | 0.0056 | 0.0057 | 0.0057 | 0.0057 | 0.0061 | 0 | -- | -- | -- | -- | -- | -- | 1470 | -- | -- | -- | -- | -- | -- | -- |
| | Benzene | mg/kg | 51 | 0% | 51 | 0.000088 | 0.00009 | 0.000092 | 0.000092 | 0.000092 | 0.000098 | 0 | -- | -- | -- | -- | -- | -- | 0.81 | -- | 0.002 | -- | 0.04 | -- | -- | -- |
| | Bromobenzene | mg/kg | 51 | 0% | 51 | 0.00012 | 0.00013 | 0.00013 | 0.00013 | 0.00013 | 0.00014 | 0 | -- | -- | -- | -- | -- | -- | 63.5 | -- | -- | -- | -- | -- | -- | -- |
| | Bromodichloromethane | mg/kg | 51 | 0% | 51 | 0.00021 | 0.00022 | 0.00022 | 0.00022 | 0.00023 | 0.00024 | 0 | -- | -- | -- | -- | -- | -- | 10.3 | -- | 0.03 | -- | 0.6 | -- | -- | -- |
| | Bromoform | mg/kg | 51 | 0% | 51 | 0.00006 | 0.000061 | 0.000062 | 0.000062 | 0.000063 | 0.000067 | 0 | -- | -- | -- | -- | -- | -- | 61.6 | -- | 0.04 | -- | 0.8 | -- | -- | -- |
| | Bromomethane | mg/kg | 51 | 0% | 51 | 0.00013 | 0.00013 | 0.00014 | 0.00014 | 0.00014 | 0.00015 | 0 | -- | -- | -- | -- | -- | -- | 8.7 | -- | 0.01 | -- | 0.2 | -- | -- | -- |
| | Carbon disulfide | mg/kg | 51 | 0% | 51 | 0.00012 | 0.00013 | 0.00013 | 0.00013 | 0.00013 | 0.00014 | 0 | -- | -- | -- | -- | -- | -- | 721 | -- | 2 | -- | 40 | -- | -- | -- |
| | Carbon tetrachloride | mg/kg | 51 | 0% | 51 | 0.00021 | 0.00021 | 0.00022 | 0.00022 | 0.00022 | 0.00023 | 0 | -- | -- | -- | -- | -- | -- | 0.3 | -- | 0.003 | -- | 0.06 | -- | -- | -- |
| | Chlorobenzene | mg/kg | 51 | 0% | 51 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.00012 | 0 | -- | -- | -- | -- | -- | -- | 273 | -- | 0.07 | -- | 1.4 | -- | -- | -- |
| | Chlorobromomethane | mg/kg | 51 | 0% | 51 | 0.00023 | 0.00023 | 0.00024 | 0.00024 | 0.00024 | 0.00025 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Chloroethane | mg/kg | 51 | 0% | 51 | 0.00047 | 0.00048 | 0.00049 | 0.00049 | 0.00049 | 0.00052 | 0 | -- | -- | -- | -- | -- | -- | 221 | -- | -- | -- | -- | -- | -- | -- |
| | Chloroform | mg/kg | 51 | 0% | 51 | 0.0001 | 0.0001 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0 | -- | -- | -- | -- | -- | -- | 0.306 | -- | 0.03 | -- | 0.6 | -- | -- | -- |
| | Chloromethane | mg/kg | 51 | 0% | 51 | 0.00027 | 0.00028 | 0.00028 | 0.00028 | 0.00028 | 0.0003 | 0 | -- | -- | -- | -- | -- | -- | 1.6 | -- | -- | -- | -- | -- | -- | -- |
| | cis-1,2-Dichloroethene | mg/kg | 51 | 0% | 51 | 0.000055 | 0.000056 | 0.000057 | 0.000057 | 0.000057 | 0.000061 | 0 | -- | -- | -- | -- | -- | -- | 782 | -- | 0.02 | -- | 0.4 | -- | -- | -- |
| | cis-1,3-Dichloropropene | mg/kg | 51 | 0% | 51 | 0.0001 | 0.0001 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Cymene (Isopropyltoluene) | mg/kg | 51 | 0% | 51 | 0.00013 | 0.00013 | 0.00013 | 0.00013 | 0.00013 | 0.00014 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Dibromochloromethane | mg/kg | 51 | 0% | 51 | 0.00012 | 0.00012 | 0.00012 | 0.00012 | 0.00013 | 0.00013 | 0 | -- | -- | -- | -- | -- | -- | 1.12 | -- | 0.02 | -- | 0.4 | -- | -- | -- |
| | Dibromochloropropane | mg/kg | 51 | 0% | 51 | 0.00021 | 0.00022 | 0.00022 | 0.00022 | 0.00022 | 0.00024 | 0 | -- | -- | -- | -- | -- | -- | 0.0104 | -- | -- | -- | -- | -- | -- | -- |
| | Dibromomethane | mg/kg | 51 | 0% | 51 | 0.00017 | 0.00017 | 0.00017 | 0.00017 | 0.00018 | 0.00019 | 0 | -- | -- | -- | -- | -- | -- | 782 | -- | -- | -- | -- | -- | -- | -- |
| | Dichloromethane (Methylene chloride) | mg/kg | 51 | 47.1% | 27 | 0.00071 | 0.00074 | 0.0026 | 0.0027 | 0.0039 | 0.0077 | 24 | 0.0014 | 0.0035 | 0.01 | 0.011 | 0.017 | 0.028 | 11 | 0 | 0.001 | 24 | 0.02 | 1 | -- | -- |
| | Dimethyldisulfide | mg/kg | 51 | 0% | 51 | 0.00018 | 0.00018 | 0.00019 | 0.00019 | 0.00019 | 0.0002 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Ethanol | mg/kg | 51 | 0% | 51 | 0.048 | 0.049 | 0.05 | 0.05 | 0.05 | 0.053 | 0 | -- | -- | -- | -- | -- | -- | 100000 | -- | -- | -- | -- | -- | -- | -- |
| | Ethylbenzene | mg/kg | 51 | 5.9% | 48 | 0.000059 | 0.00006 | 0.000061 | 0.000061 | 0.000062 | 0.000066 | 3 | 0.000062 | 0.000062 | 0.000062 | 0.000067 | 0.000077 | 0.000077 | 3.79 | 0 | 0.7 | 0 | 14 | 0 | -- | -- |
| | Freon-11 (Trichlorofluoromethane) | mg/kg | 51 | 0% | 51 | 0.00022 | 0.00023 | 0.00023 | 0.00023 | 0.00023 | 0.00025 | 0 | -- | -- | -- | -- | -- | -- | 883 | -- | -- | -- | -- | -- | -- | -- |
| | Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethan | mg/kg | 51 | 0% | 51 | 0.00015 | 0.00015 | 0.00015 | 0.00015 | 0.00015 | 0.00016 | 0 | -- | -- | -- | -- | -- | -- | 5550 | -- | -- | -- | -- | -- | -- | -- |
| | Freon-12 (Dichlorodifluoromethane) | mg/kg | 51 | 0% | 51 | 0.00029 | 0.0003 | 0.0003 | 0.00031 | 0.00031 | 0.00033 | 0 | -- | -- | -- | -- | -- | -- | 218 | -- | -- | -- | -- | -- | -- | -- |
| | Heptane | mg/kg | 51 | 0% | 51 | 0.00016 | 0.00017 | 0.00017 | 0.00017 | 0.00017 | 0.00018 | 0 | -- | -- | -- | -- | -- | -- | 220 | -- | 0.003 | -- | 0.6 | -- | -- | -- |
| | Isopropylbenzene | mg/kg | 51 | 0% | 51 | 0.0001 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.00012 | 0 | -- | -- | -- | -- | -- | -- | 371 | -- | -- | -- | -- | -- | -- | -- |
| | m,p-Xylene | mg/kg | 51 | 0% | 51 | 0.00017 | 0.00017 | 0.00017 | 0.00017 | 0.00018 | 0.00019 | 0 | -- | -- | -- | -- | -- | -- | 214 | -- | 10 | -- | 200 | -- | -- | -- |
| | Methyl ethyl ketone (2-Butanone) | mg/kg | 51 | 0% | 51 | 0.00088 | 0.0009 | 0.00091 | 0.00092 | 0.00092 | 0.00098 | 0 | -- | -- | -- | -- | -- | -- | 32100 | -- | -- | -- | -- | -- | -- | -- |
| | Methyl iodide | mg/kg | 51 | 0% | 51 | 0.00013 | 0.00013 | 0.00013 | 0.00013 | 0.00013 | 0.00014 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | MTBE (Methyl tert-butyl ether) | mg/kg | 51 | 0% | 51 | 0.00009 | 0.000092 | 0.000094 | 0.000094 | 0.000095 | 0.0001 | 0 | -- | -- | -- | -- | -- | -- | 39.2 | -- | -- | -- | -- | -- | -- | -- |

**TABLE 3-4**
**FINAL HUMAN HEALTH RISK ASSESSMENT SOIL DATASET RESULTS SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Compound List | Units | Total Count | Detect Freq. | Censored (Non-Detect) Data | | | | | | | Detected Data[1] | | | | | | | Residential Soil BCL | Count of Detects > BCL | LBCL (DAF 1) | Count of Detects > DAF 1 | LBCL (DAF 20) | Count of Detects > DAF 20 | Max. Bkgrnd[2] | Count of Detects > Bkgrnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max | | | | | | | | |
| **Volatile Organic Compounds** | n-Butylbenzene | mg/kg | 51 | 0% | 51 | 0.00018 | 0.00019 | 0.00019 | 0.00019 | 0.00019 | 0.0002 | 0 | -- | -- | -- | -- | -- | -- | 237 | -- | -- | -- | -- | -- | -- | -- |
| | Nonanal | mg/kg | 51 | 3.9% | 49 | 0.00047 | 0.00049 | 0.00049 | 0.00049 | 0.0005 | 0.00053 | 2 | 0.0008 | -- | 0.00089 | 0.00089 | -- | 0.00098 | -- | -- | -- | -- | -- | -- | -- | -- |
| | n-Propylbenzene | mg/kg | 51 | 0% | 51 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.00012 | 0.00012 | 0 | -- | -- | -- | -- | -- | -- | 237 | -- | -- | -- | -- | -- | -- | -- |
| | o-Xylene | mg/kg | 51 | 0% | 51 | 0.000077 | 0.000079 | 0.00008 | 0.00008 | 0.000081 | 0.000086 | 0 | -- | -- | -- | -- | -- | -- | 282 | -- | 9 | -- | 180 | -- | -- | -- |
| | sec-Butylbenzene | mg/kg | 51 | 0% | 51 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.00012 | 0 | -- | -- | -- | -- | -- | -- | 223 | -- | -- | -- | -- | -- | -- | -- |
| | Styrene | mg/kg | 51 | 0% | 51 | 0.00018 | 0.00018 | 0.00018 | 0.00019 | 0.0002 | 0.00027 | 0 | -- | -- | -- | -- | -- | -- | 1730 | -- | 0.2 | -- | 4 | -- | -- | -- |
| | tert-Butylbenzene | mg/kg | 51 | 0% | 51 | 0.0001 | 0.0001 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0 | -- | -- | -- | -- | -- | -- | 393 | -- | -- | -- | -- | -- | -- | -- |
| | Tetrachloroethene | mg/kg | 51 | 0% | 51 | 0.000088 | 0.00009 | 0.000092 | 0.000092 | 0.000092 | 0.000098 | 0 | -- | -- | -- | -- | -- | -- | 0.624 | -- | 0.003 | -- | 0.06 | -- | -- | -- |
| | Toluene | mg/kg | 51 | 2.0% | 50 | 0.00033 | 0.00033 | 0.00034 | 0.00034 | 0.00034 | 0.00036 | 1 | 0.00036 | -- | 0.00036 | 0.00036 | -- | 0.00036 | 521 | 0 | 0.6 | 0 | 12 | 0 | -- | -- |
| | trans-1,2-Dichloroethene | mg/kg | 51 | 0% | 51 | 0.000091 | 0.000093 | 0.000095 | 0.000095 | 0.000096 | 0.0001 | 0 | -- | -- | -- | -- | -- | -- | 122 | -- | 0.03 | -- | 0.6 | -- | -- | -- |
| | trans-1,3-Dichloropropene | mg/kg | 51 | 0% | 51 | 0.0001 | 0.0001 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | Trichloroethene | mg/kg | 51 | 0% | 51 | 0.0001 | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.00012 | 0 | -- | -- | -- | -- | -- | -- | 1.06 | -- | 0.003 | -- | 0.06 | -- | -- | -- |
| | Vinyl acetate | mg/kg | 51 | 0% | 51 | 0.00024 | 0.00025 | 0.00025 | 0.00025 | 0.00025 | 0.00027 | 0 | -- | -- | -- | -- | -- | -- | 988 | -- | 8 | -- | 160 | -- | -- | -- |
| | Vinyl chloride | mg/kg | 51 | 0% | 51 | 0.00011 | 0.00012 | 0.00012 | 0.00012 | 0.00012 | 0.00013 | 0 | -- | -- | -- | -- | -- | -- | 0.349 | -- | 0.0007 | -- | 0.014 | -- | -- | -- |
| | Xylenes (total) | mg/kg | 51 | 0% | 51 | 0.00023 | 0.00024 | 0.00024 | 0.00024 | 0.00025 | 0.00026 | 0 | -- | -- | -- | -- | -- | -- | 214 | -- | 10 | -- | 200 | -- | -- | -- |

**Notes:**
This table includes only data included in the risk assessment. Because of this, the total number of analyses does not always coincide with the total number of analyses reported in the tables in Appendix B, which include all data, regardless of status.
The values used are simply a comparison to NDEP BCL values for information purposes only.
Because both non-detect and detected radionuclides have reported activity levels, calculated summary statistics (and exceedances of comparison levels) are presented as detected regardless of the lab detect flag. Lab detect flags are represented by the censored (non-detect) and detect count fields in the table.
Values for Q1, median, mean, and Q3 are rounded to 2 significant figures. BCLs are rounded to 3 significant figures.
BCL = Basic Comparison Levels (BCLs) from NDEP 2011a.
LBCL = Leaching-based BCLs from NDEP 2011a.
Max = Maximum
Min = Minimum
Q1 = 1st quartile (25th percentile)
Q3 = 3rd quartile (75th percentile)
(1) Range of detections include estimated values of detect results between the detection limit and reporting limit. As such some minimum detected concentrations may be below the minimum reporting limit. In these cases the respective sample results are flagged in the dataset.
(2) Comparisons are for information purposes only. See Chapter 5 for statistical background comparisons, and the background dataset used.
(3) Asbestos results shown are for long protocol structures (>10um). The minimum and maximum values represent the number of protocol structures in an individual sample. The detect count represents the number of samples with at least one detected protocol structure, not the total number of structures.
(4) TCDD TEQ values are calculated from congener-specific (dioxins, furans, and PCBs) concentrations. An individual TCDD TEQ value may include detect and non-detect congeners. Therefore, the number of detects and non-detects, and a frequency of detection for TCDD TEQ are not presented.
-- = Not applicable or no value has been established.

**TABLE 3-7**
**SOIL VAPOR FLUX SAMPLE ANALYSES**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Compound | CAS Number | MDL ppbv | RL ppbv | MDL µg/m$^3$ | RL µg/m$^3$ |
|---|---|---|---|---|---|
| **List of Compounds for USEPA Method TO-15 Full Scan Mode Operation and MDLs** | | | | | |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | 0.1 | 0.51 | 0.72 | 3.62 |
| 1,1,1-Trichloroethane | 71-55-6 | 0.1 | 0.52 | 0.58 | 2.89 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 0.1 | 0.52 | 0.73 | 3.65 |
| 1,1,2-Trichloroethane | 79-00-5 | 0.1 | 0.51 | 0.57 | 2.86 |
| 1,1-Dichloroethane | 75-34-3 | 0.1 | 0.52 | 0.43 | 2.15 |
| 1,1-Dichloroethene | 75-35-4 | 0.1 | 0.52 | 0.42 | 2.13 |
| 1,1-Dichloropropene | 563-58-6 | 0.1 | 0.49 | 0.46 | 2.3 |
| 1,2,3-Trichloropropane | 96-18-4 | 0.11 | 0.55 | 0.68 | 3.39 |
| 1,2,4-Trichlorobenzene | 120-82-1 | 0.1 | 0.52 | 0.79 | 3.94 |
| 1,2,4-Trimethylbenzene | 95-63-6 | 0.1 | 0.52 | 0.52 | 2.61 |
| 1,2-Dibromo-3-chloropropane | 96-12-8 | 0.22 | 1.1 | 2.2 | 10.98 |
| 1,2-Dibromoethane | 106-93-4 | 0.1 | 0.52 | 0.82 | 4.09 |
| 1,2-Dichlorobenzene | 95-50-1 | 0.1 | 0.52 | 0.64 | 3.2 |
| 1,2-Dichloroethane | 107-06-2 | 0.1 | 0.52 | 0.43 | 2.15 |
| 1,2-Dichloropropane | 78-87-5 | 0.1 | 0.52 | 0.49 | 2.46 |
| 1,3,5-Trimethylbenzene | 108-67-8 | 0.1 | 0.52 | 0.53 | 2.64 |
| 1,3-Dichlorobenzene | 541-73-1 | 0.1 | 0.52 | 0.64 | 3.2 |
| 1,3-Dichloropropane | 142-28-9 | 0.11 | 0.54 | 0.52 | 2.58 |
| 1,4-Dichlorobenzene | 106-46-7 | 0.1 | 0.52 | 0.64 | 3.2 |
| 1,4-Dioxane | 123-91-1 | 0.09 | 0.44 | 0.33 | 1.64 |
| 2,2-Dichloropropane | 594-20-7 | 0.11 | 0.53 | 0.5 | 2.53 |
| 2-Butanone | 78-93-3 | 0.09 | 0.43 | 0.26 | 1.31 |
| 2-Hexanone | 591-78-6 | 0.09 | 0.44 | 0.37 | 1.86 |
| Acetone | 67-64-1 | 0.09 | 0.45 | 0.22 | 1.1 |
| Acetonitrile | 75-05-8 | 0.22 | 1.12 | 0.48 | 2.39 |
| Benzene | 71-43-2 | 0.1 | 0.52 | 0.34 | 1.7 |
| Benzyl chloride | 100-44-7 | 0.09 | 0.45 | 0.48 | 2.41 |

**TABLE 3-7**
**SOIL VAPOR FLUX SAMPLE ANALYSES**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Compound | CAS Number | MDL ppbv | RL ppbv | MDL µg/m$^3$ | RL µg/m$^3$ |
|---|---|---|---|---|---|
| Bromochloromethane | 74-97-5 | 0.1 | 0.51 | 0.55 | 2.76 |
| Bromodichloromethane | 75-27-4 | 0.08 | 0.4 | 0.55 | 2.77 |
| Bromoform | 75-25-2 | 0.09 | 0.47 | 0.99 | 4.96 |
| Bromomethane | 74-83-9 | 0.1 | 0.51 | 0.41 | 2.04 |
| Carbon disulfide | 75-15-0 | 0.09 | 0.45 | 0.29 | 1.45 |
| Carbon tetrachloride | 56-23-5 | 0.1 | 0.52 | 0.67 | 3.38 |
| Chlorobenzene | 108-90-7 | 0.1 | 0.52 | 0.5 | 2.48 |
| Chloroethane | 75-00-3 | 0.1 | 0.51 | 0.28 | 1.39 |
| Chloroform | 67-66-3 | 0.1 | 0.52 | 0.52 | 2.59 |
| Chloromethane | 74-87-3 | 0.1 | 0.51 | 0.22 | 1.09 |
| cis-1,2-Dichloroethene | 156-59-2 | 0.1 | 0.52 | 0.42 | 2.11 |
| cis-1,3-Dichloropropene | 10061-01-5 | 0.1 | 0.52 | 0.48 | 2.41 |
| Dibromochloromethane | 124-48-1 | 0.09 | 0.44 | 0.77 | 3.87 |
| Dibromomethane | 74-95-3 | 0.11 | 0.55 | 0.97 | 4.84 |
| Dichlorodifluoromethane | 75-71-8 | 0.1 | 0.51 | 0.52 | 2.61 |
| Dichloromethane | 75-09-2 | 0.1 | 0.52 | 0.37 | 1.86 |
| Ethanol | 64-17-5 | 0.22 | 1.12 | 0.44 | 2.18 |
| Ethylbenzene | 100-41-4 | 0.1 | 0.52 | 0.46 | 2.33 |
| Freon 113 | 76-13-1 | 0.1 | 0.52 | 0.81 | 4.07 |
| Hexachlorobutadiene | 87-68-3 | 0.1 | 0.52 | 1.14 | 5.68 |
| Isobutyl alcohol | 78-83-1 | 0.23 | 1.13 | 0.84 | 4.21 |
| Isopropylbenzene | 98-82-8 | 0.11 | 0.57 | 0.58 | 2.89 |
| Isopropyltoluene | 99-87-6 | 0.11 | 0.55 | 0.62 | 3.12 |
| m & p-Xylene | 108-38-3 | 0.21 | 1.03 | 0.92 | 4.61 |
| Methyl iodide | 4227-95-6 | 0.19 | 0.94 | 1.13 | 5.67 |
| Methyl Isobutyl Ketone | 108-10-1 | 0.09 | 0.46 | 0.38 | 1.95 |
| Methyl tert butyl ether | 1634-04-4 | 0.08 | 0.39 | 0.29 | 1.45 |
| Naphthalene | 91-20-3 | 0.22 | 1.09 | 1.19 | 5.9 |

**TABLE 3-7**
**SOIL VAPOR FLUX SAMPLE ANALYSES**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Compound | CAS Number | MDL ppbv | RL ppbv | MDL µg/m$^3$ | RL µg/m$^3$ |
|---|---|---|---|---|---|
| n-Butylbenzene | 104-51-8 | 0.1 | 0.52 | 0.59 | 2.95 |
| n-Heptane | 142-82-5 | 0.08 | 0.42 | 0.35 | 1.78 |
| n-Propylbenzene | 103-65-1 | 0.11 | 0.54 | 0.55 | 2.74 |
| o-Xylene | 95-47-6 | 0.1 | 0.52 | 0.46 | 2.31 |
| sec-Butylbenzene | 135-98-8 | 0.11 | 0.52 | 0.59 | 2.95 |
| Styrene | 100-42-5 | 0.1 | 0.52 | 0.45 | 2.26 |
| tert-Butylbenzene | 98-06-6 | 0.11 | 0.52 | 0.59 | 2.85 |
| Tetrachloroethene | 127-18-4 | 0.1 | 0.52 | 0.72 | 3.61 |
| Toluene | 108-88-3 | 0.1 | 0.52 | 0.4 | 2 |
| trans-1,2-Dichloroethene | 156-60-5 | 0.09 | 0.44 | 0.36 | 1.8 |
| trans-1,3-Dichloropropene | 10061-02-6 | 0.1 | 0.52 | 0.48 | 2.41 |
| Trichloroethene | 79-01-6 | 0.1 | 0.52 | 0.57 | 2.85 |
| Trichlorofluoromethane | 75-69-4 | 0.1 | 0.51 | 0.59 | 2.95 |
| Vinyl acetate | 108-05-4 | 0.09 | 0.43 | 0.31 | 1.56 |
| Vinyl chloride | 75-01-4 | 0.1 | 0.51 | 0.27 | 1.35 |
| **List of Compounds for USEPA Method TO-15 Selective Ion Mode (SIM) Operation and MDLs** | | | | | |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | 0.005 | 0.026 | 0.035 | 0.18 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 0.005 | 0.026 | 0.035 | 0.18 |
| 1,1,2-Trichloroethane | 79-00-5 | 0.005 | 0.026 | 0.028 | 0.14 |
| 1,2,3-Trichloropropane | 96-18-4 | 0.005 | 0.026 | 0.031 | 0.16 |
| 1,2-Dibromo-3-chloropropane | 96-12-8 | 0.01 | 0.026 | 0.098 | 0.26 |
| 1,2-Dibromoethane | 106-93-4 | 0.005 | 0.026 | 0.039 | 0.2 |
| 1,2-Dichlorobenzene | 95-50-1 | 0.005 | 0.026 | 0.031 | 0.16 |
| 1,2-Dichloroethane | 107-06-2 | 0.005 | 0.026 | 0.021 | 0.11 |
| 1,2-Dichloropropane | 78-87-5 | 0.005 | 0.026 | 0.024 | 0.12 |
| 1,3-Dichlorobenzene | 541-73-1 | 0.005 | 0.026 | 0.031 | 0.16 |
| 1,4-Dichlorobenzene | 106-46-7 | 0.005 | 0.026 | 0.031 | 0.16 |
| Benzene | 71-43-2 | 0.005 | 0.026 | 0.016 | 0.085 |

**TABLE 3-7**
**SOIL VAPOR FLUX SAMPLE ANALYSES**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Compound | CAS Number | MDL ppbv | RL ppbv | MDL µg/m$^3$ | RL µg/m$^3$ |
|---|---|---|---|---|---|
| Benzyl chloride | 100-44-7 | 0.005 | 0.026 | 0.026 | 0.14 |
| Bromodichloromethane | 75-27-4 | 0.005 | 0.026 | 0.034 | 0.18 |
| Carbon tetrachloride | 56-23-5 | 0.005 | 0.026 | 0.032 | 0.17 |
| Chloroform | 67-66-3 | 0.005 | 0.026 | 0.025 | 0.13 |
| Dibromochloromethane | 124-48-1 | 0.005 | 0.026 | 0.043 | 0.23 |
| Hexachlorobutadiene | 87-68-3 | 0.01 | 0.026 | 0.108 | 0.28 |
| Naphthalene | 91-20-3 | 0.01 | 0.026 | 0.534 | 0.14 |
| Tetrachloroethene | 127-18-4 | 0.005 | 0.026 | 0.035 | 0.18 |
| Trichloroethene | 79-01-6 | 0.005 | 0.026 | 0.027 | 0.14 |
| Vinyl chloride | 75-01-4 | 0.005 | 0.026 | 0.013 | 0.068 |

Note:
The actual reported MDL may vary based on Canister dilution or matrix interferences.
CAS - Chemical abstract system
MDL - Method detection limit
RL - Reporting limit
ppbv - Parts per billion by volume
µg/m$^3$ - microgram per cubic meter

**TABLE 3-8**
**SOIL VAPOR FLUX SAMPLE RESULTS SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 3)**

| Parameter of Interest | Compound List | Units | Total Count | Detect Freq. | Censored (Non-Detect) Data | | | | | | | Detected Data[(1)] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max |
| **Volatile Organic Compounds (Full Scan)** | 1,1,1,2-Tetrachloroethane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.015 | 0.0154 | 0.0158 | 0.0161 | 0.0158 | 0.0231 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,1,1-Trichloroethane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0138 | 0.0139 | 0.0142 | 0.0146 | 0.0145 | 0.0212 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,1,2,2-Tetrachloroethane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0173 | 0.0177 | 0.0181 | 0.0185 | 0.0181 | 0.0265 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,1,2-Trichloroethane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0138 | 0.0139 | 0.0142 | 0.0146 | 0.0145 | 0.0212 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,1-Dichloroethane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.01 | 0.0104 | 0.0104 | 0.0108 | 0.0107 | 0.0154 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,1-Dichloroethene | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.01 | 0.01 | 0.0104 | 0.0106 | 0.0104 | 0.0154 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,1-Dichloropropene | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.00962 | 0.00962 | 0.00962 | 0.01 | 0.01 | 0.0146 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,2,3-Trichloropropane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0127 | 0.0131 | 0.0135 | 0.0137 | 0.0135 | 0.0196 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,2,4-Trichlorobenzene | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0381 | 0.0386 | 0.0392 | 0.0403 | 0.0396 | 0.0581 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,2,4-Trimethylbenzene | $\mu g/m^2,min^{-1}$ | 16 | 25.0% | 12 | 0.025 | 0.0254 | 0.0258 | 0.0268 | 0.0264 | 0.0381 | 4 | 0.0254 | 0.0322 | 0.0545 | 0.0521 | 0.0697 | 0.0742 |
| | 1,2-Dibromoethane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.02 | 0.0201 | 0.0204 | 0.0211 | 0.0208 | 0.0304 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,2-Dichlorobenzene | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.03 | 0.0304 | 0.0308 | 0.0317 | 0.0312 | 0.0458 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,2-Dichloroethane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0104 | 0.0105 | 0.0108 | 0.0111 | 0.0108 | 0.0158 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,2-Dichloropropane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0119 | 0.0119 | 0.0123 | 0.0125 | 0.0123 | 0.0181 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,3,5-Trimethylbenzene | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0258 | 0.0263 | 0.0265 | 0.0274 | 0.0269 | 0.0396 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,3-Dichlorobenzene | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0304 | 0.0309 | 0.0315 | 0.0323 | 0.0318 | 0.0465 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,3-Dichloropropane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.00962 | 0.00962 | 0.01 | 0.0101 | 0.01 | 0.0146 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,4-Dichlorobenzene | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0304 | 0.0309 | 0.0315 | 0.0323 | 0.0318 | 0.0465 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,4-Dioxane | $\mu g/m^2,min^{-1}$ | 16 | 6.3% | 15 | 0.00769 | 0.00808 | 0.00808 | 0.00836 | 0.00808 | 0.0119 | 1 | 0.0177 | -- | 0.0177 | 0.0177 | -- | 0.0177 |
| | 2,2-Dichloropropane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0104 | 0.0108 | 0.0108 | 0.0112 | 0.0108 | 0.0162 | 0 | -- | -- | -- | -- | -- | -- |
| | 2-Hexanone | $\mu g/m^2,min^{-1}$ | 16 | 18.8% | 13 | 0.00885 | 0.00923 | 0.00923 | 0.00958 | 0.00923 | 0.0138 | 3 | 0.01 | 0.01 | 0.0131 | 0.0173 | 0.0288 | 0.0288 |
| | 2-Methyl-1-propanol | $\mu g/m^2,min^{-1}$ | 16 | 6.3% | 15 | 0.0185 | 0.0188 | 0.0192 | 0.0197 | 0.0192 | 0.0285 | 1 | 0.0488 | -- | 0.0488 | 0.0488 | -- | 0.0488 |
| | 4-Methyl-2-pentanone (MIBK) | $\mu g/m^2,min^{-1}$ | 16 | 6.3% | 15 | 0.00923 | 0.00962 | 0.00962 | 0.00995 | 0.00962 | 0.0142 | 1 | 0.0131 | -- | 0.0131 | 0.0131 | -- | 0.0131 |
| | Acetone | $\mu g/m^2,min^{-1}$ | 16 | 50.0% | 8 | 0.00538 | 0.00538 | 0.00693 | 0.0236 | 0.0418 | 0.0858 | 8 | 0.0273 | 0.0515 | 0.117 | 0.126 | 0.2 | 0.247 |
| | Acetonitrile | $\mu g/m^2,min^{-1}$ | 16 | 18.8% | 13 | 0.01 | 0.0104 | 0.0104 | 0.0112 | 0.0108 | 0.0158 | 3 | 0.015 | 0.015 | 0.0419 | 0.0382 | 0.0577 | 0.0577 |
| | Benzene | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.00846 | 0.00972 | 0.0375 | 0.0429 | 0.065 | 0.13 | 0 | -- | -- | -- | -- | -- | -- |
| | Benzyl chloride | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0231 | 0.0236 | 0.0238 | 0.0246 | 0.0242 | 0.0354 | 0 | -- | -- | -- | -- | -- | -- |
| | Bromodichloromethane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0135 | 0.0135 | 0.0138 | 0.0141 | 0.0138 | 0.0204 | 0 | -- | -- | -- | -- | -- | -- |
| | Bromoform | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0238 | 0.0243 | 0.0246 | 0.0254 | 0.025 | 0.0365 | 0 | -- | -- | -- | -- | -- | -- |
| | Bromomethane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.01 | 0.0101 | 0.0104 | 0.0107 | 0.0104 | 0.0154 | 0 | -- | -- | -- | -- | -- | -- |
| | Carbon disulfide | $\mu g/m^2,min^{-1}$ | 16 | 43.8% | 9 | 0.00692 | 0.00692 | 0.00692 | 0.00705 | 0.00731 | 0.00731 | 7 | 0.00846 | 0.0123 | 0.0269 | 0.0228 | 0.0319 | 0.0385 |
| | Carbon tetrachloride | $\mu g/m^2,min^{-1}$ | 16 | 6.3% | 15 | 0.0158 | 0.0162 | 0.0165 | 0.0169 | 0.0165 | 0.0242 | 1 | 0.0188 | -- | 0.0188 | 0.0188 | -- | 0.0188 |
| | Chlorobenzene | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0115 | 0.0119 | 0.0119 | 0.0123 | 0.0123 | 0.0177 | 0 | -- | -- | -- | -- | -- | -- |
| | Chlorobromomethane | $\mu g/m^2,min^{-1}$ | 16 | 0% | 16 | 0.0112 | 0.0115 | 0.0115 | 0.0119 | 0.0119 | 0.0173 | 0 | -- | -- | -- | -- | -- | -- |
| | Chloroethane | $\mu g/m^2,min^{-1}$ | 16 | 18.8% | 13 | 0.00692 | 0.00692 | 0.00692 | 0.00725 | 0.00712 | 0.0104 | 3 | 0.0338 | 0.0338 | 0.112 | 0.0926 | 0.132 | 0.132 |
| | Chloroform | $\mu g/m^2,min^{-1}$ | 16 | 12.5% | 14 | 0.0123 | 0.0127 | 0.0127 | 0.0128 | 0.0128 | 0.0131 | 2 | 0.0177 | -- | 0.0189 | 0.0189 | -- | 0.02 |
| | Chloromethane | $\mu g/m^2,min^{-1}$ | 16 | 6.3% | 15 | 0.00538 | 0.00538 | 0.00538 | 0.00559 | 0.00538 | 0.00808 | 1 | 0.0169 | -- | 0.0169 | 0.0169 | -- | 0.0169 |

**TABLE 3-8**
**SOIL VAPOR FLUX SAMPLE RESULTS SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 2 of 3)**

| Parameter of Interest | Compound List | Units | Total Count | Detect Freq. | Censored (Non-Detect) Data | | | | | | | Detected Data[1] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max |
| **Volatile Organic Compounds (Full Scan)** | cis-1,2-Dichloroethene | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.01 | 0.0104 | 0.0104 | 0.0108 | 0.0107 | 0.0154 | 0 | -- | -- | -- | -- | -- | -- |
| | cis-1,3-Dichloropropene | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.0119 | 0.0123 | 0.0123 | 0.0127 | 0.0126 | 0.0185 | 0 | -- | -- | -- | -- | -- | -- |
| | Cymene (Isopropyltoluene) | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.0246 | 0.0251 | 0.0258 | 0.0264 | 0.0261 | 0.0381 | 0 | -- | -- | -- | -- | -- | -- |
| | Dibromochloromethane | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.0188 | 0.0192 | 0.0192 | 0.0199 | 0.0196 | 0.0288 | 0 | -- | -- | -- | -- | -- | -- |
| | Dibromochloropropane | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.115 | 0.117 | 0.119 | 0.122 | 0.121 | 0.176 | 0 | -- | -- | -- | -- | -- | -- |
| | Dibromomethane | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.0154 | 0.0158 | 0.0162 | 0.0165 | 0.0162 | 0.0238 | 0 | -- | -- | -- | -- | -- | -- |
| | Dichloromethane (Methylene chloride) | µg/m$^2$,min$^{-1}$ | 16 | 12.5% | 14 | 0.00885 | 0.00923 | 0.00923 | 0.00959 | 0.00933 | 0.0138 | 2 | 0.0162 | -- | 0.128 | 0.128 | -- | 0.239 |
| | Ethanol | µg/m$^2$,min$^{-1}$ | 16 | 18.8% | 13 | 0.0115 | 0.0115 | 0.0115 | 0.0121 | 0.0119 | 0.0173 | 3 | 0.0304 | 0.0304 | 0.0646 | 0.0883 | 0.17 | 0.17 |
| | Ethylbenzene | µg/m$^2$,min$^{-1}$ | 16 | 25.0% | 12 | 0.0112 | 0.0115 | 0.0115 | 0.0121 | 0.0119 | 0.0173 | 4 | 0.0154 | 0.016 | 0.0187 | 0.0199 | 0.0251 | 0.0269 |
| | Freon-11 (Trichlorofluoromethane) | µg/m$^2$,min$^{-1}$ | 16 | 18.8% | 13 | 0.0146 | 0.0146 | 0.015 | 0.0155 | 0.0152 | 0.0223 | 3 | 0.0196 | 0.0196 | 0.0265 | 0.0255 | 0.0304 | 0.0304 |
| | Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroe | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.0192 | 0.0197 | 0.02 | 0.0206 | 0.0203 | 0.0296 | 0 | -- | -- | -- | -- | -- | -- |
| | Freon-12 (Dichlorodifluoromethane) | µg/m$^2$,min$^{-1}$ | 16 | 18.8% | 13 | 0.0131 | 0.0131 | 0.0131 | 0.0138 | 0.0135 | 0.0196 | 3 | 0.04 | 0.04 | 0.0473 | 0.0494 | 0.0608 | 0.0608 |
| | Heptane | µg/m$^2$,min$^{-1}$ | 16 | 12.5% | 14 | 0.00846 | 0.00885 | 0.00885 | 0.00918 | 0.00895 | 0.0131 | 2 | 0.0119 | -- | 0.0141 | 0.0141 | -- | 0.0162 |
| | Hexachlorobutadiene | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.0546 | 0.0555 | 0.0562 | 0.0579 | 0.0571 | 0.0835 | 0 | -- | -- | -- | -- | -- | -- |
| | Isopropylbenzene | µg/m$^2$,min$^{-1}$ | 16 | 18.8% | 13 | 0.0115 | 0.0119 | 0.0119 | 0.0125 | 0.0123 | 0.0177 | 3 | 0.0473 | 0.0473 | 0.0515 | 0.0532 | 0.0608 | 0.0608 |
| | m & p-Xylenes | µg/m$^2$,min$^{-1}$ | 16 | 37.5% | 10 | 0.0223 | 0.0227 | 0.0231 | 0.026 | 0.0261 | 0.0427 | 6 | 0.0246 | 0.0246 | 0.0466 | 0.0505 | 0.0755 | 0.0896 |
| | Methyl ethyl ketone (2-Butanone) | µg/m$^2$,min$^{-1}$ | 16 | 43.8% | 9 | 0.00654 | 0.00654 | 0.00654 | 0.00838 | 0.00827 | 0.0196 | 7 | 0.00923 | 0.0112 | 0.0196 | 0.0374 | 0.085 | 0.101 |
| | Methyl iodide | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.0296 | 0.0301 | 0.0304 | 0.0314 | 0.0311 | 0.0454 | 0 | -- | -- | -- | -- | -- | -- |
| | MTBE (Methyl tert-butyl ether) | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00692 | 0.00702 | 0.00731 | 0.00743 | 0.00731 | 0.0108 | 0 | -- | -- | -- | -- | -- | -- |
| | n-Butylbenzene | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.025 | 0.0255 | 0.0258 | 0.0266 | 0.0262 | 0.0385 | 0 | -- | -- | -- | -- | -- | -- |
| | n-Propylbenzene | µg/m$^2$,min$^{-1}$ | 16 | 18.8% | 13 | 0.0104 | 0.0104 | 0.0108 | 0.0111 | 0.0108 | 0.0158 | 3 | 0.0115 | 0.0115 | 0.0131 | 0.0135 | 0.0158 | 0.0158 |
| | o-Xylene | µg/m$^2$,min$^{-1}$ | 16 | 18.8% | 13 | 0.0112 | 0.0112 | 0.0115 | 0.014 | 0.0144 | 0.0288 | 3 | 0.0146 | 0.0146 | 0.0281 | 0.0285 | 0.0427 | 0.0427 |
| | sec-Butylbenzene | µg/m$^2$,min$^{-1}$ | 16 | 6.3% | 15 | 0.0246 | 0.025 | 0.0258 | 0.0264 | 0.0262 | 0.0381 | 1 | 0.0265 | -- | 0.0265 | 0.0265 | -- | 0.0265 |
| | Styrene | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.0108 | 0.0112 | 0.0112 | 0.0116 | 0.0114 | 0.0165 | 0 | -- | -- | -- | -- | -- | -- |
| | tert-Butylbenzene | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.0246 | 0.025 | 0.0254 | 0.0261 | 0.0257 | 0.0377 | 0 | -- | -- | -- | -- | -- | -- |
| | Tetrachloroethene | µg/m$^2$,min$^{-1}$ | 16 | 6.3% | 15 | 0.0173 | 0.0173 | 0.0177 | 0.0183 | 0.0181 | 0.0262 | 1 | 0.02 | -- | 0.02 | 0.02 | -- | 0.02 |
| | Toluene | µg/m$^2$,min$^{-1}$ | 16 | 37.5% | 10 | 0.00962 | 0.00991 | 0.01 | 0.0119 | 0.0148 | 0.02 | 6 | 0.0312 | 0.0387 | 0.0543 | 0.0627 | 0.0859 | 0.121 |
| | Total Xylenes | µg/m$^2$,min$^{-1}$ | 16 | 43.8% | 9 | 0.0167 | 0.0169 | 0.0173 | 0.0197 | 0.0215 | 0.0325 | 7 | 0.0262 | 0.0304 | 0.0337 | 0.0616 | 0.0989 | 0.132 |
| | trans-1,2-Dichloroethene | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00846 | 0.00885 | 0.00885 | 0.00914 | 0.00885 | 0.0131 | 0 | -- | -- | -- | -- | -- | -- |
| | trans-1,3-Dichloropropene | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.0115 | 0.0119 | 0.0119 | 0.0124 | 0.0123 | 0.0181 | 0 | -- | -- | -- | -- | -- | -- |
| | Trichloroethene | µg/m$^2$,min$^{-1}$ | 16 | 6.3% | 15 | 0.0138 | 0.0142 | 0.0142 | 0.0206 | 0.0146 | 0.0627 | 1 | 0.114 | -- | 0.114 | 0.114 | -- | 0.114 |
| | Vinyl acetate | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00769 | 0.00769 | 0.00769 | 0.00798 | 0.00769 | 0.0115 | 0 | -- | -- | -- | -- | -- | -- |
| | Vinyl chloride | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00654 | 0.00664 | 0.00692 | 0.00702 | 0.00692 | 0.01 | 0 | -- | -- | -- | -- | -- | -- |

**TABLE 3-8**
**SOIL VAPOR FLUX SAMPLE RESULTS SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Compound List | Units | Total Count | Detect Freq. | Censored (Non-Detect) Data | | | | | | | Detected Data[1] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max |
| **Volatile Organic Compounds (SIM)** | 1,1,2,2-Tetrachloroethane | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00173 | 0.00177 | 0.00181 | 0.00198 | 0.00184 | 0.00465 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,1,2-Trichloroethane | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00138 | 0.00139 | 0.00142 | 0.00161 | 0.00146 | 0.00442 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,2,3-Trichloropropane | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00119 | 0.00123 | 0.00123 | 0.00124 | 0.00126 | 0.00127 | 0 | -- | -- | -- | -- | -- | -- |
| | 1,2-Dibromoethane | µg/m$^2$,min$^{-1}$ | 16 | 6.3% | 15 | 0.002 | 0.00204 | 0.00204 | 0.0027 | 0.00212 | 0.00969 | 1 | 0.00885 | -- | 0.00885 | 0.00885 | -- | 0.00885 |
| | 1,2-Dichlorobenzene | µg/m$^2$,min$^{-1}$ | 16 | 12.5% | 14 | 0.0015 | 0.00153 | 0.00154 | 0.00169 | 0.00162 | 0.00273 | 2 | 0.00165 | -- | 0.00242 | 0.00242 | -- | 0.00319 |
| | 1,2-Dichloroethane | µg/m$^2$,min$^{-1}$ | 16 | 6.3% | 15 | 0.00104 | 0.00108 | 0.00108 | 0.00109 | 0.00108 | 0.00112 | 1 | 0.00196 | -- | 0.00196 | 0.00196 | -- | 0.00196 |
| | 1,2-Dichloropropane | µg/m$^2$,min$^{-1}$ | 16 | 6.3% | 15 | 0.00119 | 0.00123 | 0.00123 | 0.00124 | 0.00127 | 0.00127 | 1 | 0.00135 | -- | 0.00135 | 0.00135 | -- | 0.00135 |
| | 1,3-Dichlorobenzene | µg/m$^2$,min$^{-1}$ | 16 | 6.3% | 15 | 0.00154 | 0.00158 | 0.00158 | 0.00178 | 0.00162 | 0.00331 | 1 | 0.00208 | -- | 0.00208 | 0.00208 | -- | 0.00208 |
| | 1,4-Dichlorobenzene | µg/m$^2$,min$^{-1}$ | 16 | 6.3% | 15 | 0.00154 | 0.00158 | 0.00158 | 0.00179 | 0.00162 | 0.00319 | 1 | 0.00235 | -- | 0.00235 | 0.00235 | -- | 0.00235 |
| | Benzene | µg/m$^2$,min$^{-1}$ | 16 | 93.8% | 1 | 0.00085 | -- | 0.00085 | 0.00085 | -- | 0.000846 | 15 | 0.00331 | 0.00412 | 0.00612 | 0.00742 | 0.0105 | 0.0162 |
| | Benzyl chloride | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00096 | 0.001 | 0.001 | 0.00101 | 0.00103 | 0.00104 | 0 | -- | -- | -- | -- | -- | -- |
| | Bromodichloromethane | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00112 | 0.00115 | 0.00115 | 0.00117 | 0.00119 | 0.00123 | 0 | -- | -- | -- | -- | -- | -- |
| | Carbon tetrachloride | µg/m$^2$,min$^{-1}$ | 16 | 100% | 0 | -- | -- | -- | -- | -- | -- | 16 | 0.00269 | 0.00531 | 0.00716 | 0.0074 | 0.00904 | 0.0167 |
| | Chloroform | µg/m$^2$,min$^{-1}$ | 16 | 100% | 0 | -- | -- | -- | -- | -- | -- | 16 | 0.00412 | 0.00807 | 0.0187 | 0.0178 | 0.0281 | 0.0333 |
| | Dibromochloromethane | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00158 | 0.00159 | 0.00162 | 0.00162 | 0.00164 | 0.00169 | 0 | -- | -- | -- | -- | -- | -- |
| | Dibromochloropropane | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00512 | 0.00524 | 0.00531 | 0.00532 | 0.00537 | 0.0055 | 0 | -- | -- | -- | -- | -- | -- |
| | Dichloromethane (Methylene chloride) | µg/m$^2$,min$^{-1}$ | 16 | 6.3% | 15 | 0.00089 | 0.00092 | 0.00092 | 0.00093 | 0.00092 | 0.000962 | 1 | 0.00408 | -- | 0.00408 | 0.00408 | -- | 0.00408 |
| | Hexachlorobutadiene | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00277 | 0.00281 | 0.00285 | 0.00285 | 0.00287 | 0.00296 | 0 | -- | -- | -- | -- | -- | -- |
| | Naphthalene | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00277 | 0.00285 | 0.00288 | 0.00288 | 0.00291 | 0.003 | 0 | -- | -- | -- | -- | -- | -- |
| | Tetrachloroethene | µg/m$^2$,min$^{-1}$ | 16 | 87.5% | 2 | 0.00177 | -- | 0.0037 | 0.0037 | -- | 0.00562 | 14 | 0.00254 | 0.00382 | 0.00619 | 0.00794 | 0.0134 | 0.018 |
| | Trichloroethene | µg/m$^2$,min$^{-1}$ | 16 | 6.3% | 15 | 0.00138 | 0.00142 | 0.00146 | 0.00186 | 0.00242 | 0.00346 | 1 | 0.00281 | -- | 0.00281 | 0.00281 | -- | 0.00281 |
| | Vinyl chloride | µg/m$^2$,min$^{-1}$ | 16 | 0% | 16 | 0.00065 | 0.00066 | 0.00069 | 0.00068 | 0.00069 | 0.000692 | 0 | -- | -- | -- | -- | -- | -- |

**Notes:**

Values for Q1, median, mean, and Q3 are rounded to 3 significant figures.

Max = Maximum

Min = Minimum

Q1 = 1st quartile (25th percentile)

Q3 = 3rd quartile (75th percentile)

(1) Range of detections include estimated values of detect results ("J" flagged values).

-- = Not applicable or no value has been established.

**TABLE 5-1**
**BACKGROUND COMPARISON SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 6)**

| | Galleria North School Site | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Censored (Non-Detect) Data | | | | | | | Detected Data[1] | | | | | | |
| Chemical | Total Count | Detect Freq. | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max |
| Aluminum | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 6210 | 9500 | 11000 | 10000 | 11000 | 14700 |
| Antimony | 53 | 0% | 53 | 0.225 | 0.32 | 0.32 | 0.46 | 0.32 | 2.7 | 0 | -- | -- | -- | -- | -- | -- |
| Arsenic | 53 | 96% | 2 | 5 | -- | 5.1 | 5.1 | -- | 5.1 | 51 | 2.6 | 3.8 | 4.7 | 4.8 | 5.5 | 8.8 |
| Barium | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 142 | 280 | 330 | 330 | 380 | 613 |
| **Beryllium** | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 0.4 | 0.58 | 0.63 | 0.65 | 0.68 | 1.1 |
| **Boron** | 53 | 13% | 46 | 16.5 | 17 | 17 | 20 | 17 | 53 | 7 | 17.2 | 18 | 21 | 26 | 39 | 47.1 |
| **Cadmium** | 53 | 74% | 14 | 0.1 | 0.1 | 0.1 | 0.15 | 0.26 | 0.27 | 39 | 0.11 | 0.12 | 0.14 | 0.17 | 0.18 | 0.44 |
| Calcium | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 15400 | 24000 | 29000 | 31000 | 35000 | 103000 |
| **Chromium** | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 7.3 | 14 | 16 | 17 | 19 | 62.8 |
| Chromium (VI) | 53 | 60% | 21 | 0.1 | 0.1 | 0.1 | 0.1 | 0.11 | 0.11 | 32 | 0.11 | 0.15 | 0.19 | 0.27 | 0.3 | 1.8 |
| Cobalt | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 5.2 | 8.8 | 9.6 | 9.7 | 11 | 12.8 |
| **Copper** | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 13.3 | 18 | 20 | 20 | 22 | 32.5 |
| Iron | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 10200 | 17000 | 19000 | 19000 | 20000 | 27300 |
| **Lead** | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 7 | 12 | 16 | 23 | 21 | 272 |
| Lithium | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 11.8 | 14 | 15 | 15 | 16 | 20.9 |
| Magnesium | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 7670 | 10000 | 11000 | 11000 | 12000 | 28500 |
| Manganese | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 295 | 480 | 540 | 540 | 610 | 808 |
| **Mercury** | 53 | 30% | 37 | 0.005 | 0.005 | 0.035 | 0.024 | 0.035 | 0.0373 | 16 | 0.0366 | 0.038 | 0.052 | 0.058 | 0.071 | 0.122 |
| **Molybdenum** | 53 | 85% | 8 | 0.47 | 2.5 | 2.6 | 2.3 | 2.6 | 2.7 | 45 | 0.58 | 0.75 | 0.93 | 1 | 1.1 | 3.2 |
| **Nickel** | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 13 | 16 | 17 | 17 | 19 | 28.2 |
| **Potassium** | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 1380 | 1900 | 2300 | 2300 | 2700 | 3710 |
| **Selenium** | 53 | 2% | 52 | 0.4 | 0.4 | 0.4 | 0.69 | 0.4 | 2.7 | 1 | 0.47 | -- | 0.47 | 0.47 | -- | 0.47 |
| Silver | 53 | 72% | 15 | 0.04 | 0.11 | 0.11 | 0.1 | 0.11 | 0.11 | 38 | 0.083 | 0.12 | 0.13 | 0.13 | 0.14 | 0.28 |

**TABLE 5-1**
**BACKGROUND COMPARISON SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 2 of 6)**

| | Galleria North School Site | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Censored (Non-Detect) Data | | | | | | | Detected Data[1] | | | | | | |
| Chemical | Total Count | Detect Freq. | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max |
| Sodium | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 247 | 520 | 830 | 940 | 1200 | 4420 |
| Strontium | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 189 | 270 | 310 | 330 | 390 | 623 |
| Thallium | 53 | 0% | 53 | 0.105 | 0.75 | 0.75 | 0.67 | 0.75 | 0.75 | 0 | -- | -- | -- | -- | -- | -- |
| **Tin** | 53 | 15% | 45 | 0.75 | 0.75 | 0.75 | 0.8 | 0.75 | 1.1 | 8 | 1 | 1.1 | 1.5 | 3 | 3.9 | 10.4 |
| **Titanium** | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 435 | 670 | 800 | 810 | 950 | 1350 |
| **Tungsten** | 53 | 6% | 50 | 0.185 | 1.3 | 1.3 | 1.2 | 1.3 | 2.6 | 3 | 1.4 | 1.4 | 2.9 | 2.5 | 3.2 | 3.2 |
| Uranium | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 0.59 | 0.86 | 1.1 | 1.1 | 1.3 | 2.5 |
| Vanadium | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 28.2 | 50 | 56 | 56 | 63 | 82.7 |
| **Zinc** | 53 | 100% | 0 | -- | -- | -- | -- | -- | -- | 53 | 33.6 | 46 | 52 | 57 | 59 | 155 |
| Radium-226 | 50 | 98.0% | 1 | -- | -- | -- | -- | -- | -- | 49 | 0.497 | 0.99 | 1.1 | 1.2 | 1.5 | 2.51 |
| Radium-228 | 50 | 92.0% | 4 | -- | -- | -- | -- | -- | -- | 46 | 0.405 | 0.94 | 1.3 | 1.3 | 1.5 | 2.41 |
| Thorium-228 | 50 | 98.0% | 1 | -- | -- | -- | -- | -- | -- | 49 | 0.421 | 1.2 | 1.5 | 1.4 | 1.7 | 2.31 |
| Thorium-230 | 50 | 92.0% | 4 | -- | -- | -- | -- | -- | -- | 46 | 0.537 | 0.91 | 1.0 | 1.1 | 1.2 | 2.11 |
| Thorium-232 | 50 | 100% | 0 | -- | -- | -- | -- | -- | -- | 50 | 0.509 | 1.1 | 1.4 | 1.4 | 1.6 | 2.32 |
| Uranium-233/234 | 50 | 74.0% | 13 | -- | -- | -- | -- | -- | -- | 37 | 0.13 | 0.82 | 1.0 | 0.99 | 1.1 | 1.79 |
| Uranium-235/236 | 50 | 10.0% | 45 | -- | -- | -- | -- | -- | -- | 5 | -0.0987 | 0.038 | 0.068 | 0.099 | 0.12 | 1 |
| Uranium-238 | 50 | 74.0% | 13 | -- | -- | -- | -- | -- | -- | 37 | -0.0422 | 0.82 | 1.0 | 0.96 | 1.2 | 1.58 |

Note: Background comparison statistics were performed using one-half the detection limit for metals and using GiSdT® (Neptune and Company 2009).
Max = Maximum
Min = Minimum
Q1 = 1st quartile (25th percentile)
Q3 = 3rd quartile (75th percentile)
(1) Range of detections include estimated values of detect results between the detection limit and reporting limit. As such some minimum detected concentrations may be below the minimum reporting limit. In these cases the respective sample results are flagged in the dataset.
(2) Geochemical evaluation of background is presented in Appendix H.
**BOLD with Highlight indicates Site concentrations are greater than background.**
WRS = Wilcoxon Rank Sum Test with the Gehan Modification
N/A = Not applicable.

**TABLE 5-1**
**BACKGROUND COMPARISON SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| | Qal Background | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Censored (Non-Detect) Data | | | | | | | Detected Data[1] | | | | | | |
| Chemical | Total Count | Detect Freq. | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max |
| Aluminum | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 3740 | 7100 | 8800 | 9000 | 11000 | 15500 |
| Antimony | 292 | 66% | 98 | 0.0394 | 0.13 | 0.33 | 0.22 | 0.33 | 0.3298 | 194 | 0.089 | 0.14 | 0.18 | 0.2 | 0.23 | 0.61 |
| Arsenic | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 2.1 | 3.6 | 4.7 | 5.4 | 6.5 | 27.6 |
| Barium | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 73 | 150 | 210 | 280 | 370 | 1350 |
| **Beryllium** | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 0.16 | 0.45 | 0.53 | 0.53 | 0.61 | 0.89 |
| **Boron** | 276 | 29% | 196 | 2.824 | 2.8 | 2.8 | 3.3 | 3.2 | 6.6 | 80 | 3 | 5.6 | 6.6 | 7.8 | 8.3 | 57 |
| **Cadmium** | 292 | 54% | 134 | 0.01 | 0.13 | 0.13 | 0.11 | 0.13 | 0.1291 | 158 | 0.034 | 0.077 | 0.091 | 0.096 | 0.11 | 0.26 |
| Calcium | 276 | 100% | 0 | -- | -- | -- | -- | -- | -- | 276 | 0.43 | 18000 | 24000 | 26000 | 31000 | 82800 |
| **Chromium** | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 1.1 | 8.2 | 10 | 10 | 12 | 24.2 |
| Chromium (VI) | 272 | 13% | 236 | 0.16 | 0.17 | 0.25 | 0.25 | 0.26 | 0.56 | 36 | 0.16 | 0.21 | 0.28 | 0.4 | 0.45 | 1.6 |
| Cobalt | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 3.5 | 5.3 | 7.2 | 7.2 | 8.8 | 16.3 |
| **Copper** | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 7.8 | 12 | 16 | 15 | 18 | 36.2 |
| Iron | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 5410 | 11000 | 13000 | 13000 | 15000 | 22500 |
| **Lead** | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 3 | 6.7 | 9.1 | 10 | 12 | 53 |
| Lithium | 276 | 86% | 39 | 1.4628 | 3.7 | 3.7 | 7.9 | 15 | 36.57 | 237 | 7.5 | 13 | 17 | 19 | 23 | 124 |
| Magnesium | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 1550 | 7300 | 9000 | 9100 | 11000 | 17500 |
| Manganese | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 87.5 | 270 | 350 | 370 | 450 | 2070 |
| **Mercury** | 284 | 50% | 141 | 0.00668 | 0.0067 | 0.0067 | 0.0068 | 0.0067 | 0.0072 | 143 | 0.007 | 0.01 | 0.015 | 0.018 | 0.022 | 0.11 |
| **Molybdenum** | 292 | 92% | 22 | 0.1046 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1046 | 270 | 0.17 | 0.4 | 0.51 | 0.6 | 0.69 | 2.3 |
| **Nickel** | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 7.8 | 12 | 15 | 15 | 16 | 30 |
| **Potassium** | 276 | 100% | 0 | -- | -- | -- | -- | -- | -- | 276 | 625 | 1300 | 1800 | 2200 | 2600 | 12600 |
| **Selenium** | 292 | 18% | 240 | 0.0467 | 0.16 | 0.32 | 0.27 | 0.32 | 0.36 | 52 | 0.1 | 0.23 | 0.29 | 0.29 | 0.36 | 0.6 |
| Silver | 292 | 58% | 123 | 0.11 | 0.26 | 0.26 | 0.24 | 0.26 | 0.2609 | 169 | 0.019 | 0.083 | 0.12 | 0.19 | 0.19 | 2.2 |

**TABLE 5-1**
**BACKGROUND COMPARISON SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 4 of 6)**

| | Qal Background | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Censored (Non-Detect) Data | | | | | | | Detected Data[1] | | | | | | |
| Chemical | Total Count | Detect Freq. | Count | Min | Q1 | Median | Mean | Q3 | Max | Count | Min | Q1 | Median | Mean | Q3 | Max |
| Sodium | 276 | 100% | 0 | -- | -- | -- | -- | -- | -- | 276 | 111 | 420 | 700 | 830 | 1000 | 4210 |
| Strontium | 276 | 100% | 0 | -- | -- | -- | -- | -- | -- | 276 | 69 | 180 | 240 | 260 | 320 | 808 |
| Thallium | 292 | 18% | 240 | 0.2 | 0.2 | 0.2 | 0.32 | 0.54 | 0.5428 | 52 | 0.1 | 0.19 | 1.1 | 0.84 | 1.4 | 2 |
| **Tin** | 276 | 82% | 50 | 0.0526 | 0.053 | 0.053 | 0.14 | 0.3 | 0.3 | 226 | 0.2 | 0.41 | 0.51 | 0.5 | 0.57 | 1 |
| **Titanium** | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 200 | 440 | 540 | 540 | 660 | 1010 |
| **Tungsten** | 276 | 18% | 225 | 0.0175 | 0.018 | 0.2 | 0.16 | 0.2 | 0.5 | 51 | 0.19 | 0.26 | 0.33 | 0.45 | 0.46 | 3.6 |
| Uranium | 275 | 100% | 0 | -- | -- | -- | -- | -- | -- | 275 | 0.43 | 0.9 | 1.1 | 1.2 | 1.4 | 4.3 |
| Vanadium | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 14.6 | 31 | 37 | 38 | 44 | 73.3 |
| **Zinc** | 292 | 100% | 0 | -- | -- | -- | -- | -- | -- | 292 | 15.4 | 30 | 34 | 36 | 40 | 121 |
| Radium-226 | 244 | 96% | 10 | -- | -- | -- | -- | -- | -- | 234 | 0.153 | 0.94 | 1.2 | 1.2 | 1.5 | 2.75 |
| Radium-228 | 223 | 90% | 22 | -- | -- | -- | -- | -- | -- | 201 | 0.452 | 1.3 | 1.5 | 1.6 | 1.9 | 2.94 |
| Thorium-228 | 288 | 100% | 0 | -- | -- | -- | -- | -- | -- | 288 | 0.944 | 1.4 | 1.6 | 1.7 | 1.9 | 3.37 |
| Thorium-230 | 288 | 98% | 6 | -- | -- | -- | -- | -- | -- | 282 | 0.552 | 1 | 1.3 | 1.4 | 1.6 | 3.64 |
| Thorium-232 | 288 | 100% | 0 | -- | -- | -- | -- | -- | -- | 288 | 0.898 | 1.4 | 1.5 | 1.5 | 1.7 | 2.8 |
| Uranium-233/234 | 274 | 76% | 66 | -- | -- | -- | -- | -- | -- | 208 | 0.47 | 0.92 | 1.2 | 1.3 | 1.6 | 4.78 |
| Uranium-235/236 | 274 | 59% | 112 | -- | -- | -- | -- | -- | -- | 162 | -0.000681 | 0.042 | 0.059 | 0.066 | 0.083 | 0.241 |
| Uranium-238 | 274 | 97% | 8 | -- | -- | -- | -- | -- | -- | 266 | 0.45 | 0.92 | 1.1 | 1.2 | 1.5 | 4.01 |

Note: Background comparison statistics were performed using one-half the detection limit for metals and using GiSdT® (Neptune and Company 2009).
Max = Maximum
Min = Minimum
Q1 = 1st quartile (25th percentile)
Q3 = 3rd quartile (75th percentile)
(1) Range of detections include estimated values of detect results between the detection limit and reporting limit. As such some minimum detected concentrations may be below the minimum reporting limit. In these cases the respective sample results are flagged in the dataset.
(2) Geochemical evaluation of background is presented in Appendix H.
**BOLD with Highlight indicates Site concentrations are greater than background.**
WRS = Wilcoxon Rank Sum Test with the Gehan Modification
N/A = Not applicable.

**TABLE 5-1**
**BACKGROUND COMPARISON SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | T Test *p* | Quantile Test *p* | Slippage Test *p* | WRS Test *p* | Statistical Tests Greater than Background? | Geochemical Evaluation Greater than Background?[(2)] | Greater than Background? | Units | Basis |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 2.6 E-9 | 7.5 E-1 | 1.0 E+0 | 5.9 E-8 | YES | NO | NO | mg/kg | Geochemical evaluation |
| Antimony | 9.7 E-2 | 1.0 E+0 | 1.0 E+0 | 3.6 E-9 | NO | N/A | NO | mg/kg | Multiple tests; ND in Site data |
| Arsenic | 1.0 E+0 | 1.0 E+0 | 1.0 E+0 | 8.5 E-1 | NO | NO | NO | mg/kg | Multiple tests; geochemical evaluation |
| Barium | 1.3 E-4 | 9.8 E-1 | 1.0 E+0 | 1.4 E-6 | YES | NO | NO | mg/kg | Geochemical evaluation |
| **Beryllium** | 4.9 E-7 | 1.9 E-1 | 4.0 E-3 | 1.4 E-8 | YES | N/A | YES | mg/kg | Multiple tests |
| **Boron** | 4.1 E-10 | 2.4 E-1 | 1.0 E+0 | 0.0 E+0 | YES | N/A | YES | mg/kg | Multiple tests |
| **Cadmium** | 9.3 E-9 | 2.1 E-15 | 8.5 E-5 | 1.5 E-12 | YES | N/A | YES | mg/kg | Multiple tests |
| Calcium | 3.5 E-3 | 6.4 E-1 | 1.6 E-1 | 6.7 E-5 | YES | NO | NO | mg/kg | Geochemical evaluation |
| **Chromium** | 1.2 E-8 | 3.6 E-13 | 4.0 E-3 | 0.0 E+0 | YES | N/A | YES | mg/kg | Multiple tests |
| Chromium (VI) | 2.6 E-1 | 3.7 E-2 | 1.6 E-1 | 1.0 E+0 | NO | N/A | NO | mg/kg | Multiple tests |
| Cobalt | 1.4 E-17 | 8.0 E-4 | 1.0 E+0 | 2.5 E-13 | YES | NO | NO | mg/kg | Geochemical evaluation |
| **Copper** | 1.2 E-12 | 1.2 E-4 | 1.0 E+0 | 5.9 E-13 | YES | N/A | YES | mg/kg | Multiple tests |
| Iron | 2.8 E-18 | 2.5 E-10 | 4.0 E-3 | 0.0 E+0 | YES | NO | NO | mg/kg | Geochemical evaluation |
| **Lead** | 6.3 E-3 | 8.3 E-6 | 2.6 E-2 | 3.3 E-16 | YES | N/A | YES | mg/kg | Multiple tests |
| Lithium | 1.0 E+0 | 1.0 E+0 | 1.0 E+0 | 9.1 E-1 | NO | N/A | NO | mg/kg | Multiple tests |
| Magnesium | 9.1 E-7 | 4.5 E-1 | 1.6 E-1 | 6.9 E-9 | YES | NO | NO | mg/kg | Geochemical evaluation |
| Manganese | 4.6 E-17 | 3.6 E-6 | 1.0 E+0 | 1.1 E-16 | YES | NO | NO | mg/kg | Geochemical evaluation |
| **Mercury** | 3.2 E-5 | 1.7 E-6 | 1.7 E-1 | 8.8 E-8 | YES | N/A | YES | mg/kg | Multiple tests |
| **Molybdenum** | 8.2 E-11 | 1.7 E-3 | 1.4 E-1 | 0.0 E+0 | YES | N/A | YES | mg/kg | Multiple tests |
| **Nickel** | 2.3 E-8 | 7.9 E-3 | 1.0 E+0 | 4.8 E-9 | YES | N/A | YES | mg/kg | Multiple tests |
| **Potassium** | 2.2 E-1 | 1.0 E+0 | 1.0 E+0 | 9.2 E-5 | YES | N/A | YES | mg/kg | WRS test |
| **Selenium** | 4.1 E-4 | 1.0 E+0 | 1.0 E+0 | 0.0 E+0 | YES | N/A | YES | mg/kg | Multiple tests |
| Silver | 1.0 E+0 | 9.8 E-1 | 1.0 E+0 | 1.0 E+0 | NO | N/A | NO | mg/kg | Multiple tests |

**TABLE 5-1**
**BACKGROUND COMPARISON SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 6 of 6)**

| Chemical | T Test *p* | Quantile Test *p* | Slippage Test *p* | WRS Test *p* | Statistical Tests Greater than Background? | Geochemical Evaluation Greater than Background?(2) | Greater than Background? | Units | Basis |
|---|---|---|---|---|---|---|---|---|---|
| Sodium | 1.3 E-1 | 9.3 E-1 | 1.6 E-1 | 3.3 E-2 | NO | N/A | NO | mg/kg | Multiple tests |
| Strontium | 5.4 E-5 | 2.7 E-1 | 1.0 E+0 | 1.5 E-6 | YES | NO | NO | mg/kg | Geochemical evaluation |
| Thallium | 3.9 E-2 | 1.0 E+0 | 1.0 E+0 | 1.6 E-13 | NO | N/A | NO | mg/kg | Multiple tests; ND in Site data |
| **Tin** | 4.1 E-2 | 1.4 E-1 | 1.0 E-5 | 0.0 E+0 | YES | N/A | YES | mg/kg | Multiple tests |
| **Titanium** | 2.0 E-13 | 4.3 E-11 | 4.0 E-8 | 6.7 E-16 | YES | N/A | YES | mg/kg | Multiple tests |
| **Tungsten** | 1.1 E-10 | 9.3 E-1 | 1.0 E+0 | 0.0 E+0 | YES | N/A | YES | mg/kg | Multiple tests |
| Uranium | 8.7 E-1 | 6.3 E-1 | 1.0 E+0 | 7.3 E-1 | NO | N/A | NO | mg/kg | Multiple tests |
| Vanadium | 3.3 E-20 | 6.6 E-12 | 1.6 E-1 | 0.0 E+0 | YES | NO | NO | mg/kg | Geochemical evaluation |
| **Zinc** | 4.2 E-9 | 1.5 E-13 | 2.6 E-2 | 0.0 E+0 | YES | N/A | YES | mg/kg | Multiple tests |
| Radium-226 | 5.4 E-1 | 6.0 E-1 | 1.0 E+0 | 5.1 E-1 | NO | N/A | NO | pCi/g | Multiple tests |
| Radium-228 | 1.0 E+0 | 9.1 E-1 | 1.0 E+0 | 1.0 E+0 | NO | N/A | NO | pCi/g | Multiple tests |
| Thorium-228 | 1.0 E+0 | 7.9 E-1 | 1.0 E+0 | 1.0 E+0 | NO | N/A | NO | pCi/g | Multiple tests |
| Thorium-230 | 1.0 E+0 | 1.0 E+0 | 1.0 E+0 | 1.0 E+0 | NO | N/A | NO | pCi/g | Multiple tests |
| Thorium-232 | 1.0 E+0 | 9.1 E-1 | 1.0 E+0 | 1.0 E+0 | NO | N/A | NO | pCi/g | Multiple tests |
| Uranium-233/234 | 1.0 E+0 | 1.0 E+0 | 1.0 E+0 | 1.0 E+0 | NO | N/A | NO | pCi/g | Multiple tests |
| Uranium-235/236 | 6.4 E-2 | 2.7 E-4 | 6.3 E-4 | 9.4 E-2 | NO | N/A | NO | pCi/g | All other radionuclides (and uranium metal) not greater than background; all results near noise level of instrument |
| Uranium-238 | 1.0 E+0 | 1.0 E+0 | 1.0 E+0 | 1.0 E+0 | NO | N/A | NO | pCi/g | Multiple tests |

Note: Background comparison statistics were performed using one-half the detection limit for metals and using GiSdT® (Neptune and Company 2009).
Max = Maximum
Min = Minimum
Q1 = 1st quartile (25th percentile)
Q3 = 3rd quartile (75th percentile)
(1) Range of detections include estimated values of detect results between the detection limit and reporting limit. As such some minimum detected concentrations may be below the minimum reporting limit. In these cases the respective sample results are flagged in the dataset.
(2) Geochemical evaluation of background is presented in Appendix H.
**BOLD with Highlight indicates Site concentrations are greater than background.**
WRS = Wilcoxon Rank Sum Test with the Gehan Modification
N/A = Not applicable.

**TABLE 5-5**
**COMPARISONS TO RESIDENTIAL SOIL BCLs AND MAXIMUM BACKGROUND LEVELS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 8)**

| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Max. Detect | Greater than Background? | Residential Soil BCL | 1/10th Residential Soil BCL | Max. Detect Greater than 1/10th Residential BCL |
|---|---|---|---|---|---|---|---|---|---|
| *Aldehydes* | | | | | | | | | |
| Acetaldehyde | mg/kg | 1 | 51 | 2.0% | 0.338 | -- | 13.9 | 1.39 | NO |
| Formaldehyde | mg/kg | 30 | 51 | 58.8% | 0.887 | -- | 10.6 | 1.06 | NO |
| *Asbestos* | | | | | | | | | |
| Asbestos | Structures | 1 | 1 | 4% | 1 | -- | -- | -- | -- |
| *Dioxins / Furans* | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | mg/kg | 34 | 35 | 97.1% | 200 | -- | -- | -- | -- |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | mg/kg | 26 | 35 | 74.3% | 1600 | -- | -- | -- | -- |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | mg/kg | 31 | 35 | 88.6% | 76 | -- | -- | -- | -- |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | mg/kg | 31 | 35 | 88.6% | 85 | -- | -- | -- | -- |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | mg/kg | 2 | 35 | 5.7% | 3.3 | -- | -- | -- | -- |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | mg/kg | 30 | 35 | 85.7% | 57 | -- | -- | -- | -- |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | mg/kg | 13 | 35 | 37.1% | 22 | -- | -- | -- | -- |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | mg/kg | 13 | 35 | 37.1% | 9 | -- | -- | -- | -- |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | mg/kg | 12 | 35 | 34.3% | 12 | -- | -- | -- | -- |
| 1,2,3,7,8-Pentachlorodibenzofuran | mg/kg | 31 | 35 | 88.6% | 48 | -- | -- | -- | -- |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | mg/kg | 4 | 35 | 11.4% | 3.6 | -- | -- | -- | -- |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | mg/kg | 18 | 35 | 51.4% | 18 | -- | -- | -- | -- |
| 2,3,4,7,8-Pentachlorodibenzofuran | mg/kg | 23 | 35 | 65.7% | 26 | -- | -- | -- | -- |
| 2,3,7,8-Tetrachlorodibenzofuran | mg/kg | 34 | 35 | 97.1% | 57 | -- | -- | -- | -- |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | mg/kg | 11 | 35 | 31.4% | 1.2 | -- | -- | -- | -- |
| Octachlorodibenzodioxin | mg/kg | 28 | 35 | 80.0% | 11000 | -- | -- | -- | -- |
| Octachlorodibenzofuran | mg/kg | 34 | 35 | 97.1% | 840 | -- | -- | -- | -- |
| TCDD TEQ | ppt | 35 | 35 | -- | 47 | -- | 50 | -- | -- |
| *General Chemistry/Ions* | | | | | | | | | |
| Ammonia (as N) | mg/kg | 10 | 49 | 20.4% | 8.2 | -- | -- | -- | -- |
| Bromide | mg/kg | 7 | 51 | 13.7% | 1.3 | -- | -- | -- | -- |
| Chlorate | mg/kg | 26 | 51 | 51.0% | 41.3 | -- | -- | -- | -- |
| Chloride | mg/kg | 51 | 51 | 100% | 2830 | -- | -- | -- | -- |
| Cyanide, Total | mg/kg | 10 | 51 | 19.6% | 5.8 | -- | 1220 | 122 | NO |
| Fluoride | mg/kg | 39 | 51 | 76.5% | 2.1 | -- | 3670 | 367 | NO |
| Nitrate | mg/kg | 51 | 51 | 100% | 121 | -- | 100000 | 10000 | NO |
| Nitrite | mg/kg | 9 | 51 | 17.6% | 2.1 | -- | 7820 | 782 | NO |
| Orthophosphate as P | mg/kg | 19 | 51 | 37.3% | 14.4 | -- | -- | -- | -- |
| Perchlorate | mg/kg | 50 | 50 | 100% | 28.6 | -- | 54.8 | 5.48 | YES |
| Sulfate | mg/kg | 51 | 51 | 100% | 17300 | -- | -- | -- | -- |
| Sulfide | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| Total Kjeldahl Nitrogen (TKN) | mg/kg | 51 | 51 | 100% | 1660 | -- | -- | -- | -- |

**TABLE 5-5**
**COMPARISONS TO RESIDENTIAL SOIL BCLs AND MAXIMUM BACKGROUND LEVELS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Max. Detect | Greater than Background? | Residential Soil BCL | 1/10th Residential Soil BCL | Max. Detect Greater than 1/10th Residential BCL |
|---|---|---|---|---|---|---|---|---|---|
| *Metals* | | | | | | | | | |
| Aluminum | mg/kg | 53 | 53 | 100% | 14700 | NO | 77200 | 7720 | -- |
| Antimony | mg/kg | 0 | 53 | 0% | -- | NO | 31.3 | 3.13 | -- |
| Arsenic | mg/kg | 51 | 53 | 96.2% | 8.8 | NO | 0.39 | 0.039 | -- |
| Barium | mg/kg | 53 | 53 | 100% | 613 | NO | 15300 | 1530 | -- |
| Beryllium | mg/kg | 53 | 53 | 100% | 1.1 | YES | 155 | 15.5 | NO |
| Boron | mg/kg | 7 | 53 | 13.2% | 47.1 | YES | 15600 | 1560 | NO |
| Cadmium | mg/kg | 39 | 53 | 73.6% | 0.44 | YES | 38.9 | 3.89 | NO |
| Calcium | mg/kg | 53 | 53 | 100% | 103000 | NO | -- | -- | -- |
| Chromium | mg/kg | 53 | 53 | 100% | 62.8 | YES | 100000 | 10000 | NO |
| Chromium (VI) | mg/kg | 32 | 53 | 60.4% | 1.8 | NO | 229 | 22.9 | -- |
| Cobalt | mg/kg | 53 | 53 | 100% | 12.8 | NO | 23.4 | 2.34 | -- |
| Copper | mg/kg | 53 | 53 | 100% | 32.5 | YES | 2910 | 291 | NO |
| Iron | mg/kg | 53 | 53 | 100% | 27300 | NO | 54800 | 5480 | -- |
| Lead | mg/kg | 53 | 53 | 100% | 272 | YES | 400 | -- | -- |
| Lithium | mg/kg | 53 | 53 | 100% | 20.9 | NO | 156 | 15.6 | -- |
| Magnesium | mg/kg | 53 | 53 | 100% | 28500 | NO | 100000 | 10000 | -- |
| Manganese | mg/kg | 53 | 53 | 100% | 808 | NO | 1080 | 108 | -- |
| Mercury | mg/kg | 16 | 53 | 30.2% | 0.122 | YES | 23.5 | 2.35 | NO |
| Molybdenum | mg/kg | 45 | 53 | 84.9% | 3.2 | YES | 391 | 39.1 | NO |
| Nickel | mg/kg | 53 | 53 | 100% | 28.2 | YES | 1540 | 154 | NO |
| Potassium | mg/kg | 53 | 53 | 100% | 3710 | YES | -- | -- | -- |
| Selenium | mg/kg | 1 | 53 | 1.9% | 0.47 | YES | 391 | 39.1 | NO |
| Silver | mg/kg | 38 | 53 | 71.7% | 0.28 | NO | 391 | 39.1 | -- |
| Sodium | mg/kg | 53 | 53 | 100% | 4420 | NO | -- | -- | -- |
| Strontium | mg/kg | 53 | 53 | 100% | 623 | NO | 46900 | 4690 | -- |
| Thallium | mg/kg | 0 | 53 | 0% | -- | NO | 5.48 | 0.548 | -- |
| Tin | mg/kg | 8 | 53 | 15.1% | 10.4 | YES | 46900 | 4690 | NO |
| Titanium | mg/kg | 53 | 53 | 100% | 1350 | YES | 100000 | 10000 | NO |
| Tungsten | mg/kg | 3 | 53 | 5.7% | 3.2 | YES | 587 | 58.7 | NO |
| Uranium | mg/kg | 53 | 53 | 100% | 2.5 | NO | 235 | 23.5 | -- |
| Vanadium | mg/kg | 53 | 53 | 100% | 82.7 | NO | 391 | 39.1 | -- |
| Zinc | mg/kg | 53 | 53 | 100% | 155 | YES | 23500 | 2350 | NO |
| *Organochlorine Pesticides* | | | | | | | | | |
| 2,4-DDD | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 2,4-DDE | mg/kg | 11 | 51 | 21.6% | 0.015 | -- | -- | -- | -- |
| 4,4-DDD | mg/kg | 1 | 51 | 2.0% | 0.0044 | -- | 2.44 | 0.244 | NO |
| 4,4-DDE | mg/kg | 22 | 51 | 43.1% | 0.031 | -- | 1.72 | 0.172 | NO |

**TABLE 5-5**
**COMPARISONS TO RESIDENTIAL SOIL BCLs AND MAXIMUM BACKGROUND LEVELS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Max. Detect | Greater than Background? | Residential Soil BCL | 1/10th Residential Soil BCL | Max. Detect Greater than 1/10th Residential BCL |
|---|---|---|---|---|---|---|---|---|---|
| 4,4-DDT | mg/kg | 20 | 51 | 39.2% | 0.016 | -- | 1.72 | 0.172 | NO |
| Aldrin | mg/kg | 0 | 51 | 0% | -- | -- | 0.0286 | 0.00286 | -- |
| alpha-BHC | mg/kg | 1 | 51 | 2.0% | 0.0022 | -- | 0.0902 | 0.00902 | NO |
| alpha-Chlordane | mg/kg | 2 | 51 | 3.9% | 0.0057 | -- | -- | -- | -- |
| beta-BHC | mg/kg | 18 | 51 | 35.3% | 0.019 | -- | 0.316 | 0.0316 | NO |
| Chlordane | mg/kg | 2 | 51 | 3.9% | 0.043 | -- | 1.62 | 0.162 | NO |
| delta-BHC | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| Dieldrin | mg/kg | 0 | 51 | 0% | -- | -- | 0.0304 | 0.00304 | -- |
| Endosulfan I | mg/kg | 0 | 51 | 0% | -- | -- | 367 | 36.7 | -- |
| Endosulfan II | mg/kg | 0 | 51 | 0% | -- | -- | 367 | 36.7 | -- |
| Endosulfan sulfate | mg/kg | 1 | 51 | 2.0% | 0.019 | -- | -- | -- | -- |
| Endrin | mg/kg | 1 | 51 | 2.0% | 0.0021 | -- | 18.3 | 1.83 | NO |
| Endrin aldehyde | mg/kg | 1 | 51 | 2.0% | 0.015 | -- | -- | -- | -- |
| Endrin ketone | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| gamma-BHC (Lindane) | mg/kg | 0 | 51 | 0% | -- | -- | 0.437 | 0.0437 | -- |
| gamma-Chlordane | mg/kg | 3 | 51 | 5.9% | 0.007 | -- | -- | -- | -- |
| Heptachlor | mg/kg | 0 | 51 | 0% | -- | -- | 0.108 | 0.0108 | -- |
| Heptachlor epoxide | mg/kg | 0 | 51 | 0% | -- | -- | 0.0535 | 0.00535 | -- |
| Methoxychlor | mg/kg | 6 | 51 | 11.8% | 0.025 | -- | 306 | 30.6 | NO |
| Toxaphene | mg/kg | 0 | 51 | 0% | -- | -- | 0.442 | 0.0442 | -- |
| *Polynuclear Aromatic Hydrocarbons* | | | | | | | | | |
| Acenaphthene | mg/kg | 1 | 50 | 2.0% | 0.00209 | -- | 4690 | 469 | NO |
| Acenaphthylene | mg/kg | 1 | 50 | 2.0% | 0.00206 | -- | 147 | 14.7 | NO |
| Anthracene | mg/kg | 8 | 50 | 16.0% | 0.00599 | -- | 23500 | 2350 | NO |
| Benzo(a)anthracene | mg/kg | 8 | 50 | 16.0% | 0.0576 | -- | 0.622 | 0.0622 | NO |
| Benzo(a)pyrene | mg/kg | 17 | 50 | 34.0% | 0.0585 | -- | 0.0622 | 0.00622 | YES |
| Benzo(b)fluoranthene | mg/kg | 19 | 50 | 38.0% | 0.129 | -- | 0.622 | 0.0622 | YES |
| Benzo(g,h,i)perylene | mg/kg | 6 | 50 | 12.0% | 0.0295 | -- | 2350 | 235 | NO |
| Benzo(k)fluoranthene | mg/kg | 6 | 50 | 12.0% | 0.00658 | -- | 6.21 | 0.621 | NO |
| Chrysene | mg/kg | 17 | 50 | 34.0% | 0.0904 | -- | 62.1 | 6.21 | NO |
| Dibenzo(a,h)anthracene | mg/kg | 4 | 50 | 8.0% | 0.0587 | -- | 0.0622 | 0.00622 | YES |
| Indeno(1,2,3-cd)pyrene | mg/kg | 5 | 50 | 10.0% | 0.0311 | -- | 0.622 | 0.0622 | NO |
| Phenanthrene | mg/kg | 17 | 50 | 34.0% | 0.0343 | -- | 24.5 | 2.45 | NO |
| Pyrene | mg/kg | 20 | 50 | 40.0% | 0.12 | -- | 2350 | 235 | NO |
| *Polychlorinated Biphenyls* | | | | | | | | | |
| PCB 105 | mg/kg | 34 | 35 | 97.1% | 590 | -- | -- | -- | -- |
| PCB 114 | mg/kg | 25 | 35 | 71.4% | 24 | -- | -- | -- | -- |
| PCB 118 | mg/kg | 35 | 35 | 100% | 1200 | -- | -- | -- | -- |

**TABLE 5-5**
**COMPARISONS TO RESIDENTIAL SOIL BCLs AND MAXIMUM BACKGROUND LEVELS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Max. Detect | Greater than Background? | Residential Soil BCL | 1/10th Residential Soil BCL | Max. Detect Greater than 1/10th Residential BCL |
|---|---|---|---|---|---|---|---|---|---|
| PCB 123 | mg/kg | 1 | 35 | 2.9% | 6.8 | -- | -- | -- | -- |
| PCB 126 | mg/kg | 21 | 35 | 60.0% | 11 | -- | -- | -- | -- |
| PCB 156 | mg/kg | 32 | 35 | 91.4% | 160 | -- | -- | -- | -- |
| PCB 157 | mg/kg | 23 | 35 | 65.7% | 39 | -- | -- | -- | -- |
| PCB 167 | mg/kg | 26 | 35 | 74.3% | 65 | -- | -- | -- | -- |
| PCB 169 | mg/kg | 4 | 35 | 11.4% | 6.2 | -- | -- | -- | -- |
| PCB 189 | mg/kg | 24 | 35 | 68.6% | 19 | -- | -- | -- | -- |
| PCB 209 | mg/kg | 35 | 35 | 100% | 6300 | -- | -- | -- | -- |
| PCB 77 | mg/kg | 2 | 35 | 5.7% | 7.4 | -- | -- | -- | -- |
| PCB 81 | mg/kg | 2 | 35 | 5.7% | 7.4 | -- | -- | -- | -- |
| *Radionuclides* | | | | | | | | | |
| Radium-226 | pCi/g | 49 | 50 | 98.0% | 2.51 | NO | 0.0071 | 0.00071 | -- |
| Radium-228 | pCi/g | 46 | 50 | 92.0% | 2.41 | NO | 0.013 | 0.0013 | -- |
| Thorium-228 | pCi/g | 49 | 50 | 98.0% | 2.31 | NO | 0.0078 | 0.00078 | -- |
| Thorium-230 | pCi/g | 46 | 50 | 92.0% | 2.11 | NO | 3.2 | 0.32 | -- |
| Thorium-232 | pCi/g | 50 | 50 | 100% | 2.32 | NO | 2.8 | 0.28 | -- |
| Uranium-233/234 | pCi/g | 37 | 50 | 74.0% | 1.79 | NO | 4.2 | 0.42 | -- |
| Uranium-235/236 | pCi/g | 5 | 50 | 10.0% | 1 | NO | 0.11 | 0.011 | -- |
| Uranium-238 | pCi/g | 37 | 50 | 74.0% | 1.58 | NO | 0.46 | 0.046 | -- |
| *Semi-Volatile Organic Compounds* | | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | mg/kg | 0 | 49 | 0% | -- | -- | 18.3 | 1.83 | -- |
| 1,2-Diphenylhydrazine | mg/kg | 0 | 49 | 0% | -- | -- | 0.608 | 0.0608 | -- |
| 1,4-Dioxane | mg/kg | 0 | 49 | 0% | -- | -- | 44.2 | 4.42 | -- |
| 2,2'-Dichlorobenzil | mg/kg | 0 | 49 | 0% | -- | -- | 23.5 | 2.35 | -- |
| 2,4,5-Trichlorophenol | mg/kg | 0 | 49 | 0% | -- | -- | 6110 | 611 | -- |
| 2,4,6-Trichlorophenol | mg/kg | 0 | 49 | 0% | -- | -- | 44.2 | 4.42 | -- |
| 2,4-Dichlorophenol | mg/kg | 0 | 49 | 0% | -- | -- | 183 | 18.3 | -- |
| 2,4-Dimethylphenol | mg/kg | 0 | 49 | 0% | -- | -- | 1220 | 122 | -- |
| 2,4-Dinitrophenol | mg/kg | 0 | 49 | 0% | -- | -- | 122 | 12.2 | -- |
| 2,4-Dinitrotoluene | mg/kg | 0 | 49 | 0% | -- | -- | 1.57 | 0.157 | -- |
| 2,6-Dinitrotoluene | mg/kg | 0 | 49 | 0% | -- | -- | 61.1 | 6.11 | -- |
| 2-Chloronaphthalene | mg/kg | 0 | 49 | 0% | -- | -- | 6260 | 626 | -- |
| 2-Chlorophenol | mg/kg | 0 | 49 | 0% | -- | -- | 391 | 39.1 | -- |
| 2-Methylnaphthalene | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| 2-Nitroaniline | mg/kg | 0 | 49 | 0% | -- | -- | 183 | 18.3 | -- |
| 2-Nitrophenol | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| 3,3-Dichlorobenzidine | mg/kg | 0 | 49 | 0% | -- | -- | 1.08 | 0.108 | -- |
| 3-Nitroaniline | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |

**TABLE 5-5**
**COMPARISONS TO RESIDENTIAL SOIL BCLs AND MAXIMUM BACKGROUND LEVELS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Max. Detect | Greater than Background? | Residential Soil BCL | 1/10th Residential Soil BCL | Max. Detect Greater than 1/10th Residential BCL |
|---|---|---|---|---|---|---|---|---|---|
| 4-Bromophenyl phenyl ether | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| 4-Chloro-3-methylphenol | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| 4-Chlorophenyl phenyl ether | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| 4-Chlorothioanisole | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| 4-Nitroaniline | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| 4-Nitrophenol | mg/kg | 0 | 49 | 0% | -- | -- | 489 | 48.9 | -- |
| Acetophenone | mg/kg | 0 | 49 | 0% | -- | -- | 1740 | 174 | -- |
| Aniline | mg/kg | 0 | 49 | 0% | -- | -- | 85.3 | 8.53 | -- |
| Benzenethiol | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| Benzoic acid | mg/kg | 1 | 49 | 2.0% | 0.32 | -- | 100000 | 10000 | NO |
| Benzyl alcohol | mg/kg | 0 | 49 | 0% | -- | -- | 30600 | 3060 | -- |
| bis(2-Chloroethoxy)methane | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| bis(2-Chloroethyl) ether | mg/kg | 0 | 49 | 0% | -- | -- | 0.244 | 0.0244 | -- |
| bis(2-Chloroisopropyl) ether | mg/kg | 0 | 49 | 0% | -- | -- | 3.38 | 0.338 | -- |
| bis(2-Ethylhexyl) phthalate | mg/kg | 4 | 49 | 8.2% | 1.04 | -- | 34.7 | 3.47 | NO |
| bis(p-Chlorophenyl) sulfone | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| bis(p-Chlorophenyl)disulfide | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| Butylbenzyl phthalate | mg/kg | 1 | 49 | 2.0% | 126 | -- | 240 | 24 | YES |
| Carbazole | mg/kg | 0 | 49 | 0% | -- | -- | 24.3 | 2.43 | -- |
| Dibenzofuran | mg/kg | 0 | 49 | 0% | -- | -- | 156 | 15.6 | -- |
| Dichloromethyl ether | mg/kg | 0 | 49 | 0% | -- | -- | 0.000242 | 0.0000242 | -- |
| Diethyl phthalate | mg/kg | 0 | 49 | 0% | -- | -- | 48900 | 4890 | -- |
| Dimethyl phthalate | mg/kg | 0 | 49 | 0% | -- |  | 100000 | 10000 | -- |
| Di-n-butyl phthalate | mg/kg | 1 | 49 | 2.0% | 0.115 | -- | 6110 | 611 | NO |
| Di-n-octyl phthalate | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| Diphenyl disulfide | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| Diphenyl sulfide | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| Diphenyl sulfone | mg/kg | 0 | 49 | 0% | -- | -- | 183 | 18.3 | -- |
| Diphenylamine | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| Fluoranthene | mg/kg | 6 | 49 | 12.2% | 0.127 | -- | 2290 | 229 | NO |
| Fluorene | mg/kg | 0 | 49 | 0% | -- | -- | 3130 | 313 | -- |
| Hexachlorobenzene | mg/kg | 0 | 49 | 0% | -- | -- | 0.304 | 0.0304 | -- |
| Hexachlorobutadiene | mg/kg | 0 | 49 | 0% | -- | -- | 6.24 | 0.624 | -- |
| Hexachlorocyclopentadiene | mg/kg | 0 | 49 | 0% | -- | -- | 366 | 36.6 | -- |
| Hexachloroethane | mg/kg | 0 | 49 | 0% | -- | -- | 34.7 | 3.47 | -- |
| Hydroxymethyl phthalimide | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| Isophorone | mg/kg | 0 | 49 | 0% | -- |  | 512 | 51.2 | -- |
| m,p-Cresols | mg/kg | 0 | 49 | 0% | -- | -- | 306 | 30.6 | -- |

**TABLE 5-5**
**COMPARISONS TO RESIDENTIAL SOIL BCLs AND MAXIMUM BACKGROUND LEVELS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Max. Detect | Greater than Background? | Residential Soil BCL | 1/10th Residential Soil BCL | Max. Detect Greater than 1/10th Residential BCL |
|---|---|---|---|---|---|---|---|---|---|
| Naphthalene | mg/kg | 0 | 49 | 0% | -- | -- | 3.1 | 0.31 | -- |
| Nitrobenzene | mg/kg | 0 | 49 | 0% | -- | -- | 2.69 | 0.269 | -- |
| N-nitrosodi-n-propylamine | mg/kg | 0 | 49 | 0% | -- | -- | 0.0695 | 0.00695 | -- |
| o-Cresol | mg/kg | 0 | 49 | 0% | -- | -- | 3060 | 306 | -- |
| Octachlorostyrene | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| p-Chloroaniline | mg/kg | 0 | 49 | 0% | -- | -- | 244 | 24.4 | -- |
| p-Chlorobenzenethiol | mg/kg | 0 | 49 | 0% | -- | -- | -- | -- | -- |
| Pentachlorobenzene | mg/kg | 0 | 49 | 0% | -- | -- | 48.9 | 4.89 | -- |
| Pentachlorophenol | mg/kg | 0 | 49 | 0% | -- | -- | 2.98 | 0.298 | -- |
| Phenol | mg/kg | 0 | 49 | 0% | -- | -- | 18300 | 1830 | -- |
| Phthalic acid | mg/kg | 1 | 49 | 2.0% | 0.387 | -- | 100000 | 10000 | NO |
| Pyridine | mg/kg | 0 | 49 | 0% | -- | -- | 61.1 | 6.11 | -- |
| *Volatile Organic Compounds* | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | mg/kg | 0 | 51 | 0% | -- | -- | 3.69 | 0.369 | -- |
| 1,1,1-Trichloroethane | mg/kg | 0 | 51 | 0% | -- | -- | 1390 | 139 | -- |
| 1,1,2,2-Tetrachloroethane | mg/kg | 0 | 51 | 0% | -- | -- | 0.472 | 0.0472 | -- |
| 1,1,2-Trichloroethane | mg/kg | 0 | 51 | 0% | -- | -- | 1.05 | 0.105 | -- |
| 1,1-Dichloroethane | mg/kg | 0 | 51 | 0% | -- | -- | 4.19 | 0.419 | -- |
| 1,1-Dichloroethene | mg/kg | 0 | 51 | 0% | -- | -- | 285 | 28.5 | -- |
| 1,1-Dichloropropene | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 1,2,3-Trichlorobenzene | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | mg/kg | 0 | 51 | 0% | -- | -- | 0.32 | 0.032 | -- |
| 1,2,4-Trichlorobenzene | mg/kg | 0 | 51 | 0% | -- | -- | 143 | 14.3 | -- |
| 1,2,4-Trimethylbenzene | mg/kg | 17 | 51 | 33.3% | 0.0017 | -- | 144 | 14.4 | NO |
| 1,2-Dichlorobenzene | mg/kg | 0 | 51 | 0% | -- | -- | 373 | 37.3 | -- |
| 1,2-Dichloroethane | mg/kg | 0 | 51 | 0% | -- | -- | 0.433 | 0.0433 | -- |
| 1,2-Dichloroethene | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 1,2-Dichloropropane | mg/kg | 0 | 51 | 0% | -- | -- | 0.82 | 0.082 | -- |
| 1,3,5-Trichlorobenzene | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 1,3,5-Trimethylbenzene | mg/kg | 1 | 51 | 2.0% | 0.00012 | -- | 49.8 | 4.98 | NO |
| 1,3-Dichlorobenzene | mg/kg | 0 | 51 | 0% | -- | -- | 235 | 23.5 | -- |
| 1,3-Dichloropropane | mg/kg | 0 | 51 | 0% | -- | -- | 1130 | 113 | -- |
| 1,4-Dichlorobenzene | mg/kg | 0 | 51 | 0% | -- | -- | 2.59 | 0.259 | -- |
| 2,2,3-Trimethylbutane | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 2,2-Dichloropropane | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 2,2-Dimethylpentane | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 2,3-Dimethylpentane | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 2,4-Dimethylpentane | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |

**TABLE 5-5**
**COMPARISONS TO RESIDENTIAL SOIL BCLs AND MAXIMUM BACKGROUND LEVELS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Max. Detect | Greater than Background? | Residential Soil BCL | 1/10th Residential Soil BCL | Max. Detect Greater than 1/10th Residential BCL |
|---|---|---|---|---|---|---|---|---|---|
| 2-Chlorotoluene | mg/kg | 0 | 51 | 0% | -- | -- | 511 | 51.1 | -- |
| 2-Hexanone | mg/kg | 0 | 51 | 0% | -- | -- | 460 | 46 | -- |
| 2-Methylhexane | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 2-Nitropropane | mg/kg | 0 | 51 | 0% | -- | -- | 0.0681 | 0.00681 | -- |
| 3,3-Dimethylpentane | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 3-Ethylpentane | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 3-Methylhexane | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 4-Chlorotoluene | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| 4-Methyl-2-pentanone (MIBK) | mg/kg | 0 | 51 | 0% | -- | -- | 5800 | 580 | -- |
| Acetone | mg/kg | 1 | 51 | 2.0% | 0.017 | -- | 60000 | 6000 | NO |
| Acetonitrile | mg/kg | 0 | 51 | 0% | -- | -- | 1470 | 147 | -- |
| Benzene | mg/kg | 0 | 51 | 0% | -- | -- | 0.81 | 0.081 | -- |
| Bromobenzene | mg/kg | 0 | 51 | 0% | -- | -- | 63.5 | 6.35 | -- |
| Bromodichloromethane | mg/kg | 0 | 51 | 0% | -- | -- | 10.3 | 1.03 | -- |
| Bromoform | mg/kg | 0 | 51 | 0% | -- | -- | 61.6 | 6.16 | -- |
| Bromomethane | mg/kg | 0 | 51 | 0% | -- | -- | 8.7 | 0.87 | -- |
| Carbon disulfide | mg/kg | 0 | 51 | 0% | -- | -- | 721 | 72.1 | -- |
| Carbon tetrachloride | mg/kg | 0 | 51 | 0% | -- | -- | 0.3 | 0.03 | -- |
| Chlorobenzene | mg/kg | 0 | 51 | 0% | -- | -- | 273 | 27.3 | -- |
| Chlorobromomethane | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| Chloroethane | mg/kg | 0 | 51 | 0% | -- | -- | 221 | 22.1 | -- |
| Chloroform | mg/kg | 0 | 51 | 0% | -- | -- | 0.306 | 0.0306 | -- |
| Chloromethane | mg/kg | 0 | 51 | 0% | -- | -- | 1.6 | 0.16 | -- |
| cis-1,2-Dichloroethene | mg/kg | 0 | 51 | 0% | -- | -- | 782 | 78.2 | -- |
| cis-1,3-Dichloropropene | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| Cymene (Isopropyltoluene) | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| Dibromochloromethane | mg/kg | 0 | 51 | 0% | -- | -- | 1.12 | 0.112 | -- |
| Dibromochloropropane | mg/kg | 0 | 51 | 0% | -- | -- | 0.0104 | 0.00104 | -- |
| Dibromomethane | mg/kg | 0 | 51 | 0% | -- | -- | 782 | 78.2 | -- |
| Dichloromethane (Methylene chloride) | mg/kg | 24 | 51 | 47.1% | 0.028 | -- | 11 | 1.1 | NO |
| Dimethyldisulfide | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| Ethanol | mg/kg | 0 | 51 | 0% | -- | -- | 100000 | 10000 | -- |
| Ethylbenzene | mg/kg | 3 | 51 | 5.9% | 0.000077 | -- | 3.79 | 0.379 | NO |
| Freon-11 (Trichlorofluoromethane) | mg/kg | 0 | 51 | 0% | -- | -- | 883 | 88.3 | -- |
| Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane) | mg/kg | 0 | 51 | 0% | -- | -- | 5550 | 555 | -- |
| Freon-12 (Dichlorodifluoromethane) | mg/kg | 0 | 51 | 0% | -- | -- | 218 | 21.8 | -- |
| Heptane | mg/kg | 0 | 51 | 0% | -- | -- | 220 | 22 | -- |
| Isopropylbenzene | mg/kg | 0 | 51 | 0% | -- | -- | 371 | 37.1 | -- |

**TABLE 5-5**
**COMPARISONS TO RESIDENTIAL SOIL BCLs AND MAXIMUM BACKGROUND LEVELS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Max. Detect | Greater than Background? | Residential Soil BCL | 1/10th Residential Soil BCL | Max. Detect Greater than 1/10th Residential BCL |
|---|---|---|---|---|---|---|---|---|---|
| m,p-Xylene | mg/kg | 0 | 51 | 0% | -- | -- | 214 | 21.4 | -- |
| Methyl ethyl ketone (2-Butanone) | mg/kg | 0 | 51 | 0% | -- | -- | 32100 | 3210 | -- |
| Methyl iodide | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| MTBE (Methyl tert-butyl ether) | mg/kg | 0 | 51 | 0% | -- | -- | 39.2 | 3.92 | -- |
| n-Butylbenzene | mg/kg | 0 | 51 | 0% | -- | -- | 237 | 23.7 | -- |
| Nonanal | mg/kg | 2 | 51 | 3.9% | 0.00098 | -- | -- | -- | -- |
| n-Propylbenzene | mg/kg | 0 | 51 | 0% | -- | -- | 237 | 23.7 | -- |
| o-Xylene | mg/kg | 0 | 51 | 0% | -- | -- | 282 | 28.2 | -- |
| sec-Butylbenzene | mg/kg | 0 | 51 | 0% | -- | -- | 223 | 22.3 | -- |
| Styrene | mg/kg | 0 | 51 | 0% | -- | -- | 1730 | 173 | -- |
| tert-Butylbenzene | mg/kg | 0 | 51 | 0% | -- | -- | 393 | 39.3 | -- |
| Tetrachloroethene | mg/kg | 0 | 51 | 0% | -- | -- | 0.624 | 0.0624 | -- |
| Toluene | mg/kg | 1 | 51 | 2.0% | 0.00036 | -- | 521 | 52.1 | NO |
| trans-1,2-Dichloroethene | mg/kg | 0 | 51 | 0% | -- | -- | 122 | 12.2 | -- |
| trans-1,3-Dichloropropene | mg/kg | 0 | 51 | 0% | -- | -- | -- | -- | -- |
| Trichloroethene | mg/kg | 0 | 51 | 0% | -- | -- | 1.06 | 0.106 | -- |
| Vinyl acetate | mg/kg | 0 | 51 | 0% | -- | -- | 988 | 98.8 | -- |
| Vinyl chloride | mg/kg | 0 | 51 | 0% | -- | -- | 0.349 | 0.0349 | -- |
| Xylenes (total) | mg/kg | 0 | 51 | 0% | -- | -- | 214 | 21.4 | -- |

mg/kg - milligrams per kilogram

pCi/g - picoCuries per gram

ppt - parts per trillion

-- - Not available or not applicable

Chemical with at least one detection was compared to it's respective BCL.

Dioxin/furans and PCB congeners are evaluated as TCDD TEQs. These constituents, as well as lead, are evaluated using a separate process (see text).

Highlight indicates metals exceeding background and other inorganic/organic chemicals exceeding 1/10th residential BCLs.

**TABLE 5-7**
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPC)**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Min ND | Max ND | Min Detect | Max Detect | Mean | Standard Deviation | Greater than Background? | PBT(1) or Class A Carcinogen? | COPC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Aldehydes* | | | | | | | | | | | | | | |
| Acetaldehyde | mg/kg | 1 | 51 | 2% | 0.306 | 0.503 | 0.338 | 0.338 | 0.33 | 0.031 | -- | No | No | (4)(13) |
| Formaldehyde | mg/kg | 30 | 51 | 59% | 0.208 | 0.385 | 0.205 | 0.887 | 0.32 | 0.16 | -- | No | No | (5)(13) |
| *Asbestos* | | | | | | | | | | | | | | |
| Asbestos | Structures | 1 | 25 | 4% | N/A | N/A | 1 | 1 | N/A | N/A | -- | Yes | Yes | (1) |
| *Dioxins / Furans* | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | mg/kg | 34 | 35 | 97% | 0.0000051 | 0.0000051 | 0.0000036 | 0.0002 | 0.000061 | 0.000061 | -- | Yes | No | (1)(3) |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | mg/kg | 26 | 35 | 74% | 0.0000012 | 0.0000051 | 0.0000027 | 0.0016 | 0.000062 | 0.00027 | -- | Yes | No | (1)(3) |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | mg/kg | 31 | 35 | 89% | 0.0000012 | 0.0000051 | 0.0000026 | 0.000076 | 0.000023 | 0.000023 | -- | Yes | No | (1)(3) |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | mg/kg | 31 | 35 | 89% | 0.0000015 | 0.0000051 | 0.0000039 | 0.000085 | 0.000026 | 0.000025 | -- | Yes | No | (1)(3) |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | mg/kg | 2 | 35 | 6% | 7.5E-08 | 0.0000058 | 0.0000026 | 0.0000033 | 0.0000026 | 0.0000022 | -- | Yes | No | (1)(3) |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | mg/kg | 30 | 35 | 86% | 8.9E-07 | 0.0000051 | 0.000003 | 0.000057 | 0.000018 | 0.000017 | -- | Yes | No | (1)(3) |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | mg/kg | 13 | 35 | 37% | 2.3E-07 | 0.0000053 | 0.0000029 | 0.000022 | 0.0000035 | 0.0000038 | -- | Yes | No | (1)(3) |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | mg/kg | 13 | 35 | 37% | 4.1E-07 | 0.0000053 | 0.0000027 | 0.000009 | 0.0000037 | 0.0000023 | -- | Yes | No | (1)(3) |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | mg/kg | 12 | 35 | 34% | 2.6E-07 | 0.0000053 | 0.0000031 | 0.000012 | 0.0000033 | 0.0000025 | -- | Yes | No | (1)(3) |
| 1,2,3,7,8-Pentachlorodibenzofuran | mg/kg | 31 | 35 | 89% | 7.6E-07 | 0.0000051 | 0.0000028 | 0.000048 | 0.000016 | 0.000015 | -- | Yes | No | (1)(3) |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | mg/kg | 4 | 35 | 11% | 0.0000001 | 0.0000055 | 0.0000033 | 0.0000036 | 0.0000027 | 0.000002 | -- | Yes | No | (1)(3) |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | mg/kg | 18 | 35 | 51% | 0.0000005 | 0.0000053 | 0.0000027 | 0.000018 | 0.0000058 | 0.0000046 | -- | Yes | No | (1)(3) |
| 2,3,4,7,8-Pentachlorodibenzofuran | mg/kg | 23 | 35 | 66% | 3.9E-07 | 0.0000053 | 0.0000033 | 0.000026 | 0.0000089 | 0.0000074 | -- | Yes | No | (1)(3) |
| 2,3,7,8-Tetrachlorodibenzofuran | mg/kg | 34 | 35 | 97% | 0.0000005 | 0.0000005 | 5.4E-07 | 0.000057 | 0.000011 | 0.000011 | -- | Yes | No | (1)(3) |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | mg/kg | 11 | 35 | 31% | 5.1E-08 | 0.0000011 | 6.6E-07 | 0.0000012 | 6.4E-07 | 3.7E-07 | -- | Yes | No | (1)(3) |
| Octachlorodibenzodioxin | mg/kg | 28 | 35 | 80% | 0.0000043 | 0.00002 | 0.0000054 | 0.011 | 0.0004 | 0.0018 | -- | Yes | No | (1)(3) |
| Octachlorodibenzofuran | mg/kg | 34 | 35 | 97% | 0.00001 | 0.00001 | 0.00001 | 0.00084 | 0.00021 | 0.00022 | -- | Yes | No | (1)(3) |
| TCDD TEQ | ppt | | 35 | --(4) | -- | -- | 0.58 | 47 | 16 | 14 | -- | Yes | No | (1)(3) |
| *General Chemistry/Ions* | | | | | | | | | | | | | | |
| Ammonia (as N) | mg/kg | 10 | 49 | 20% | 0.79 | 5.5 | 0.89 | 8.2 | 1.4 | 1.5 | -- | No | Yes | (5)(15) |
| Bromide | mg/kg | 7 | 51 | 14% | 0.26 | 0.29 | 0.39 | 1.3 | 0.35 | 0.23 | -- | No | No | (9) |
| Chlorate | mg/kg | 26 | 51 | 51% | 0.48 | 0.52 | 0.6 | 41.3 | 3 | 6.5 | -- | No | No | (9) |
| Chloride | mg/kg | 51 | 51 | 100% | -- | -- | 3.3 | 2830 | 330 | 570 | -- | No | No | (9) |
| Cyanide, Total | mg/kg | 10 | 51 | 20% | 0.083 | 0.57 | 0.54 | 5.8 | 0.6 | 0.77 | -- | No | No | (5)(13) |
| Fluoride | mg/kg | 39 | 51 | 76% | 0.1 | 0.11 | 0.15 | 2.1 | 0.68 | 0.54 | -- | No | No | (5)(13) |
| Nitrate | mg/kg | 51 | 51 | 100% | -- | -- | 1.3 | 121 | 17 | 27 | -- | No | No | (5)(13) |
| Nitrite | mg/kg | 9 | 51 | 18% | 0.033 | 3.4 | 0.087 | 2.1 | 0.33 | 0.67 | -- | No | No | (5)(13) |
| Orthophosphate as P | mg/kg | 19 | 51 | 37% | 0.51 | 5.7 | 0.74 | 14.4 | 3.3 | 4 | -- | No | No | (9) |
| Perchlorate | mg/kg | 50 | 50 | 100% | -- | -- | 0.017 | 28.6 | 3.3 | 6.4 | -- | No | Yes | (5)(14) |

**TABLE 5-7**
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPC)**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Min ND | Max ND | Min Detect | Max Detect | Mean | Standard Deviation | Greater than Background? | PBT(1) or Class A Carcinogen? | COPC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | mg/kg | 51 | 51 | 100% | -- | -- | 48.4 | 17300 | 3600 | 4200 | -- | No | No | (9) |
| Sulfide | mg/kg | 0 | 51 | 0% | 1.8 | 2 | -- | -- | 1.9 | 0.052 | -- | No | No | (2) |
| Total Kjeldahl Nitrogen (TKN) | mg/kg | 51 | 51 | 100% | -- | -- | 44.4 | 1660 | 240 | 330 | -- | No | No | (9) |
| *Metals* | | | | | | | | | | | | | | |
| Aluminum | mg/kg | 53 | 53 | 100% | -- | -- | 6210 | 14700 | 10000 | 1500 | NO | No | No | (6) |
| Antimony | mg/kg | 0 | 53 | 0% | 0.225 | 2.7 | -- | -- | 0.46 | 0.55 | NO | No | No | (2)(6) |
| Arsenic | mg/kg | 51 | 53 | 96% | 5 | 5.1 | 2.6 | 8.8 | 4.8 | 1.3 | NO | Yes | No | (1)(6) |
| Barium | mg/kg | 53 | 53 | 100% | -- | -- | 142 | 613 | 330 | 84 | NO | No | No | (6) |
| Beryllium | mg/kg | 53 | 53 | 100% | -- | -- | 0.4 | 1.1 | 0.65 | 0.13 | YES | No | No | (8)(13) |
| Boron | mg/kg | 7 | 53 | 13% | 16.5 | 53 | 17.2 | 47.1 | 21 | 11 | YES | No | No | (8)(13) |
| Cadmium | mg/kg | 39 | 53 | 74% | 0.1 | 0.27 | 0.11 | 0.44 | 0.16 | 0.072 | YES | No | No | (8)(13) |
| Calcium | mg/kg | 53 | 53 | 100% | -- | -- | 15400 | 103000 | 31000 | 12000 | YES | No | No | (12)(15) |
| Chromium | mg/kg | 53 | 53 | 100% | -- | -- | 7.3 | 62.8 | 17 | 7.6 | YES | No | No | (8)(13) |
| Chromium (VI) | mg/kg | 32 | 53 | 60% | 0.1 | 0.11 | 0.11 | 1.8 | 0.2 | 0.24 | NO | Yes | No | (1)(6) |
| Cobalt | mg/kg | 53 | 53 | 100% | -- | -- | 5.2 | 12.8 | 9.7 | 1.4 | NO | No | No | (6) |
| Copper | mg/kg | 53 | 53 | 100% | -- | -- | 13.3 | 32.5 | 20 | 3.4 | YES | No | No | (8)(13) |
| Iron | mg/kg | 53 | 53 | 100% | -- | -- | 10200 | 27300 | 19000 | 3100 | NO | No | No | (12)(6) |
| Lead | mg/kg | 53 | 53 | 100% | -- | -- | 7 | 272 | 23 | 36 | YES | Yes | No | (11) |
| Lithium | mg/kg | 53 | 53 | 100% | -- | -- | 11.8 | 20.9 | 15 | 2.1 | NO | No | No | (6) |
| Magnesium | mg/kg | 53 | 53 | 100% | -- | -- | 7670 | 28500 | 11000 | 2800 | NO | No | No | (12)(6) |
| Manganese | mg/kg | 53 | 53 | 100% | -- | -- | 295 | 808 | 540 | 100 | NO | No | No | (6) |
| Mercury | mg/kg | 16 | 53 | 30% | 0.005 | 0.0373 | 0.0366 | 0.122 | 0.034 | 0.024 | YES | No | No | (8)(13) |
| Molybdenum | mg/kg | 45 | 53 | 85% | 0.47 | 2.7 | 0.58 | 3.2 | 1.2 | 0.68 | YES | No | No | (8)(13) |
| Nickel | mg/kg | 53 | 53 | 100% | -- | -- | 13 | 28.2 | 17 | 2.7 | YES | No | No | (8)(13) |
| Potassium | mg/kg | 53 | 53 | 100% | -- | -- | 1380 | 3710 | 2300 | 520 | YES | No | No | (12)(15) |
| Selenium | mg/kg | 1 | 53 | 2% | 0.4 | 2.7 | 0.47 | 0.47 | 0.69 | 0.75 | YES | No | No | (4)(8)(13) |
| Silver | mg/kg | 38 | 53 | 72% | 0.04 | 0.11 | 0.083 | 0.28 | 0.12 | 0.035 | NO | No | No | (6) |
| Sodium | mg/kg | 53 | 53 | 100% | -- | -- | 247 | 4420 | 940 | 660 | NO | No | No | (12)(6) |
| Strontium | mg/kg | 53 | 53 | 100% | -- | -- | 189 | 623 | 330 | 97 | NO | No | No | (6) |
| Thallium | mg/kg | 0 | 53 | 0% | 0.105 | 0.75 | -- | -- | 0.67 | 0.2 | NO | No | No | (2)(6) |
| Tin | mg/kg | 8 | 53 | 15% | 0.75 | 1.1 | 1 | 10.4 | 1.1 | 1.4 | YES | No | No | (8)(13) |
| Titanium | mg/kg | 53 | 53 | 100% | -- | -- | 435 | 1350 | 810 | 200 | YES | No | No | (8)(13) |
| Tungsten | mg/kg | 3 | 53 | 6% | 0.185 | 2.6 | 1.4 | 3.2 | 1.3 | 0.54 | YES | No | No | (8)(13) |
| Uranium | mg/kg | 53 | 53 | 100% | -- | -- | 0.59 | 2.5 | 1.1 | 0.37 | NO | No | No | (6) |
| Vanadium | mg/kg | 53 | 53 | 100% | -- | -- | 28.2 | 82.7 | 56 | 9.6 | NO | No | No | (6) |

**TABLE 5-7**
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPC)**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Min ND | Max ND | Min Detect | Max Detect | Mean | Standard Deviation | Greater than Background? | PBT(1) or Class A Carcinogen? | COPC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zinc | mg/kg | 53 | 53 | 100% | -- | -- | 33.6 | 155 | 57 | 22 | YES | No | No | (8)(13) |
| *Organochlorine Pesticides* | | | | | | | | | | | | | | |
| 2,4-DDD | mg/kg | 0 | 51 | 0% | 0.00031 | 0.0016 | -- | -- | 0.00035 | 0.00018 | -- | Yes | No | (2) |
| 2,4-DDE | mg/kg | 11 | 51 | 22% | 0.00021 | 0.001 | 0.002 | 0.015 | 0.0013 | 0.0027 | -- | Yes | No | (1)(5)(13) |
| 4,4-DDD | mg/kg | 1 | 51 | 2% | 0.00009 | 0.00046 | 0.0044 | 0.0044 | 0.00019 | 0.0006 | -- | Yes | No | (7)(13) |
| 4,4-DDE | mg/kg | 22 | 51 | 43% | 0.0002 | 0.00099 | 0.0018 | 0.031 | 0.0035 | 0.0061 | -- | Yes | No | (1)(5)(13) |
| 4,4-DDT | mg/kg | 20 | 51 | 39% | 0.00021 | 0.001 | 0.0018 | 0.016 | 0.0021 | 0.0035 | -- | Yes | No | (1)(5)(13) |
| Aldrin | mg/kg | 0 | 51 | 0% | 0.000096 | 0.00049 | -- | -- | 0.00011 | 0.000055 | -- | Yes | No | (2) |
| alpha-BHC | mg/kg | 1 | 51 | 2% | 0.00028 | 0.0014 | 0.0022 | 0.0022 | 0.00036 | 0.00031 | -- | No | No | (4)(13) |
| alpha-Chlordane | mg/kg | 2 | 51 | 4% | 0.00021 | 0.0011 | 0.0022 | 0.0057 | 0.00038 | 0.00082 | -- | Yes | No | (7)(13) |
| beta-BHC | mg/kg | 18 | 51 | 35% | 0.00019 | 0.00096 | 0.0022 | 0.019 | 0.0026 | 0.0042 | -- | No | No | (5)(13) |
| Chlordane | mg/kg | 2 | 51 | 4% | 0.0024 | 0.012 | 0.02 | 0.043 | 0.0038 | 0.0062 | -- | Yes | No | (7)(13) |
| delta-BHC | mg/kg | 0 | 51 | 0% | 0.00017 | 0.00086 | -- | -- | 0.00019 | 0.000096 | -- | No | No | (2) |
| Dieldrin | mg/kg | 0 | 51 | 0% | 0.000092 | 0.00047 | -- | -- | 0.0001 | 0.000052 | -- | Yes | No | (2) |
| Endosulfan I | mg/kg | 0 | 51 | 0% | 0.00011 | 0.00054 | -- | -- | 0.00012 | 0.00006 | -- | No | No | (2) |
| Endosulfan II | mg/kg | 0 | 51 | 0% | 0.000094 | 0.00048 | -- | -- | 0.00011 | 0.000054 | -- | No | No | (2) |
| Endosulfan sulfate | mg/kg | 1 | 51 | 2% | 0.00026 | 0.0013 | 0.019 | 0.019 | 0.00066 | 0.0026 | -- | No | No | (4)(13) |
| Endrin | mg/kg | 1 | 51 | 2% | 0.000084 | 0.00043 | 0.0021 | 0.0021 | 0.00013 | 0.00028 | -- | No | No | (4)(13) |
| Endrin aldehyde | mg/kg | 1 | 51 | 2% | 0.00018 | 0.00092 | 0.015 | 0.015 | 0.0005 | 0.0021 | -- | No | No | (4)(13) |
| Endrin ketone | mg/kg | 0 | 51 | 0% | 0.00016 | 0.00084 | -- | -- | 0.00018 | 0.000094 | -- | No | No | (2) |
| gamma-BHC (Lindane) | mg/kg | 0 | 51 | 0% | 0.00012 | 0.00063 | -- | -- | 0.00014 | 0.00007 | -- | No | No | (2) |
| gamma-Chlordane | mg/kg | 3 | 51 | 6% | 0.000084 | 0.00043 | 0.0022 | 0.007 | 0.00032 | 0.0011 | -- | Yes | No | (5)(13) |
| Heptachlor | mg/kg | 0 | 51 | 0% | 0.00017 | 0.00088 | -- | -- | 0.00019 | 0.000098 | -- | No | No | (2) |
| Heptachlor epoxide | mg/kg | 0 | 51 | 0% | 0.00013 | 0.00067 | -- | -- | 0.00015 | 0.000074 | -- | No | No | (2) |
| Methoxychlor | mg/kg | 6 | 51 | 12% | 0.00032 | 0.0016 | 0.0023 | 0.025 | 0.0017 | 0.0046 | -- | No | No | (5)(13) |
| Toxaphene | mg/kg | 0 | 51 | 0% | 0.0059 | 0.03 | -- | -- | 0.0066 | 0.0033 | -- | Yes | No | (2) |
| *Polynuclear Aromatic Hydrocarbons* | | | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 1 | 50 | 2% | 0.00169 | 0.00183 | 0.00209 | 0.00209 | 0.0018 | 0.000057 | -- | No | No | (4)(13) |
| Acenaphthylene | mg/kg | 1 | 50 | 2% | 0.00169 | 0.00183 | 0.00206 | 0.00206 | 0.0018 | 0.000053 | -- | No | No | (4)(13) |
| Anthracene | mg/kg | 8 | 50 | 16% | 0.00169 | 0.00183 | 0.0019 | 0.00599 | 0.002 | 0.00068 | -- | No | No | (5)(13) |
| Benzo(a)anthracene | mg/kg | 8 | 50 | 16% | 0.00169 | 0.00183 | 0.00225 | 0.0576 | 0.0035 | 0.0081 | -- | No | Yes | (5)(13)(10) |
| Benzo(a)pyrene | mg/kg | 17 | 50 | 34% | 0.00169 | 0.00182 | 0.00185 | 0.0585 | 0.0045 | 0.0091 | -- | Yes | Yes | (1)(5)(14) |
| Benzo(b)fluoranthene | mg/kg | 19 | 50 | 38% | 0.0017 | 0.00183 | 0.0022 | 0.129 | 0.0084 | 0.021 | -- | No | Yes | (1)(5)(14) |
| Benzo(g,h,i)perylene | mg/kg | 6 | 50 | 12% | 0.00169 | 0.00183 | 0.00224 | 0.0295 | 0.0026 | 0.0041 | -- | No | No | (5)(13) |
| Benzo(k)fluoranthene | mg/kg | 6 | 50 | 12% | 0.00169 | 0.00182 | 0.00229 | 0.00658 | 0.002 | 0.00086 | -- | No | Yes | (5)(13)(10) |

**TABLE 5-7**
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPC)**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Min ND | Max ND | Min Detect | Max Detect | Mean | Standard Deviation | Greater than Background? | PBT(1) or Class A Carcinogen? | COPC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chrysene | mg/kg | 17 | 50 | 34% | 0.00169 | 0.00182 | 0.00231 | 0.0904 | 0.0065 | 0.015 | -- | No | Yes | (5)(13)(10) |
| Dibenzo(a,h)anthracene | mg/kg | 4 | 50 | 8% | 0.00169 | 0.00182 | 0.00208 | 0.0587 | 0.0032 | 0.0082 | -- | No | Yes | (1)(5)(14) |
| Indeno(1,2,3-cd)pyrene | mg/kg | 5 | 50 | 10% | 0.00169 | 0.00183 | 0.00195 | 0.0311 | 0.0025 | 0.0042 | -- | No | Yes | (5)(13)(10) |
| Phenanthrene | mg/kg | 17 | 50 | 34% | 0.0017 | 0.00183 | 0.0022 | 0.0343 | 0.0042 | 0.0063 | -- | No | No | (5)(13) |
| Pyrene | mg/kg | 20 | 50 | 40% | 0.0017 | 0.00182 | 0.00248 | 0.12 | 0.0088 | 0.019 | -- | No | No | (5)(13) |
| *Polychlorinated Biphenyls* | | | | | | | | | | | | | | |
| PCB 105 | mg/kg | 34 | 35 | 97% | 0.0000021 | 0.0000021 | 0.0000022 | 0.00059 | 0.000075 | 0.00013 | -- | Yes | No | (1)(3) |
| PCB 114 | mg/kg | 25 | 35 | 71% | 0.0000019 | 0.0000021 | 0.0000021 | 0.000024 | 0.0000066 | 0.0000063 | -- | Yes | No | (1)(3) |
| PCB 118 | mg/kg | 35 | 35 | 100% | -- | -- | 0.0000047 | 0.0012 | 0.00014 | 0.00025 | -- | Yes | No | (1)(3) |
| PCB 123 | mg/kg | 1 | 35 | 3% | 0.0000019 | 0.000035 | 0.0000068 | 0.0000068 | 0.0000073 | 0.0000092 | -- | Yes | No | (1)(3) |
| PCB 126 | mg/kg | 21 | 35 | 60% | 0.0000019 | 0.0000021 | 0.0000022 | 0.000011 | 0.000004 | 0.0000025 | -- | Yes | No | (1)(3) |
| PCB 156 | mg/kg | 32 | 35 | 91% | 0.000002 | 0.0000021 | 0.0000026 | 0.00016 | 0.000027 | 0.000037 | -- | Yes | No | (1)(3) |
| PCB 157 | mg/kg | 23 | 35 | 66% | 0.0000019 | 0.0000021 | 0.0000024 | 0.000039 | 0.0000066 | 0.0000084 | -- | Yes | No | (1)(3) |
| PCB 167 | mg/kg | 26 | 35 | 74% | 0.0000019 | 0.0000021 | 0.0000021 | 0.000065 | 0.000011 | 0.000013 | -- | Yes | No | (1)(3) |
| PCB 169 | mg/kg | 4 | 35 | 11% | 0.0000019 | 0.0000023 | 0.0000022 | 0.0000062 | 0.0000022 | 0.0000007 | -- | Yes | No | (1)(3) |
| PCB 189 | mg/kg | 24 | 35 | 69% | 0.0000019 | 0.0000021 | 0.0000028 | 0.000019 | 0.0000067 | 0.0000048 | -- | Yes | No | (1)(3) |
| PCB 209 | mg/kg | 35 | 35 | 100% | -- | -- | 0.00003 | 0.0063 | 0.0013 | 0.0013 | -- | Yes | No | (1)(3) |
| PCB 77 | mg/kg | 2 | 35 | 6% | 0.000002 | 0.000052 | 0.0000021 | 0.0000074 | 0.000014 | 0.000013 | -- | Yes | No | (1)(3) |
| PCB 81 | mg/kg | 2 | 35 | 6% | 0.0000019 | 0.000032 | 0.0000034 | 0.0000074 | 0.0000055 | 0.0000062 | -- | Yes | No | (1)(3) |
| *Radionuclides* | | | | | | | | | | | | | | |
| Radium-226 | pCi/g | 49 | 50 | 98% | -- | -- | 0.497 | 2.51 | 1.2 | 0.42 | NO | Yes | No | (1)(6) |
| Radium-228 | pCi/g | 46 | 50 | 92% | -- | -- | 0.405 | 2.41 | 1.3 | 0.49 | NO | Yes | No | (1)(6) |
| Thorium-228 | pCi/g | 49 | 50 | 98% | -- | -- | 0.421 | 2.31 | 1.4 | 0.41 | NO | Yes | No | (1)(6) |
| Thorium-230 | pCi/g | 46 | 50 | 92% | -- | -- | 0.537 | 2.11 | 1.1 | 0.33 | NO | Yes | No | (1)(6) |
| Thorium-232 | pCi/g | 50 | 50 | 100% | -- | -- | 0.509 | 2.32 | 1.4 | 0.38 | NO | Yes | No | (1)(6) |
| Uranium-233/234 | pCi/g | 37 | 50 | 74% | -- | -- | 0.13 | 1.79 | 0.99 | 0.32 | NO | Yes | No | (1)(6) |
| Uranium-235/236 | pCi/g | 5 | 50 | 10% | -- | -- | -0.0987 | 1 | 0.099 | 0.15 | NO | Yes | No | (1)(6) |
| Uranium-238 | pCi/g | 37 | 50 | 74% | -- | -- | -0.0422 | 1.58 | 0.96 | 0.31 | NO | Yes | No | (1)(6) |
| *Semi-Volatile Organic Compounds* | | | | | | | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| 1,2-Diphenylhydrazine | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| 1,4-Dioxane | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| 2,2'-Dichlorobenzil | mg/kg | 0 | 49 | 0% | 0.112 | 0.121 | -- | -- | 0.12 | 0.0019 | -- | No | No | (2) |
| 2,4,5-Trichlorophenol | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| 2,4,6-Trichlorophenol | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |

**TABLE 5-7**
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPC)**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Min ND | Max ND | Min Detect | Max Detect | Mean | Standard Deviation | Greater than Background? | PBT(1) or Class A Carcinogen? | COPC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,4-Dichlorophenol | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| 2,4-Dimethylphenol | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| 2,4-Dinitrophenol | mg/kg | 0 | 49 | 0% | 0.129 | 0.139 | -- | -- | 0.13 | 0.0022 | -- | No | No | (2) |
| 2,4-Dinitrotoluene | mg/kg | 0 | 49 | 0% | 0.0338 | 0.0366 | -- | -- | 0.035 | 0.00059 | -- | No | No | (2) |
| 2,6-Dinitrotoluene | mg/kg | 0 | 49 | 0% | 0.0338 | 0.0366 | -- | -- | 0.035 | 0.00059 | -- | No | No | (2) |
| 2-Chloronaphthalene | mg/kg | 0 | 49 | 0% | 0.0118 | 0.0128 | -- | -- | 0.012 | 0.00021 | -- | No | No | (2) |
| 2-Chlorophenol | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| 2-Methylnaphthalene | mg/kg | 0 | 49 | 0% | 0.00677 | 0.00733 | -- | -- | 0.007 | 0.00012 | -- | No | No | (2) |
| 2-Nitroaniline | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| 2-Nitrophenol | mg/kg | 0 | 49 | 0% | 0.0338 | 0.0366 | -- | -- | 0.035 | 0.00059 | -- | No | No | (2) |
| 3,3-Dichlorobenzidine | mg/kg | 0 | 49 | 0% | 0.102 | 0.11 | -- | -- | 0.11 | 0.0018 | -- | No | No | (2) |
| 3-Nitroaniline | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| 4-Bromophenyl phenyl ether | mg/kg | 0 | 49 | 0% | 0.0338 | 0.0366 | -- | -- | 0.035 | 0.00059 | -- | No | No | (2) |
| 4-Chloro-3-methylphenol | mg/kg | 0 | 49 | 0% | 0.0338 | 0.0366 | -- | -- | 0.035 | 0.00059 | -- | No | No | (2) |
| 4-Chlorophenyl phenyl ether | mg/kg | 0 | 49 | 0% | 0.0338 | 0.0366 | -- | -- | 0.035 | 0.00059 | -- | No | No | (2) |
| 4-Chlorothioanisole | mg/kg | 0 | 49 | 0% | 0.112 | 0.121 | -- | -- | 0.12 | 0.0019 | -- | No | No | (2) |
| 4-Nitroaniline | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| 4-Nitrophenol | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| Acetophenone | mg/kg | 0 | 49 | 0% | 0.0338 | 0.0366 | -- | -- | 0.035 | 0.00059 | -- | No | No | (2) |
| Aniline | mg/kg | 0 | 49 | 0% | 0.118 | 0.128 | -- | -- | 0.12 | 0.0021 | -- | No | No | (2) |
| Benzenethiol | mg/kg | 0 | 49 | 0% | 0.112 | 0.121 | -- | -- | 0.12 | 0.0019 | -- | No | No | (2) |
| Benzoic acid | mg/kg | 1 | 49 | 2% | 0.169 | 0.183 | 0.32 | 0.32 | 0.18 | 0.021 | -- | No | No | (4)(13) |
| Benzyl alcohol | mg/kg | 0 | 49 | 0% | 0.102 | 0.11 | -- | -- | 0.11 | 0.0018 | -- | No | No | (2) |
| bis(2-Chloroethoxy)methane | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | Yes | No | (2) |
| bis(2-Chloroethyl) ether | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| bis(2-Chloroisopropyl) ether | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| bis(2-Ethylhexyl) phthalate | mg/kg | 4 | 49 | 8% | 0.0677 | 0.11 | 0.077 | 1.04 | 0.099 | 0.14 | -- | No | No | (5)(13) |
| bis(p-Chlorophenyl) sulfone | mg/kg | 0 | 49 | 0% | 0.112 | 0.121 | -- | -- | 0.12 | 0.0019 | -- | No | No | (2) |
| bis(p-Chlorophenyl)disulfide | mg/kg | 0 | 49 | 0% | 0.112 | 0.121 | -- | -- | 0.12 | 0.0019 | -- | No | No | (2) |
| Butylbenzyl phthalate | mg/kg | 1 | 49 | 2% | 0.0677 | 0.0733 | 126 | 126 | 2.6 | 18 | -- | No | Yes | (4)(14) |
| Carbazole | mg/kg | 0 | 49 | 0% | 0.0102 | 0.011 | -- | -- | 0.011 | 0.00018 | -- | No | No | (2) |
| Dibenzofuran | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| Dichloromethyl ether | mg/kg | 0 | 49 | 0% | 0.112 | 0.121 | -- | -- | 0.12 | 0.0019 | -- | No | No | (2) |
| Diethyl phthalate | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| Dimethyl phthalate | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |

**TABLE 5-7**
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPC)**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Min ND | Max ND | Min Detect | Max Detect | Mean | Standard Deviation | Greater than Background? | PBT(1) or Class A Carcinogen? | COPC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Di-n-butyl phthalate | mg/kg | 1 | 49 | 2% | 0.0338 | 0.0366 | 0.115 | 0.115 | 0.037 | 0.011 | -- | No | No | (4)(13) |
| Di-n-octyl phthalate | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| Diphenyl disulfide | mg/kg | 0 | 49 | 0% | 0.112 | 0.121 | -- | -- | 0.12 | 0.0019 | -- | No | No | (2) |
| Diphenyl sulfide | mg/kg | 0 | 49 | 0% | 0.112 | 0.121 | -- | -- | 0.12 | 0.0019 | -- | No | No | (2) |
| Diphenyl sulfone | mg/kg | 0 | 49 | 0% | 0.112 | 0.121 | -- | -- | 0.12 | 0.0019 | -- | No | No | (2) |
| Diphenylamine | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| Fluoranthene | mg/kg | 6 | 49 | 12% | 0.0102 | 0.011 | 0.0127 | 0.127 | 0.015 | 0.019 | -- | No | No | (5)(13) |
| Fluorene | mg/kg | 0 | 49 | 0% | 0.0102 | 0.011 | -- | -- | 0.011 | 0.00018 | -- | No | No | (2) |
| Hexachlorobenzene | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | Yes | No | (2) |
| Hexachlorobutadiene | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| Hexachlorocyclopentadiene | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| Hexachloroethane | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| Hydroxymethyl phthalimide | mg/kg | 0 | 49 | 0% | 0.112 | 0.121 | -- | -- | 0.12 | 0.0019 | -- | No | No | (2) |
| Isophorone | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| m,p-Cresols | mg/kg | 0 | 49 | 0% | 0.135 | 0.147 | -- | -- | 0.14 | 0.0024 | -- | No | No | (2) |
| Naphthalene | mg/kg | 0 | 49 | 0% | 0.0102 | 0.011 | -- | -- | 0.011 | 0.00018 | -- | No | No | (2) |
| Nitrobenzene | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| N-nitrosodi-n-propylamine | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | Yes | No | (2) |
| o-Cresol | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| Octachlorostyrene | mg/kg | 0 | 49 | 0% | 0.112 | 0.121 | -- | -- | 0.12 | 0.0019 | -- | No | No | (2) |
| p-Chloroaniline | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| p-Chlorobenzenethiol | mg/kg | 0 | 49 | 0% | 0.112 | 0.121 | -- | -- | 0.12 | 0.0019 | -- | No | No | (2) |
| Pentachlorobenzene | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| Pentachlorophenol | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| Phenol | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| Phthalic acid | mg/kg | 1 | 49 | 2% | 0.112 | 0.121 | 0.387 | 0.387 | 0.12 | 0.039 | -- | No | No | (4)(13) |
| Pyridine | mg/kg | 0 | 49 | 0% | 0.0677 | 0.0733 | -- | -- | 0.07 | 0.0012 | -- | No | No | (2) |
| *Volatile Organic Compounds* | | | | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | mg/kg | 0 | 51 | 0% | 0.00018 | 0.0002 | -- | -- | 0.00019 | 0.0000056 | -- | No | No | (2) |
| 1,1,1-Trichloroethane | mg/kg | 0 | 51 | 0% | 0.00011 | 0.00012 | -- | -- | 0.00011 | 0.0000027 | -- | No | No | (2) |
| 1,1,2,2-Tetrachloroethane | mg/kg | 0 | 51 | 0% | 0.000079 | 0.000088 | -- | -- | 0.000082 | 0.0000017 | -- | No | No | (2) |
| 1,1,2-Trichloroethane | mg/kg | 0 | 51 | 0% | 0.000068 | 0.000076 | -- | -- | 0.000071 | 0.0000016 | -- | No | No | (2) |
| 1,1-Dichloroethane | mg/kg | 0 | 51 | 0% | 0.000071 | 0.000079 | -- | -- | 0.000074 | 0.0000016 | -- | No | No | (2) |
| 1,1-Dichloroethene | mg/kg | 0 | 51 | 0% | 0.00012 | 0.00014 | -- | -- | 0.00013 | 0.0000047 | -- | No | No | (2) |
| 1,1-Dichloropropene | mg/kg | 0 | 51 | 0% | 0.000088 | 0.000098 | -- | -- | 0.000092 | 0.000002 | -- | No | No | (2) |

**TABLE 5-7**
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPC)**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Min ND | Max ND | Min Detect | Max Detect | Mean | Standard Deviation | Greater than Background? | PBT(1) or Class A Carcinogen? | COPC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,2,3-Trichlorobenzene | mg/kg | 0 | 51 | 0% | 0.00039 | 0.00044 | -- | -- | 0.00041 | 0.0000093 | -- | No | No | (2) |
| 1,2,3-Trichloropropane | mg/kg | 0 | 51 | 0% | 0.00025 | 0.00028 | -- | -- | 0.00026 | 0.0000065 | -- | No | No | (2) |
| 1,2,4-Trichlorobenzene | mg/kg | 0 | 51 | 0% | 0.00033 | 0.00037 | -- | -- | 0.00035 | 0.0000078 | -- | No | No | (2) |
| 1,2,4-Trimethylbenzene | mg/kg | 17 | 51 | 33% | 0.00014 | 0.00073 | 0.00069 | 0.0017 | 0.00063 | 0.00026 | -- | No | No | (5)(13) |
| 1,2-Dichlorobenzene | mg/kg | 0 | 51 | 0% | 0.00012 | 0.00014 | -- | -- | 0.00013 | 0.0000034 | -- | No | No | (2) |
| 1,2-Dichloroethane | mg/kg | 0 | 51 | 0% | 0.000067 | 0.000075 | -- | -- | 0.00007 | 0.0000016 | -- | No | No | (2) |
| 1,2-Dichloroethene | mg/kg | 0 | 51 | 0% | 0.00011 | 0.00012 | -- | -- | 0.00011 | 0.000004 | -- | No | No | (2) |
| 1,2-Dichloropropane | mg/kg | 0 | 51 | 0% | 0.00011 | 0.00012 | -- | -- | 0.00012 | 0.0000046 | -- | No | No | (2) |
| 1,3,5-Trichlorobenzene | mg/kg | 0 | 51 | 0% | 0.00037 | 0.00042 | -- | -- | 0.00039 | 0.0000095 | -- | No | No | (2) |
| 1,3,5-Trimethylbenzene | mg/kg | 1 | 51 | 2% | 0.000098 | 0.00011 | 0.00012 | 0.00012 | 0.0001 | 0.0000041 | -- | No | No | (4)(13) |
| 1,3-Dichlorobenzene | mg/kg | 0 | 51 | 0% | 0.00013 | 0.00015 | -- | -- | 0.00014 | 0.0000032 | -- | No | No | (2) |
| 1,3-Dichloropropane | mg/kg | 0 | 51 | 0% | 0.000051 | 0.000058 | -- | -- | 0.000054 | 0.0000012 | -- | No | No | (2) |
| 1,4-Dichlorobenzene | mg/kg | 0 | 51 | 0% | 0.00014 | 0.00015 | -- | -- | 0.00014 | 0.0000039 | -- | No | No | (2) |
| 2,2,3-Trimethylbutane | mg/kg | 0 | 51 | 0% | 0.00021 | 0.00024 | -- | -- | 0.00022 | 0.0000046 | -- | No | No | (2) |
| 2,2-Dichloropropane | mg/kg | 0 | 51 | 0% | 0.00023 | 0.00026 | -- | -- | 0.00024 | 0.000007 | -- | No | No | (2) |
| 2,2-Dimethylpentane | mg/kg | 0 | 51 | 0% | 0.00028 | 0.00031 | -- | -- | 0.00029 | 0.0000066 | -- | No | No | (2) |
| 2,3-Dimethylpentane | mg/kg | 0 | 51 | 0% | 0.00023 | 0.00025 | -- | -- | 0.00024 | 0.0000063 | -- | No | No | (2) |
| 2,4-Dimethylpentane | mg/kg | 0 | 51 | 0% | 0.00019 | 0.00022 | -- | -- | 0.0002 | 0.0000058 | -- | No | No | (2) |
| 2-Chlorotoluene | mg/kg | 0 | 51 | 0% | 0.00025 | 0.00028 | -- | -- | 0.00026 | 0.0000056 | -- | No | No | (2) |
| 2-Hexanone | mg/kg | 0 | 51 | 0% | 0.00024 | 0.00027 | -- | -- | 0.00025 | 0.0000054 | -- | No | No | (2) |
| 2-Methylhexane | mg/kg | 0 | 51 | 0% | 0.0002 | 0.00023 | -- | -- | 0.00021 | 0.0000061 | -- | No | No | (2) |
| 2-Nitropropane | mg/kg | 0 | 51 | 0% | 0.00061 | 0.00068 | -- | -- | 0.00063 | 0.000014 | -- | No | No | (2) |
| 3,3-Dimethylpentane | mg/kg | 0 | 51 | 0% | 0.0002 | 0.00023 | -- | -- | 0.00021 | 0.0000061 | -- | No | No | (2) |
| 3-Ethylpentane | mg/kg | 0 | 51 | 0% | 0.00021 | 0.00024 | -- | -- | 0.00022 | 0.0000046 | -- | No | No | (2) |
| 3-Methylhexane | mg/kg | 0 | 51 | 0% | 0.00014 | 0.00016 | -- | -- | 0.00015 | 0.0000045 | -- | No | No | (2) |
| 4-Chlorotoluene | mg/kg | 0 | 51 | 0% | 0.00017 | 0.00019 | -- | -- | 0.00018 | 0.0000037 | -- | No | No | (2) |
| 4-Methyl-2-pentanone (MIBK) | mg/kg | 0 | 51 | 0% | 0.00029 | 0.00033 | -- | -- | 0.0003 | 0.0000075 | -- | No | No | (2) |
| Acetone | mg/kg | 1 | 51 | 2% | 0.0018 | 0.021 | 0.017 | 0.017 | 0.011 | 0.0064 | -- | No | No | (4)(13) |
| Acetonitrile | mg/kg | 0 | 51 | 0% | 0.0055 | 0.0061 | -- | -- | 0.0057 | 0.00013 | -- | No | No | (2) |
| Benzene | mg/kg | 0 | 51 | 0% | 0.000088 | 0.000098 | -- | -- | 0.000092 | 0.000002 | -- | Yes | No | (2) |
| Bromobenzene | mg/kg | 0 | 51 | 0% | 0.00012 | 0.00014 | -- | -- | 0.00013 | 0.0000034 | -- | No | No | (2) |
| Bromodichloromethane | mg/kg | 0 | 51 | 0% | 0.00021 | 0.00024 | -- | -- | 0.00022 | 0.000006 | -- | No | No | (2) |
| Bromoform | mg/kg | 0 | 51 | 0% | 0.00006 | 0.000067 | -- | -- | 0.000062 | 0.0000013 | -- | No | No | (2) |
| Bromomethane | mg/kg | 0 | 51 | 0% | 0.00013 | 0.00015 | -- | -- | 0.00014 | 0.000005 | -- | No | No | (2) |
| Carbon disulfide | mg/kg | 0 | 51 | 0% | 0.00012 | 0.00014 | -- | -- | 0.00013 | 0.0000034 | -- | No | No | (2) |

**TABLE 5-7**
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPC)**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Min ND | Max ND | Min Detect | Max Detect | Mean | Standard Deviation | Greater than Background? | PBT(1) or Class A Carcinogen? | COPC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon tetrachloride | mg/kg | 0 | 51 | 0% | 0.00021 | 0.00023 | -- | -- | 0.00022 | 0.0000063 | -- | No | No | (2) |
| Chlorobenzene | mg/kg | 0 | 51 | 0% | 0.00011 | 0.00012 | -- | -- | 0.00011 | 0.000004 | -- | No | No | (2) |
| Chlorobromomethane | mg/kg | 0 | 51 | 0% | 0.00023 | 0.00025 | -- | -- | 0.00024 | 0.0000059 | -- | No | No | (2) |
| Chloroethane | mg/kg | 0 | 51 | 0% | 0.00047 | 0.00052 | -- | -- | 0.00049 | 0.000011 | -- | No | No | (2) |
| Chloroform | mg/kg | 0 | 51 | 0% | 0.0001 | 0.00011 | -- | -- | 0.00011 | 0.000005 | -- | No | No | (2) |
| Chloromethane | mg/kg | 0 | 51 | 0% | 0.00027 | 0.0003 | -- | -- | 0.00028 | 0.0000062 | -- | No | No | (2) |
| cis-1,2-Dichloroethene | mg/kg | 0 | 51 | 0% | 0.000055 | 0.000061 | -- | -- | 0.000057 | 0.0000012 | -- | No | No | (2) |
| cis-1,3-Dichloropropene | mg/kg | 0 | 51 | 0% | 0.0001 | 0.00011 | -- | -- | 0.00011 | 0.000005 | -- | No | No | (2) |
| Cymene (Isopropyltoluene) | mg/kg | 0 | 51 | 0% | 0.00013 | 0.00014 | -- | -- | 0.00013 | 0.000003 | -- | No | No | (2) |
| Dibromochloromethane | mg/kg | 0 | 51 | 0% | 0.00012 | 0.00013 | -- | -- | 0.00012 | 0.0000046 | -- | No | No | (2) |
| Dibromochloropropane | mg/kg | 0 | 51 | 0% | 0.00021 | 0.00024 | -- | -- | 0.00022 | 0.0000056 | -- | No | No | (2) |
| Dibromomethane | mg/kg | 0 | 51 | 0% | 0.00017 | 0.00019 | -- | -- | 0.00017 | 0.0000058 | -- | No | No | (2) |
| Dichloromethane (Methylene chloride) | mg/kg | 24 | 51 | 47% | 0.00071 | 0.0077 | 0.0014 | 0.028 | 0.0065 | 0.0065 | -- | No | No | (5)(13) |
| Dimethyldisulfide | mg/kg | 0 | 51 | 0% | 0.00018 | 0.0002 | -- | -- | 0.00019 | 0.0000057 | -- | No | No | (2) |
| Ethanol | mg/kg | 0 | 51 | 0% | 0.048 | 0.053 | -- | -- | 0.05 | 0.0011 | -- | No | No | (2) |
| Ethylbenzene | mg/kg | 3 | 51 | 6% | 0.000059 | 0.000066 | 0.000062 | 0.000077 | 0.000062 | 0.0000026 | -- | No | No | (5)(13) |
| Freon-11 (Trichlorofluoromethane) | mg/kg | 0 | 51 | 0% | 0.00022 | 0.00025 | -- | -- | 0.00023 | 0.0000049 | -- | No | No | (2) |
| Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane) | mg/kg | 0 | 51 | 0% | 0.00015 | 0.00016 | -- | -- | 0.00015 | 0.0000035 | -- | No | No | (2) |
| Freon-12 (Dichlorodifluoromethane) | mg/kg | 0 | 51 | 0% | 0.00029 | 0.00033 | -- | -- | 0.00031 | 0.0000078 | -- | No | No | (2) |
| Heptane | mg/kg | 0 | 51 | 0% | 0.00016 | 0.00018 | -- | -- | 0.00017 | 0.0000039 | -- | No | No | (2) |
| Isopropylbenzene | mg/kg | 0 | 51 | 0% | 0.0001 | 0.00012 | -- | -- | 0.00011 | 0.0000028 | -- | No | No | (2) |
| m,p-Xylene | mg/kg | 0 | 51 | 0% | 0.00017 | 0.00019 | -- | -- | 0.00017 | 0.0000058 | -- | No | No | (2) |
| Methyl ethyl ketone (2-Butanone) | mg/kg | 0 | 51 | 0% | 0.00088 | 0.00098 | -- | -- | 0.00092 | 0.00002 | -- | No | No | (2) |
| Methyl iodide | mg/kg | 0 | 51 | 0% | 0.00013 | 0.00014 | -- | -- | 0.00013 | 0.000003 | -- | No | No | (2) |
| MTBE (Methyl tert-butyl ether) | mg/kg | 0 | 51 | 0% | 0.00009 | 0.0001 | -- | -- | 0.000094 | 0.0000021 | -- | No | No | (2) |
| n-Butylbenzene | mg/kg | 0 | 51 | 0% | 0.00018 | 0.0002 | -- | -- | 0.00019 | 0.000004 | -- | No | No | (2) |
| Nonanal | mg/kg | 2 | 51 | 4% | 0.00047 | 0.00053 | 0.0008 | 0.00098 | 0.00051 | 0.000081 | -- | No | No | (4)(15) |
| n-Propylbenzene | mg/kg | 0 | 51 | 0% | 0.00011 | 0.00012 | -- | -- | 0.00011 | 0.000005 | -- | No | No | (2) |
| o-Xylene | mg/kg | 0 | 51 | 0% | 0.000077 | 0.000086 | -- | -- | 0.00008 | 0.0000017 | -- | No | No | (2) |
| sec-Butylbenzene | mg/kg | 0 | 51 | 0% | 0.00011 | 0.00012 | -- | -- | 0.00011 | 0.000003 | -- | No | No | (2) |
| Styrene | mg/kg | 0 | 51 | 0% | 0.00018 | 0.00027 | -- | -- | 0.00019 | 0.000022 | -- | No | No | (2) |
| tert-Butylbenzene | mg/kg | 0 | 51 | 0% | 0.0001 | 0.00011 | -- | -- | 0.00011 | 0.000005 | -- | No | No | (2) |
| Tetrachloroethene | mg/kg | 0 | 51 | 0% | 0.000088 | 0.000098 | -- | -- | 0.000092 | 0.000002 | -- | No | No | (2) |
| Toluene | mg/kg | 1 | 51 | 2% | 0.00033 | 0.00036 | 0.00036 | 0.00036 | 0.00034 | 0.0000076 | -- | No | No | (4)(13) |
| trans-1,2-Dichloroethene | mg/kg | 0 | 51 | 0% | 0.000091 | 0.0001 | -- | -- | 0.000095 | 0.000002 | -- | No | No | (2) |

**TABLE 5-7**
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPC)**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Min ND | Max ND | Min Detect | Max Detect | Mean | Standard Deviation | Greater than Background? | PBT(1) or Class A Carcinogen? | COPC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| trans-1,3-Dichloropropene | mg/kg | 0 | 51 | 0% | 0.0001 | 0.00011 | -- | -- | 0.00011 | 0.000005 | -- | No | No | (2) |
| Trichloroethene | mg/kg | 0 | 51 | 0% | 0.0001 | 0.00012 | -- | -- | 0.00011 | 0.0000024 | -- | No | No | (2) |
| Vinyl acetate | mg/kg | 0 | 51 | 0% | 0.00024 | 0.00027 | -- | -- | 0.00025 | 0.0000058 | -- | No | No | (2) |
| Vinyl chloride | mg/kg | 0 | 51 | 0% | 0.00011 | 0.00013 | -- | -- | 0.00012 | 0.0000028 | -- | No | No | (2) |
| Xylenes (total) | mg/kg | 0 | 51 | 0% | 0.00023 | 0.00026 | -- | -- | 0.00024 | 0.000006 | -- | No | No | (2) |

mg/kg - milligrams per kilogram

pCi/g - picoCuries per gram

ppt - parts per trillion

-- - Not available or not applicable.

ND - Not detected.

Highlight indicates selected as COPC.

(1) Persistent, Bioaccumulative, and Toxic (PBT) Program.

(2) Not detected.

(3) Dioxin and PCB congeners are not evaluated separately. Dioxin and PCB congeners are evaluated as TCDD TEQs. The maximum TCDD TEQ was less than the 50 ppt residential BCL.

(4) Chemical detected in less than 5 percent of the samples and is not a PBT or Class A carcinogen.

(5) Chemical detected in greater than 5 percent of samples.

(6) Chemical concentrations are equivalent to background.

(7) Chemical detected in less than 5 percent of the samples, but is a PBT or Class A carcinogen.

(8) Based on statistical tests, Site concentrations are elevated compared to background.

(9) No toxicity criteria or applicable surrogate criteria are available.

(10) At least one carcinogenic polynuclear aromatic hydrocarbon (PAH) is a COPC, therefore all carcinogenic PAHs are COPCs.

(11) Lead was not selected as a COPC because the maximum concentration is below 400 mg/kg.

(12) USEPA (1989) states that "Chemicals that are (1) essential human nutrients, (2) present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and (3) toxic only at very high doses (i.e., much higher than those that could be associated with contact at the site) need not be considered further in the quantitative risk assessment. Examples of such chemicals are iron, magnesium, calcium, potassium, and sodium."

(13) Maximum detected site concentration below one-tenth residential BCL.

(14) Maximum detected site concentration greater than one-tenth residential BCL.

(15) Chemical has no BCL.

**TABLE 6-1**
**EXPOSURE POINT CONCENTRATIONS IN SOIL**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 2)**

| Chemical | Units | Number of Detects | Total Count | Detect Freq. | Min ND | Max ND | Min Detect | Max Detect | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|
| *Inorganics* | | | | | | | | | | |
| Ammonia (as N) | mg/kg | 10 | 49 | 20% | 0.79 | 5.5 | 0.89 | 8.2 | 1.4 | 1.5 |
| Perchlorate | mg/kg | 50 | 50 | 100% | -- | -- | 0.017 | 28.6 | 3.3 | 6.4 |
| *Semi-Volatile Organic Compounds* | | | | | | | | | | |
| Butylbenzyl phthalate | mg/kg | 1 | 49 | 2% | 0.0677 | 0.0733 | 126 | 126 | 2.6 | 18 |
| *Polynuclear Aromatic Hydrocarbons* | | | | | | | | | | |
| Benzo(a)anthracene | mg/kg | 8 | 50 | 16% | 0.00169 | 0.00183 | 0.00225 | 0.0576 | 0.0035 | 0.0081 |
| Benzo(a)pyrene | mg/kg | 17 | 50 | 34% | 0.00169 | 0.00182 | 0.00185 | 0.0585 | 0.0045 | 0.0091 |
| Benzo(b)fluoranthene | mg/kg | 19 | 50 | 38% | 0.0017 | 0.00183 | 0.0022 | 0.129 | 0.0084 | 0.021 |
| Benzo(k)fluoranthene | mg/kg | 6 | 50 | 12% | 0.00169 | 0.00182 | 0.00229 | 0.00658 | 0.002 | 0.00086 |
| Chrysene | mg/kg | 17 | 50 | 34% | 0.00169 | 0.00182 | 0.00231 | 0.0904 | 0.0065 | 0.015 |
| Dibenzo(a,h)anthracene | mg/kg | 4 | 50 | 8% | 0.00169 | 0.00182 | 0.00208 | 0.0587 | 0.0032 | 0.0082 |
| Indeno(1,2,3-cd)pyrene | mg/kg | 5 | 50 | 10% | 0.00169 | 0.00183 | 0.00195 | 0.0311 | 0.0025 | 0.0042 |

(1) The EPC is either the maximum of the All and Surface 95 UCLs unless it exceeds the maximum detection concentration, then it is the maximum detected concentration.

EPC - Exposure point concentration.

UCL - Upper Confidence Limit

NA - Not applicable.

**TABLE 6-1**
**EXPOSURE POINT CONCENTRATIONS IN SOIL**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 2 of 2)**

| Chemical | All | | Surface | | EPC[1] |
|---|---|---|---|---|---|
| | 95% UCL | UCL Calc Method | 95% UCL | UCL Calc Method | |
| | *Inorganics* | | | | |
| Ammonia (as N) | 1.5 | Bootstrap BCa UCL | 2.3 | Bootstrap BCa UCL | 2.3 |
| Perchlorate | 5.2 | Bootstrap BCa UCL | 7.3 | Bootstrap BCa UCL | 7.3 |
| | *Semi-Volatile Organic Compounds* | | | | |
| Butylbenzyl phthalate | 10.3 | Bootstrap BCa UCL | 26.3 | Bootstrap BCa UCL | 26.3 |
| | *Polynuclear Aromatic Hydrocarbons* | | | | |
| Benzo(a)anthracene | 0.0066 | Bootstrap BCa UCL | 0.013 | Bootstrap BCa UCL | 0.013 |
| Benzo(a)pyrene | 0.0076 | Bootstrap BCa UCL | 0.013 | Bootstrap BCa UCL | 0.013 |
| Benzo(b)fluoranthene | 0.015 | Bootstrap BCa UCL | 0.027 | Bootstrap BCa UCL | 0.027 |
| Benzo(k)fluoranthene | 0.0016 | Bootstrap BCa UCL | 0.0022 | Bootstrap BCa UCL | 0.0022 |
| Chrysene | 0.011 | Bootstrap BCa UCL | 0.021 | Bootstrap BCa UCL | 0.021 |
| Dibenzo(a,h)anthracene | 0.0058 | Bootstrap BCa UCL | 0.013 | Bootstrap BCa UCL | 0.013 |
| Indeno(1,2,3-cd)pyrene | 0.0038 | Bootstrap BCa UCL | 0.0063 | Bootstrap BCa UCL | 0.0063 |

(1) The EPC is either the maximum of the All and Surface 95 UCLs unless it exceeds the maximum detection concentration, then it is the maximum detected concentration.

EPC - Exposure point concentration.

UCL - Upper Confidence Limit

NA - Not applicable.

**TABLE 6-2**
**ASBESTOS RESULTS AND ANALYTICAL SENSITIVITIES**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 1)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Analytical Sensitivity ($10^6$ s/gPM$_{10}$) | Concentration Protocol Structures[1] | | Number of Protocol Structures[2] | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Chrysotile | Amphibole | Chrysotile | | Amphibole | |
| | | | | | ($10^6$ s/gPM$_{10}$) | ($10^6$ s/gPM$_{10}$) | Total | Long | Total | Long |
| GNC1-BD19 | 0 | NORM | 1/29/09 | 2.987 | < 8.930 E+6 | < 8.930 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BD20 | 0 | NORM | 1/26/09 | 2.991 | 1.418 E+7 | < 8.944 E+6 | 4 | 1 | 0 | 0 |
| GNC1-BD21 | 0 | NORM | 1/29/09 | 2.967 | < 8.870 E+6 | < 8.870 E+6 | 0 | 0 | 1 | 0 |
| GNC1-BE19 | 0 | NORM | 1/29/09 | 2.991 | < 8.944 E+6 | < 8.944 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BE21 | 0 | NORM | 1/29/09 | 2.979 | < 8.908 E+6 | < 8.908 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BE22 | 0 | NORM | 1/29/09 | 2.987 | < 8.930 E+6 | < 8.930 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BF19 | 0 | NORM | 1/29/09 | 2.979 | < 8.908 E+6 | < 8.908 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BF20 | 0 | NORM | 1/29/09 | 2.990 | < 8.939 E+6 | < 8.939 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BF21 | 0 | NORM | 1/29/09 | 2.943 | < 8.799 E+6 | < 8.799 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BF22 | 0 | NORM | 1/29/09 | 2.979 | < 8.908 E+6 | < 8.908 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BG19 | 0 | NORM | 1/29/09 | 2.900 | < 8.671 E+6 | < 8.671 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BG20 | 0 | NORM | 1/29/09 | 2.987 | < 8.930 E+6 | < 8.930 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BG20 | 0 | FD | 1/29/09 | 2.991 | < 8.944 E+6 | < 8.944 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BG21 | 0 | NORM | 1/29/09 | 2.960 | < 8.851 E+6 | < 8.851 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BG22 | 0 | NORM | 1/26/09 | 2.987 | < 8.930 E+6 | < 8.930 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JD07 | 0 | NORM | 1/29/09 | 2.987 | < 8.930 E+6 | < 8.930 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JD08 | 0 | NORM | 1/29/09 | 2.966 | < 8.869 E+6 | < 8.869 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JD09 | 0 | NORM | 1/29/09 | 2.959 | < 8.846 E+6 | < 8.846 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JD11 | 0 | NORM | 1/29/09 | 2.967 | < 8.870 E+6 | < 8.870 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JS10 | 0 | NORM | 1/29/09 | 2.961 | < 8.854 E+6 | < 8.854 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JS11 | 0 | NORM | 1/26/09 | 2.987 | < 8.930 E+6 | < 8.930 E+6 | 0 | 0 | 0 | 0 |
| GNC2-JD10 | 0 | NORM | 6/25/10 | 2.970 | < 8.870 E+6 | < 8.870 E+6 | 0 | 0 | 0 | 0 |
| GNC3-BE20C | 0 | NORM | 6/25/10 | 2.990 | < 8.940 E+6 | < 8.940 E+6 | 0 | 0 | 0 | 0 |
| GNC3-BE20C | 0 | FD | 6/25/10 | 3.000 | < 8.960 E+6 | < 8.960 E+6 | 0 | 0 | 0 | 0 |
| GNC3-JS09C | 0 | NORM | 8/4/10 | 2.990 | < 8.940 E+6 | < 8.940 E+6 | 0 | 0 | 0 | 0 |

[1]Fiber dimensions are presented in the respective analytical reports for each sample.

[2]Only long structures (>10µm) present a potential risk and are used for estimating asbestos risks. Total fiber concentrations are presented for informational purposes only. Protocol structures are structures longer than 10 µm and thinner than 0.4 µm.

**TABLE 6-3**
**EXPOSURE POINT CONCENTRATIONS FROM SURFACE FLUX**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 8)**

| Chemical | GNC1-BE20 | | | | GNC1-BE21 | | | | GNC1-BE22 | | | | GNC1-BF19 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air |
| 1,1,1,2-Tetrachloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,1-Trichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,2,2-Tetrachloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,2-Trichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1-Dichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1-Dichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1-Dichloropropene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | -- | -- | -- | -- | F | 1.5 E-5 | 6.1 E-6 | 5.1 E-6 | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | -- | -- | -- | -- | S | 5.3 E-6 | 2.1 E-6 | 1.8 E-6 | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | S | 9.9 E-7 | 4.0 E-7 | 3.3 E-7 | S | 1.9 E-6 | 7.7 E-7 | 6.4 E-7 |
| 1,2-Dichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | S | 1.2 E-6 | 4.7 E-7 | 3.9 E-7 | -- | -- | -- | -- |
| 1,2-Dichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | S | 8.1 E-7 | 3.2 E-7 | 2.7 E-7 | -- | -- | -- | -- |
| 1,3,5-Trimethylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | S | 1.2 E-6 | 5.0 E-7 | 4.2 E-7 | -- | -- | -- | -- |
| 1,3-Dichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | S | 1.4 E-6 | 5.6 E-7 | 4.7 E-7 | -- | -- | -- | -- |
| 1,4-Dioxane | F | 1.1 E-5 | 4.2 E-6 | 3.5 E-6 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,2-Dichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Hexanone | F | 6.0 E-6 | 2.4 E-6 | 2.0 E-6 | -- | -- | -- | -- | -- | -- | -- | -- | F | 1.7 E-5 | 6.9 E-6 | 5.8 E-6 |
| 2-Methyl-1-propanol | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Methyl-2-pentanone (MIBK) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | F | 7.9 E-6 | 3.1 E-6 | 2.6 E-6 |
| Acetone | F | 1.5 E-4 | 5.9 E-5 | 5.0 E-5 | F | 1.2 E-4 | 4.9 E-5 | 4.1 E-5 | F | 1.6 E-5 | 6.6 E-6 | 5.5 E-6 | F | 7.4 E-5 | 3.0 E-5 | 2.5 E-5 |
| Acetonitrile | F | 3.5 E-5 | 1.4 E-5 | 1.2 E-5 | -- | -- | -- | -- | -- | -- | -- | -- | F | 9.0 E-6 | 3.6 E-6 | 3.0 E-6 |
| Benzene | S | 3.5 E-6 | 1.4 E-6 | 1.2 E-6 | S | 5.5 E-6 | 2.2 E-6 | 1.8 E-6 | S | 2.0 E-6 | 7.9 E-7 | 6.6 E-7 | S | 3.7 E-6 | 1.5 E-6 | 1.2 E-6 |
| Benzyl chloride | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromodichloromethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromoform | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromomethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Carbon disulfide | F | 2.3 E-5 | 9.2 E-6 | 7.7 E-6 | -- | -- | -- | -- | -- | -- | -- | -- | F | 1.6 E-5 | 6.5 E-6 | 5.4 E-6 |
| Carbon tetrachloride | S | 3.3 E-6 | 1.3 E-6 | 1.1 E-6 | S | 5.3 E-6 | 2.1 E-6 | 1.8 E-6 | S | 1.9 E-6 | 7.8 E-7 | 6.5 E-7 | S | 5.0 E-6 | 2.0 E-6 | 1.7 E-6 |
| Chlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chlorobromomethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chloroethane | F | 6.7 E-5 | 2.7 E-5 | 2.2 E-5 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chloroform | S | 1.2 E-5 | 5.0 E-6 | 4.2 E-6 | S | 9.3 E-6 | 3.7 E-6 | 3.1 E-6 | S | 4.6 E-6 | 1.9 E-6 | 1.6 E-6 | S | 1.7 E-5 | 7.0 E-6 | 5.8 E-6 |
| Chloromethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,2-Dichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Cymene (Isopropyltoluene) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibromochloromethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibromochloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibromomethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dichloromethane (Methylene chloride) | F | 9.7 E-6 | 3.9 E-6 | 3.2 E-6 | F | 1.4 E-4 | 5.7 E-5 | 4.8 E-5 | -- | -- | -- | -- | -- | -- | -- | -- |
| Ethanol | F | 1.0 E-4 | 4.1 E-5 | 3.4 E-5 | -- | -- | -- | -- | -- | -- | -- | -- | F | 1.8 E-5 | 7.3 E-6 | 6.1 E-6 |
| Ethylbenzene | -- | -- | -- | -- | F | 1.2 E-5 | 4.7 E-6 | 3.9 E-6 | -- | -- | -- | -- | -- | -- | -- | -- |

**TABLE 6-3**
**EXPOSURE POINT CONCENTRATIONS FROM SURFACE FLUX**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
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| Chemical | GNC1-BE20 | | | | GNC1-BE21 | | | | GNC1-BE22 | | | | GNC1-BF19 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air |
| Freon-11 (Trichlorofluoromethane) | F | 1.6 E-5 | 6.4 E-6 | 5.3 E-6 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Freon-12 (Dichlorodifluoromethane) | F | 2.4 E-5 | 9.6 E-6 | 8.0 E-6 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Heptane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Hexachlorobutadiene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| m & p-Xylenes | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Methyl ethyl ketone (2-Butanone) | F | 5.1 E-5 | 2.0 E-5 | 1.7 E-5 | -- | -- | -- | -- | -- | -- | -- | -- | F | 6.1 E-5 | 2.4 E-5 | 2.0 E-5 |
| Methyl iodide | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MTBE (Methyl tert-butyl ether) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Butylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Propylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| o-Xylene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| sec-Butylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Styrene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| tert-Butylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | S | 7.8 E-6 | 3.1 E-6 | 2.6 E-6 | S | 4.6 E-6 | 1.8 E-6 | 1.5 E-6 | S | 1.5 E-6 | 6.1 E-7 | 5.1 E-7 | S | 3.7 E-6 | 1.5 E-6 | 1.2 E-6 |
| Toluene | F | 2.5 E-5 | 9.9 E-6 | 8.3 E-6 | F | 7.3 E-5 | 2.9 E-5 | 2.4 E-5 | -- | -- | -- | -- | -- | -- | -- | -- |
| Total Xylenes | F | 1.8 E-5 | 7.3 E-6 | 6.1 E-6 | F | 5.9 E-5 | 2.4 E-5 | 2.0 E-5 | -- | -- | -- | -- | F | 1.6 E-5 | 6.3 E-6 | 5.3 E-6 |
| trans-1,2-Dichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Trichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Vinyl acetate | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Vinyl chloride | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**Notes:**

All units in $mg/m^3$.

Method represents the surface flux measurement used in the risk calculations for that particular chemical/location: S = SIM; F = Full Scan.

See Appendix I for all indoor and outdoor air concentration calculations from surface flux measurement data. See Table 6-6 for outdoor air exposure point concentrations for non-volatile COPCs in soil.

Exposure point concentrations for surface flux data are based on a sample by sample basis. Averaging of the data was not conducted. Therefore only those chemicals detected in a particular sample were included in the risk estimates. A "--" is presented for those chemical not detected and not included in the risk estimates for each sample location. The exposure point concentration is the maximum of the full scan or SIM analysis results (when both had detected values, otherwise the detected value from one or the other is used). Thus, summary statistics are not presented in this table (see Table 3-8 for the surface flux data summary ).

**TABLE 6-3**
**EXPOSURE POINT CONCENTRATIONS FROM SURFACE FLUX**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
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| Chemical | GNC1-BF20 | | | | GNC1-BF21 | | | | GNC1-BF22 | | | | GNC1-BG19 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air |
| 1,1,1,2-Tetrachloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,1-Trichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,2,2-Tetrachloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,2-Trichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1-Dichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1-Dichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1-Dichloropropene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3,5-Trimethylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dioxane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,2-Dichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Hexanone | -- | -- | -- | -- | -- | -- | -- | -- | F | 7.9 E-6 | 3.1 E-6 | 2.6 E-6 | -- | -- | -- | -- |
| 2-Methyl-1-propanol | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Methyl-2-pentanone (MIBK) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acetone | -- | -- | -- | -- | F | 6.7 E-5 | 2.7 E-5 | 2.2 E-5 | F | 1.1 E-4 | 4.3 E-5 | 3.6 E-5 | F | 2.9 E-5 | 1.1 E-5 | 9.6 E-6 |
| Acetonitrile | -- | -- | -- | -- | -- | -- | -- | -- | F | 2.5 E-5 | 1.0 E-5 | 8.4 E-6 | -- | -- | -- | -- |
| Benzene | S | 2.6 E-6 | 1.0 E-6 | 8.6 E-7 | S | 9.7 E-6 | 3.9 E-6 | 3.2 E-6 | S | 7.0 E-6 | 2.8 E-6 | 2.3 E-6 | S | 6.9 E-6 | 2.8 E-6 | 2.3 E-6 |
| Benzyl chloride | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromodichloromethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromoform | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromomethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Carbon disulfide | -- | -- | -- | -- | -- | -- | -- | -- | F | 1.9 E-5 | 7.7 E-6 | 6.4 E-6 | -- | -- | -- | -- |
| Carbon tetrachloride | S | 3.3 E-6 | 1.3 E-6 | 1.1 E-6 | S | 3.3 E-6 | 1.3 E-6 | 1.1 E-6 | S | 5.8 E-6 | 2.3 E-6 | 1.9 E-6 | S | 5.4 E-6 | 2.1 E-6 | 1.8 E-6 |
| Chlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chlorobromomethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chloroethane | -- | -- | -- | -- | -- | -- | -- | -- | F | 7.9 E-5 | 3.2 E-5 | 2.6 E-5 | -- | -- | -- | -- |
| Chloroform | S | 1.7 E-5 | 6.6 E-6 | 5.5 E-6 | S | 3.1 E-6 | 1.2 E-6 | 1.0 E-6 | S | 1.7 E-5 | 6.8 E-6 | 5.7 E-6 | S | 1.3 E-5 | 5.2 E-6 | 4.3 E-6 |
| Chloromethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,2-Dichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Cymene (Isopropyltoluene) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibromochloromethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibromochloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibromomethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dichloromethane (Methylene chloride) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Ethanol | -- | -- | -- | -- | -- | -- | -- | -- | F | 3.9 E-5 | 1.6 E-5 | 1.3 E-5 | -- | -- | -- | -- |
| Ethylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**TABLE 6-3**
**EXPOSURE POINT CONCENTRATIONS FROM SURFACE FLUX**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
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| Chemical | GNC1-BF20 | | | | GNC1-BF21 | | | | GNC1-BF22 | | | | GNC1-BG19 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air |
| Freon-11 (Trichlorofluoromethane) | -- | -- | -- | -- | -- | -- | -- | -- | F | 1.8 E-5 | 7.3 E-6 | 6.1 E-6 | -- | -- | -- | -- |
| Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Freon-12 (Dichlorodifluoromethane) | -- | -- | -- | -- | -- | -- | -- | -- | F | 3.6 E-5 | 1.5 E-5 | 1.2 E-5 | -- | -- | -- | -- |
| Heptane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Hexachlorobutadiene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | F | 3.1 E-5 | 1.2 E-5 | 1.0 E-5 | -- | -- | -- | -- |
| m & p-Xylenes | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Methyl ethyl ketone (2-Butanone) | -- | -- | -- | -- | -- | -- | -- | -- | F | 1.2 E-5 | 4.8 E-6 | 4.0 E-6 | F | 5.5 E-6 | 2.2 E-6 | 1.9 E-6 |
| Methyl iodide | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MTBE (Methyl tert-butyl ether) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Butylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Propylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| o-Xylene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| sec-Butylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Styrene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| tert-Butylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | S | 5.3 E-6 | 2.1 E-6 | 1.8 E-6 | -- | -- | -- | -- | S | 2.7 E-6 | 1.1 E-6 | 8.9 E-7 | S | 2.7 E-6 | 1.1 E-6 | 9.0 E-7 |
| Toluene | F | 3.0 E-5 | 1.2 E-5 | 1.0 E-5 | -- | -- | -- | -- | F | 1.9 E-5 | 7.5 E-6 | 6.3 E-6 | -- | -- | -- | -- |
| Total Xylenes | F | 2.0 E-5 | 8.1 E-6 | 6.8 E-6 | -- | -- | -- | -- | F | 1.8 E-5 | 7.3 E-6 | 6.1 E-6 | -- | -- | -- | -- |
| trans-1,2-Dichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Trichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Vinyl acetate | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Vinyl chloride | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**Notes:**

All units in $mg/m^3$.

Method represents the surface flux measurement used in the risk calculations for that particular chemical/location: S = SIM; F = Full Scan.

See Appendix I for all indoor and outdoor air concentration calculations from surface flux measurement data. See Table 6-6 for outdoor air exposure point concentrations for non-volatile COPCs in soil.

Exposure point concentrations for surface flux data are based on a sample by sample basis. Averaging of the data was not conducted. Therefore only those chemicals detected in a particular sample were included in the risk estimates. A "--" is presented for those chemical not detected and not included in the risk estimates for each sample location. The exposure point concentration is the maximum of the full scan or SIM analysis results (when both had detected values, otherwise the detected value from one or the other is used). Thus, summary statistics are not presented in this table (see Table 3-8 for the surface flux data summary ).

**TABLE 6-3**
**EXPOSURE POINT CONCENTRATIONS FROM SURFACE FLUX**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
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| Chemical | GNC1-BG20 | | | | GNC1-BG21 | | | | GNC1-BG22 | | | | GNC1-JD09 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air |
| 1,1,1,2-Tetrachloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,1-Trichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,2,2-Tetrachloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,2-Trichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1-Dichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1-Dichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1-Dichloropropene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3,5-Trimethylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dioxane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,2-Dichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Hexanone | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Methyl-1-propanol | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Methyl-2-pentanone (MIBK) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acetone | -- | -- | -- | -- | -- | -- | -- | -- | F | 3.8 E-5 | 1.5 E-5 | 1.3 E-5 | -- | -- | -- | -- |
| Acetonitrile | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzene | S | 6.3 E-6 | 2.5 E-6 | 2.1 E-6 | S | 5.7 E-6 | 2.3 E-6 | 1.9 E-6 | -- | -- | -- | -- | S | 2.2 E-6 | 8.8 E-7 | 7.3 E-7 |
| Benzyl chloride | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromodichloromethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromoform | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromomethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Carbon disulfide | -- | -- | -- | -- | F | 5.1 E-6 | 2.0 E-6 | 1.7 E-6 | F | 7.9 E-6 | 3.1 E-6 | 2.6 E-6 | -- | -- | -- | -- |
| Carbon tetrachloride | S | 1.0 E-5 | 4.0 E-6 | 3.3 E-6 | S | 5.4 E-6 | 2.2 E-6 | 1.8 E-6 | S | 3.6 E-6 | 1.4 E-6 | 1.2 E-6 | S | 5.0 E-6 | 2.0 E-6 | 1.7 E-6 |
| Chlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chlorobromomethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chloroform | S | 1.2 E-5 | 4.9 E-6 | 4.1 E-6 | S | 1.7 E-5 | 6.9 E-6 | 5.8 E-6 | S | 1.0 E-5 | 4.1 E-6 | 3.4 E-6 | S | 2.5 E-6 | 9.9 E-7 | 8.3 E-7 |
| Chloromethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,2-Dichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Cymene (Isopropyltoluene) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibromochloromethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibromochloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibromomethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dichloromethane (Methylene chloride) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Ethanol | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Ethylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**TABLE 6-3**
**EXPOSURE POINT CONCENTRATIONS FROM SURFACE FLUX**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 6 of 8)**

| Chemical | GNC1-BG20 | | | | GNC1-BG21 | | | | GNC1-BG22 | | | | GNC1-JD09 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air |
| Freon-11 (Trichlorofluoromethane) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Freon-12 (Dichlorodifluoromethane) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Heptane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Hexachlorobutadiene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| m & p-Xylenes | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Methyl ethyl ketone (2-Butanone) | F | 6.7 E-6 | 2.7 E-6 | 2.2 E-6 | F | 1.2 E-5 | 4.7 E-6 | 3.9 E-6 | F | 9.5 E-6 | 3.8 E-6 | 3.2 E-6 | -- | -- | -- | -- |
| Methyl iodide | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MTBE (Methyl tert-butyl ether) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Butylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Propylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| o-Xylene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| sec-Butylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Styrene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| tert-Butylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | S | 1.1 E-5 | 4.3 E-6 | 3.6 E-6 | S | 3.7 E-6 | 1.5 E-6 | 1.2 E-6 | S | 2.3 E-6 | 9.3 E-7 | 7.8 E-7 | S | 2.2 E-6 | 8.8 E-7 | 7.3 E-7 |
| Toluene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Total Xylenes | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| trans-1,2-Dichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Trichloroethene | -- | -- | -- | -- | F | 6.8 E-5 | 2.7 E-5 | 2.3 E-5 | -- | -- | -- | -- | -- | -- | -- | -- |
| Vinyl acetate | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Vinyl chloride | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**Notes:**

All units in $mg/m^3$.

Method represents the surface flux measurement used in the risk calculations for that particular chemical/location: S = SIM; F = Full Scan.

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**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
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| Chemical | GNC1-JS09 | | | | GNC1-JS10 | | | | GNC1-JS11 | | | | GNC1-JS11R | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air |
| 1,1,1,2-Tetrachloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,1-Trichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,2,2-Tetrachloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,2-Trichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1-Dichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1-Dichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1-Dichloropropene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | -- | -- | -- | -- | F | 3.4 E-5 | 1.3 E-5 | 1.1 E-5 | F | 3.2 E-5 | 1.3 E-5 | 1.1 E-5 | F | 4.5 E-5 | 1.8 E-5 | 1.5 E-5 |
| 1,2-Dibromoethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3,5-Trimethylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dioxane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,2-Dichloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Hexanone | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Methyl-1-propanol | -- | -- | -- | -- | F | 2.9 E-5 | 1.2 E-5 | 9.8 E-6 | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Methyl-2-pentanone (MIBK) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acetone | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acetonitrile | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzene | S | 2.9 E-6 | 1.1 E-6 | 9.6 E-7 | S | 2.5 E-6 | 9.9 E-7 | 8.3 E-7 | S | 2.5 E-6 | 9.9 E-7 | 8.3 E-7 | S | 3.9 E-6 | 1.6 E-6 | 1.3 E-6 |
| Benzyl chloride | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromodichloromethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromoform | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromomethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Carbon disulfide | F | 7.4 E-6 | 3.0 E-6 | 2.5 E-6 | -- | -- | -- | -- | F | 1.7 E-5 | 6.7 E-6 | 5.6 E-6 | -- | -- | -- | -- |
| Carbon tetrachloride | S | 6.5 E-6 | 2.6 E-6 | 2.2 E-6 | S | 1.6 E-6 | 6.5 E-7 | 5.4 E-7 | S | 3.2 E-6 | 1.3 E-6 | 1.1 E-6 | F | 1.1 E-5 | 4.5 E-6 | 3.8 E-6 |
| Chlorobenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chlorobromomethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chloroethane | -- | -- | -- | -- | -- | -- | -- | -- | F | 2.0 E-5 | 8.1 E-6 | 6.8 E-6 | -- | -- | -- | -- |
| Chloroform | S | 2.0 E-5 | 8.0 E-6 | 6.7 E-6 | S | 5.9 E-6 | 2.4 E-6 | 2.0 E-6 | S | 4.7 E-6 | 1.9 E-6 | 1.6 E-6 | S | 5.3 E-6 | 2.1 E-6 | 1.8 E-6 |
| Chloromethane | -- | -- | -- | -- | -- | -- | -- | -- | F | 1.0 E-5 | 4.1 E-6 | 3.4 E-6 | -- | -- | -- | -- |
| cis-1,2-Dichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Cymene (Isopropyltoluene) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibromochloromethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibromochloropropane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibromomethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dichloromethane (Methylene chloride) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | S | 2.4 E-6 | 9.8 E-7 | 8.2 E-7 |
| Ethanol | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Ethylbenzene | -- | -- | -- | -- | F | 9.2 E-6 | 3.7 E-6 | 3.1 E-6 | F | 1.1 E-5 | 4.2 E-6 | 3.5 E-6 | F | 1.6 E-5 | 6.5 E-6 | 5.4 E-6 |

**TABLE 6-3**
**EXPOSURE POINT CONCENTRATIONS FROM SURFACE FLUX**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
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| Chemical | GNC1-JS09 | | | | GNC1-JS10 | | | | GNC1-JS11 | | | | GNC1-JS11R | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air | Method | Residential Indoor Air | Commercia Indoor Air | Outdoor Air |
| Freon-11 (Trichlorofluoromethane) | -- | -- | -- | -- | -- | -- | -- | -- | F | 1.2 E-5 | 4.7 E-6 | 3.9 E-6 | -- | -- | -- | -- |
| Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Freon-12 (Dichlorodifluoromethane) | -- | -- | -- | -- | -- | -- | -- | -- | F | 2.8 E-5 | 1.1 E-5 | 9.5 E-6 | -- | -- | -- | -- |
| Heptane | -- | -- | -- | -- | -- | -- | -- | -- | F | 7.1 E-6 | 2.9 E-6 | 2.4 E-6 | F | 9.7 E-6 | 3.9 E-6 | 3.2 E-6 |
| Hexachlorobutadiene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | F | 2.8 E-5 | 1.1 E-5 | 9.5 E-6 | F | 3.6 E-5 | 1.5 E-5 | 1.2 E-5 |
| m & p-Xylenes | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Methyl ethyl ketone (2-Butanone) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Methyl iodide | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MTBE (Methyl tert-butyl ether) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Butylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Propylbenzene | -- | -- | -- | -- | F | 7.9 E-6 | 3.1 E-6 | 2.6 E-6 | F | 6.9 E-6 | 2.8 E-6 | 2.3 E-6 | F | 9.5 E-6 | 3.8 E-6 | 3.2 E-6 |
| o-Xylene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| sec-Butylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | F | 1.6 E-5 | 6.4 E-6 | 5.3 E-6 |
| Styrene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| tert-Butylbenzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | S | 8.7 E-6 | 3.5 E-6 | 2.9 E-6 | F | 1.2 E-5 | 4.8 E-6 | 4.0 E-6 | S | 1.7 E-6 | 6.7 E-7 | 5.6 E-7 | -- | -- | -- | -- |
| Toluene | -- | -- | -- | -- | -- | -- | -- | -- | F | 3.5 E-5 | 1.4 E-5 | 1.2 E-5 | F | 4.5 E-5 | 1.8 E-5 | 1.5 E-5 |
| Total Xylenes | -- | -- | -- | -- | -- | -- | -- | -- | F | 4.8 E-5 | 1.9 E-5 | 1.6 E-5 | F | 7.9 E-5 | 3.2 E-5 | 2.6 E-5 |
| trans-1,2-Dichloroethene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Trichloroethene | -- | -- | -- | -- | S | 1.7 E-6 | 6.7 E-7 | 5.6 E-7 | -- | -- | -- | -- | -- | -- | -- | -- |
| Vinyl acetate | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Vinyl chloride | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**Notes:**

All units in $mg/m^3$.

Method represents the surface flux measurement used in the risk calculations for that particular chemical/location: S = SIM; F = Full Scan.

See Appendix I for all indoor and outdoor air concentration calculations from surface flux measurement data. See Table 6-6 for outdoor air exposure point concentrations for non-volatile COPCs in soil.

Exposure point concentrations for surface flux data are based on a sample by sample basis. Averaging of the data was not conducted. Therefore only those chemicals detected in a particular sample were included in the risk estimates. A "--" is presented for those chemical not detected and not included in the risk estimates for each sample location. The exposure point concentration is the maximum of the full scan or SIM analysis results (when both had detected values, otherwise the detected value from one or the other is used). Thus, summary statistics are not presented in this table (see Table 3-8 for the surface flux data summary ).

**TABLE 6-4**
**PARTICULATE EMISSION FACTOR (PEF) FOR ON-SITE RESIDENTIAL SCENARIO**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 1)**

| Parameter | Abbrev. | Units | Value |
|---|---|---|---|
| **Wind Erosion and Construction Activities** | | | |
| Fraction of vegetative cover[1] | V | -- | 0.5 |
| Mean annual wind speed[2] | $U_m$ | m/s | 4.10 |
| Equivalent threshold value of wind speed[1] | $U_t$ | m/s | 11.32 |
| Function dependent on $U/U_t$[1] | F(x) | -- | 0.19 |
| | | | |
| **Air Dispersion Factor for Area Source[4]** | **$Q/C_{wind}$** | **$g/m^2$-sec per $kg/m^3$** | **41.02** |
| Constant A[1] | A | -- | 13.31 |
| Constant B[1] | B | -- | 19.84 |
| Constant C[1] | C | -- | 230.17 |
| Areal Extent of site surface contamination[3] | $A_{surf}$ | acres | 42.20 |
| | | | |
| **Onsite Residential PEF[5]** | **$PEF_{Onsite\ Resident}$** | **$m^3/kg$** | **8.90E+08** |
| **Total outdoor ambient air dust concentration[6]** | **$D_{Onsite\ Resident}$** | **$kg/m^3$** | **1.12E-09** |

(1) Assumed value for the site based upon USEPA (2002b). Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Solid Waste and Emergency Response, Washington, DC. OSWER 9355.4-24. December.

(2) Derived by averaging data from the Las Vegas Airport and Nellis AFB stations.

(3) Site area.

(4) From USEPA 2002b - $Q/C_{sa} = A \times \exp[(\ln(A_{surf}) - B)^2/C]$.

$$\{[2.6 \times (s/12)^{0.8} \times (W/3)^{0.4}/(M/0.2)^{0.3}] \times [(365\text{-}p)/365] \times 281.9 \times \sum VKT_{road}\}.$$

(5) From USEPA 2002b - $PEF_{Onsite\ Resident} = Q/C_{wind} * (3600/(0.036*(1\text{-}V)*((U_m/U_t)\text{^}3)*F(x)))$

(6) $D_{Onsite\ Resident} = 1/PEF_{Onsite\ Resident}$

**TABLE 6-5**
**PARTICULATE EMISSION FACTOR (PEF) FOR CONSTRUCTION SCENARIO**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 3)**

| Parameter | Abbrev. | Units | Value |
|---|---|---|---|
| **Wind Erosion and Construction Activities** | | | |
| **Fugitive dust from wind erosion[1]** | $M_{wind}$ | g | **5.0E+05** |
| Fraction of vegetative cover[2] | V | -- | 0.00 |
| Mean annual wind speed[3] | $U_m$ | m/s | 4.10 |
| Equivalent threshold value of wind speed[2] | $U_t$ | m/s | 11.32 |
| Function dependent on $U/U_t$[2] | F(x) | -- | 0.194 |
| Areal Extent of site surface contamination[4] | $A_{surf}$ | $m^2$ | 170783.40 |
| Exposure duration[5] | ED | year | 1 |
| **Fugitive dust from excavation soil dumping[6]** | $M_{excav}$ | g | **4.4E+04** |
| In situ wet soil bulk density[7] | $\rho_{soil}$ | $Mg/m^3$ | 1.83 |
| Gravimetric Soil Moisture Content %[8] | M | % | 4.98 |
| Areal extent of site excavation[9] | $A_{excav}$ | $m^2$ | 34156.68 |
| Average depth of site excavation[2] | $d_{excav}$ | m | 1.00 |
| Number of times soil is dumped[2] | $N_A$ | -- | 2.00 |
| | | | |
| **Fugitive dust from dozing[10]** | $M_{doz}$ | g | **1.2E+04** |
| Soil silt content %[7] | s | % | 6.90 |
| Gravimetric Soil Moisture Content %[8] | M | % | 4.98 |
| Average dozing speed[2] | $S_{doz}$ | km/hr | 11.40 |
| Number of times area is dozed | $N_{doze}$ | -- | 3.00 |
| Length of dozer blade | $B_d$ | m | 2.44 |
| Sum dozing kilometers traveled[11] | $VKT_{doz}$ | km | 209.98 |
| | | | |
| **Fugitive dust from grading[12]** | $M_{grade}$ | g | **9.2E+04** |
| Average grading speed[2] | $S_{grade}$ | km/hr | 11.40 |
| Number of times area is graded | $N_{grade}$ | -- | 3.00 |
| Length of grading blade | $B_g$ | m | 2.44 |
| Sum grading kilometers traveled[12] | $VKT_{grade}$ | km | 209.98 |

**TABLE 6-5**
**PARTICULATE EMISSION FACTOR (PEF) FOR CONSTRUCTION SCENARIO**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter | Abbrev. | Units | Value |
|---|---|---|---|
| **Fugitive dust from tilling[13]** | $M_{till}$ | g | **2.4E+04** |
| Soil silt content %[7] | s | % | 6.90 |
| Areal extent of site tilling[9] | $A_{till}$ | acre | 8.44 |
| Number of times soil is tilled[2] | $N_A$ | -- | 2.00 |
| **Total Time Averaged $PM_{10}$ Emission[14]** | **$J'_T$** | g/m2-sec | **1.24E-07** |
| Duration of construction[2] | T | sec | 3.15E+07 |
| **Subchronic Dispersion Factor for Area Source[15]** | **$Q/C_{sa}$** | $g/m^2$-sec per $kg/m^3$ | **6.74** |
| Constant A[2] | A | -- | 2.45 |
| Constant B[2] | B | -- | 17.57 |
| Constant C[2] | C | -- | 189.04 |
| Areal Extent of site surface contamination[4] | $A_{surf}$ | acres | 42.20 |
| **Dispersion correction factor[16]** | **$F_D$** | -- | **0.186** |
| Duration of construction (time period during which construction activities occur) | $t_c$ | hr | 8760 |
| **Subchronic PEF for Construction Activities[17]** | **$PEF_{sc}$** | **$m^3/kg$** | **2.93E+08** |
| **Unpaved Road Traffic** | | | |
| Length of road segment[18] | $L_R$ | m | 413.26 |
| Width of road segment[2] | $W_R$ | m | 6.10 |
| Surface area of contaminated road segment[19] | $A_R$ | $m^2$ | 2519.23 |
| Road surface silt content %[20] | s | % | 8.50 |
| Mean vehicle weight[2] | W | tons | 8.00 |
| Percent moisture in dry road surface[20] | M | % | 4.31 |
| Number of days/year with at least 0.01 inches of precipitation[3] | p | days | 27.00 |
| Number of vehicles for duration of construction | $N_V$ | vehicles | 30.00 |
| Length of road traveled per day | $L_D$ | m/day | 413.26 |
| Sum of fleet vehicle kilometers traveled during the exposure duration[21] | $VKT_{road}$ | km | 1611.71 |

**TABLE 6-5**
**PARTICULATE EMISSION FACTOR (PEF) FOR CONSTRUCTION SCENARIO**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter | Abbrev. | Units | Value |
|---|---|---|---|
| **Subchronic Dispersion Factor for road segment[(22)]** | $Q/C_{sr}$ | $g/m^2$-sec per $kg/m^3$ | 13.67 |
| Constant A[(2)] | A | | 12.94 |
| Constant B[(2)] | B | | 5.74 |
| Constant C[(2)] | C | | 71.77 |
| **Subchronic PEF for Unpaved Road Traffic[(23)]** | **$PEF_{sc_road}$** | **$m^3/kg$** | **1.19E+07** |
| **Total construction related PEF[(24)]** | **$PEF_{sc_total}$** | **$m^3/kg$** | **1.15E+07** |
| **Total outdoor ambient air dust concentration[(25)]** | **$D_{construct}$** | **$kg/m^3$** | **8.71E-08** |

(1) From USEPA. (2002b). Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Solid Waste and Emergency Response, Washington, DC. OSWER 9355.4-24. December. - $Mwind = 0.036 \times (1-V) \times (Um/Ut)^3 \times F(x) \times Asurf \times ED \times 8760hr/yr$.

(2) Assumed value for the site based upon USEPA (2002b).

(3) Derived by averaging data from the Las Vegas Airport and Nellis AFB stations.

(4) Site area.

(5) Construction worker ED

(6) From USEPA 2002b - $M_{excav} = 0.35 \times 0.0016 \times [(U_m/2.2_)^{1.3}/(M/2)^{1.4}] \times \rho_{soil} \times A_{excav} \times d_{excav} \times N_A \times 10^3 g/kg$.

(7) This value can change based on site specific characteristics

(8) Based on the average of percent moisture across the site.

(9) Assumed value of one fifth of the site based upon USEPA (2002b).

(10) From USEPA 2002b - $M_{doz} = 0.75 \times [(0.45 \times s^{1.5})/(M)^{1.4}] \times \sum VKT_{doz}/S_{doz} \times 10^3 g/kg$.

(11) From USEPA 2002b - $VKT_{doz} = [(A_{surf}^{0.5}/2.44m) \times A_{surf}^{0.5} \times 3]/1{,}000$ m/km.

(12) From USEPA 2002b - $M_{grade} = 0.60 \times (0.0056 \times S^{2.0}) \times \sum VKT_{grade} \times 10^3 g/kg$.

(13) From USEPA 2002b - $M_{till} = 1.1 \times s^{0.6} \times A_{till} \times 4{,}047 m^2/acre \times 10^{-4} ha/m^2 \times 10^3 g/kg \times N_A$.

(14) From USEPA 2002b - $J'_T = (M_{wind} + M_{excav} + M_{doz} + M_{grade} + M_{till})/(A_{surf} \times T)$.

(15) From USEPA 2002b - $Q/C_{sa} = A \times \exp[(\ln(A_{surf}) - B)^2/C]$.

(16) From USEPA 2002b - $F_D = 0.1852 + (5.3537/t_c) + (-9.6318/t_c^2)$, $t_c = T/(3{,}600 sec/hour)$.

(17) From USEPA 2002b - $PEF_{sc} = Q/C_{sa} \times (1/F_D) \times (1/J'_T)$.

(18) Assumed value of the square root of the site area, based upon USEPA (2002b).

(19) From USEPA 2002b - $A_R = L_R \times W_R * 0.092903$ m2/ft2

(20) Average of surface soil percent moisture results.

(21) From USEPA 2002b - $VKT_{road} = 30$ vehicles $\times L_R \times [(52$ wks/yr$)/2] \times (5$ days/week$) / (1000$ m/km).

(22) From USEPA 2002b - $Q/C_{sr} = A \times \exp[(\ln(A_{surf}) - B)^2/C]$.

(23) From USEPA 2002b - $PEF_{sc_road} = Q/C_{sr} \times (1/F_D) \times T \times A_R / \{[2.6 \times (s/12)^{0.8} \times (W/3)^{0.4}/(M/0.2)^{0.3}] \times [(365-p)/365] \times 281.9 \times \sum VKTroad\}$.

(24) $PEF_{sc_total} = \{1/[(1/PEF_{sc}) + (1/PEF_{sc_road})]\}$.

(25) $D_{construct} = 1/PEF_{sc_total}$.

**TABLE 6-6**
**OUTDOOR AIR EXPOSURE POINT CONCENTRATIONS FROM SOIL**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Soil Conc. (mg/kg) | Construction Worker Outdoor Air | | Non-Construction Worker Outdoor Air | |
|---|---|---|---|---|---|
| | | PEF/VF[(1)] ($kg/m^3$) | Air Conc.[(2)] ($mg/m^3$) | PEF/VF[(3)] ($kg/m^3$) | Air Conc.[(2)] ($mg/m^3$) |
| *Inorganics* | | | | | |
| Ammonia (as N) | 2.3 E+0 | 8.7 E-8 | 2.0 E-7 | 1.0 E-9 | 2.4 E-9 |
| Perchlorate | 7.3 E+0 | 8.7 E-8 | 6.4 E-7 | 1.0 E-9 | 7.7 E-9 |
| *Polynuclear Aromatic Hydrocarbons* | | | | | |
| Benzo(a)anthracene | 1.3 E-2 | 8.7 E-8 | 1.1 E-9 | 1.0 E-9 | 1.4 E-11 |
| Benzo(a)pyrene | 1.3 E-2 | 8.7 E-8 | 1.1 E-9 | 1.0 E-9 | 1.4 E-11 |
| Benzo(b)fluoranthene | 2.7 E-2 | 8.7 E-8 | 2.4 E-9 | 1.0 E-9 | 2.9 E-11 |
| Benzo(k)fluoranthene | 2.2 E-3 | 8.7 E-8 | 1.9 E-10 | 1.0 E-9 | 2.3 E-12 |
| Chrysene | 2.1 E-2 | 8.7 E-8 | 1.8 E-9 | 1.0 E-9 | 2.2 E-11 |
| Dibenzo(a,h)anthracene | 1.3 E-2 | 8.7 E-8 | 1.1 E-9 | 1.0 E-9 | 1.3 E-11 |
| Indeno(1,2,3-cd)pyrene | 6.3 E-3 | 8.7 E-8 | 5.5 E-10 | 1.0 E-9 | 6.6 E-12 |
| *Semi-Volatile Organic Compounds* | | | | | |
| Butylbenzyl phthalate | 2.6 E+1 | 8.7 E-8 | 2.3 E-6 | 1.0 E-9 | 2.8 E-8 |

**Notes:**
(1) Construction worker PEF from Table 6-5; PEF was used for the soil VOCs with exception of the aldehydes.
(2) Soil concentration × PEF
(3) Default PEF from Closure Plan used.

**TABLE 6-7**
**PLANT UPTAKE FACTORS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Aboveground Plant[1] Uptake Factor mg/kg plant DW/mg/kg soil | Belowground Plant[1] Uptake Factor mg/kg plant DW/mg/kg soil | Reference |
|---|---|---|---|
| *Inorganics* | | | |
| Ammonia (as N) | NA | NA | Closure Plan |
| Perchlorate | NA | NA | see text |
| *Semi-Volatile Organic Compounds* | | | |
| Benzo(a)anthracene | 2.0 E-4 | 3.0 E-3 | USEPA 2005b |
| Benzo(a)pyrene | 1.1 E-4 | 2.6 E-3 | USEPA 2005b |
| Benzo(b)fluoranthene | 1.0 E-4 | 2.4 E-3 | USEPA 2005b |
| Benzo(k)fluoranthene | 1.0 E-4 | 2.4 E-3 | USEPA 2005b |
| Chrysene | 1.9 E-4 | 3.3 E-3 | USEPA 2005b |
| Dibenzo(a,h)anthracene | 4.9 E-5 | 2.0 E-2 | USEPA 2005b |
| Indeno(1,2,3-cd)pyrene | 3.9 E-5 | 3.1 E-3 | USEPA 2005b |
| Butylbenzyl phthalate | 7.1 E-4 | 3.1 E-2 | USEPA 2005b |

(1) Calculations were performed as identified in the Closure Plan (BRC and ERM 2007) as shown in USEPA 2005 - Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

**TABLE 6-8**
**RESIDENTIAL EXPOSURE FACTORS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter | Abbrev. | Value | Units | Reference |
|---|---|---|---|---|
| Dermal absorption fraction | ABS | ---chemical-specific--- | | see text |
| Soil-plant bioconcentration factors | Br | ---chemical-specific--- | | see text |
| Dermal adherence factor, adul | $AF_a$ | 0.07 | $mg/cm^2$ | Closure Plan |
| Dermal adherence factor, chilc | $AF_c$ | 0.2 | $mg/cm^2$ | Closure Plan |
| Averaging time, carcinogeni | $AT_c$ | 70 | years | Closure Plan |
| Averaging time, carcinogenic (inhalation | $AT_c$ | 613200 | hours | Closure Plan |
| Averaging time, non-carcinogeni | $AT_{nc}$ | 6 | years | Closure Plan |
| Averaging time, non-carcinogenic (inhalation | $AT_{nc}$ | 52560 | hours | Closure Plan |
| Adult body weight | $BW_a$ | 70 | kg | Closure Plan |
| Child body weight | $BW_c$ | 15 | kg | Closure Plan |
| Exposure frequency | $EF_r$ | 350 | days/year | Closure Plan |
| Exposure duration - chilc | $ED_{rc}$ | 6 | years | Closure Plan |
| Exposure duration - child (inhalation) | $ED_{rc}$ | 52560 | hours | Closure Plan |
| Exposure duration - adult (for age-weighted | $ED_{ra}$ | 24 | years | Closure Plan |
| Exposure duration - adult (for age-weighted; inhalation | $ED_{ra}$ | 210240 | hours | Closure Plan |
| Exposure duration | EDr | 30 | years | Closure Plan |
| Exposure duration (inhalation) | EDr | 262800 | hours | Closure Plan |
| Exposure time - outdoors (inhalation only | $ET_o$ | 2.0 | hours | Closure Plan |
| Exposure time - indoors (inhalation only | $ET_i$ | 16.7 | hours | Closure Plan |
| Dilution factor for outdoor-to-indoor ai | $DF_i$ | 0.4 | unitless | Closure Plan |
| Available skin surface area, adul | $SA_a$ | 5,700 | $cm^2$/day | Closure Plan |
| Available skin surface area, chilc | $SA_c$ | 2,800 | $cm^2$/day | Closure Plan |
| Fruit/vegetable ingestion rate, aboveground, chil | $CR_{ag,c}$ | 0.0179 | kg DW/d | Closure Plan |
| Fruit/vegetable ingestion rate, belowground, chil | $CR_{bg,c}$ | 0.0033 | kg DW/d | Closure Plan |
| Fruit/vegetable ingestion rate, aboveground, adul | $CR_{ag,a}$ | 0.0609 | kg DW/d | Closure Plan |
| Fruit/vegetable ingestion rate, belowground, adul | $CR_{bg,a}$ | 0.0098 | kg DW/d | Closure Plan |
| Contaminated plant fraction from the site | CPF | 0.25 | -- | Closure Plan |
| Adult soil ingestion rat | $IR_{s,a}$ | 100 | mg/day | Closure Plan |
| Child soil ingestion rat | $IR_{s,c}$ | 200 | mg/day | Closure Plan |
| Soil ingestion, noncancer | -- | 1.28 E-5 | $day^{-1}$ | Calculated |
| Soil ingestion, cancer | -- | 1.57 E-6 | $day^{-1}$ | Calculated |
| Soil dermal contact, noncancer | -- | 3.58 E-5 | $day^{-1}$ | Calculated |
| Soil dermal contact, cancer | -- | 4.94 E-6 | $day^{-1}$ | Calculated |
| Inhalation, soil-dust, outdoor, noncancer | -- | 7.99 E-2 | unitless | Calculated |
| Inhalation, soil-dust, outdoor, cancer | -- | 3.42 E-2 | unitless | Calculated |
| Inhalation, soil-volatiles, outdoor, noncancer | -- | 7.99 E-2 | unitless | Calculated |
| Inhalation, soil-volatiles, outdoor, cancer | -- | 3.42 E-2 | unitless | Calculated |
| Fruit/Vegetable ingestion, noncancer - aboveground | -- | 2.86 E-4 | $day^{-1}$ | Calculated |
| Fruit/Vegetable ingestion, noncancer - belowground | -- | 5.27 E-5 | $day^{-1}$ | Calculated |
| Fruit/Vegetable ingestion, cancer - aboveground | -- | 9.60 E-5 | $day^{-1}$ | Calculated |
| Fruit/Vegetable ingestion, cancer - belowground | -- | 1.60 E-5 | $day^{-1}$ | Calculated |
| Inhalation, soil-dust, indoor, noncancer | -- | 2.67 E-1 | unitless | Calculated |
| Inhalation, soil-dust, indoor, cancer | -- | 1.14 E-1 | unitless | Calculated |

**TABLE 6-9**
**WORKERS EXPOSURE FACTORS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter | Abbrev. | Value | Units | Reference |
|---|---|---|---|---|
| Dermal absorption fraction | ABS | ---chemical-specific-- | | see text |
| Maintenance worker dermal adherence factor | $AF_{mw}$ | 0.2 | $mg/cm^2$ | Closure Plan |
| Commercial worker dermal adherence factor | $AF_{cmw}$ | NA | $mg/cm^2$ | Closure Plan |
| Construction worker dermal adherence factor | $AF_{cw}$ | 0.3 | $mg/cm^2$ | Closure Plan |
| Averaging time, carcinogenic | $AT_c$ | 70 | years | Closure Plan |
| Averaging time, carcinogenic (inhalation | $AT_c$ | 613200 | hours | Closure Plan |
| Averaging time, non-carcinogenic, maintenance/commercial worker | $AT_{nc}$ | 25 | years | Closure Plan |
| Averaging time, non-carcinogenic, maintenance/commercial worker (inhalation | $AT_{nc}$ | 219000 | hours | Closure Plan |
| Averaging time, non-carcinogenic, construction worker | $AT_{nc,c}$ | 1 | years | Closure Plan |
| Averaging time, non-carcinogenic, construction worker (inhalation | $AT_{nc,c}$ | 8760 | hours | Closure Plan |
| Adult body weight | $BW_a$ | 70 | kg | Closure Plan |
| Maintenance worker exposure frequency | $EF_{mw}$ | 225 | days/year | Closure Plan |
| Commercial worker exposure frequency | $EF_{cmw}$ | 250 | days/year | Closure Plan |
| Construction worker exposure frequency | $EF_{cmw}$ | 250 | days/year | Closure Plan |
| Exposure duration, maintenance/commercial worker | ED | 25 | years | Closure Plan |
| Exposure duration, maintenance/commercial worker (inhalation) | ED | 219000 | hours | Closure Plan |
| Exposure duration, construction worker | ED | 1 | years | Closure Plan |
| Exposure duration, construction worker (inhalation) | ED | 8760 | hours | Closure Plan |
| Maintenance worker exposed surface area | $SA_{mw}$ | 3,300 | $cm^2/day$ | Closure Plan |
| Construction worker exposed surface area | $SA_{mw}$ | 3,300 | $cm^2/day$ | Closure Plan |
| Commercial worker exposed surface area | $SA_{cmw}$ | NA | $cm^2/day$ | Closure Plan |
| Maintenance worker soil ingestion rate | $IR_{s,mw}$ | 100 | mg/day | Closure Plan |
| Commercial worker soil ingestion rate | $IR_{s,cmw}$ | 50 | mg/day | Closure Plan |
| Construction worker soil ingestion rate | $IR_{s,cmw}$ | 330 | mg/day | Closure Plan |
| Commercial worker exposure time, indoor | $ET_{cmw,i}$ | 8 | based on 8 hr/d | Closure Plan |
| Commercial worker exposure time, outdoor | $ET_{cmw,o}$ | 0 | indoor worker | Closure Plan |
| Maintenance worker exposure time, indoor | $ET_{mw,i}$ | 0 | outdoor worker | Closure Plan |
| Maintenance worker exposure time, outdoor | $ET_{mw,o}$ | 8 | based on 8 hr/d | Closure Plan |
| Soil ingestion, non-cancer, commercial worker | -- | 4.89 E-7 | $day^{-1}$ | Calculated |
| Soil ingestion, cancer, commercial worker | -- | 1.75 E-7 | $day^{-1}$ | Calculated |
| Soil ingestion, non-cancer, maintenance worker | -- | 8.81 E-7 | $day^{-1}$ | Calculated |
| Soil ingestion, cancer, maintenance worker | -- | 3.15 E-7 | $day^{-1}$ | Calculated |
| Soil dermal contact, non-cancer, maintenance worker | -- | 5.81 E-6 | $day^{-1}$ | Calculated |
| Soil dermal contact, cancer, maintenance worker | -- | 2.08 E-6 | $day^{-1}$ | Calculated |
| Inhalation, fugitive-dust, outdoor, non-cancer, maintenance worker | -- | 2.05 E-1 | unitless | Calculated |
| Inhalation, fugitive-dust, outdoor, cancer, maintenance worker | -- | 7.34 E-2 | unitless | Calculated |
| Soil ingestion, noncancer, construction worker | -- | 3.23 E-6 | $day^{-1}$ | Calculated |
| Soil ingestion, cancer, construction worker | -- | 4.61 E-8 | $day^{-1}$ | Calculated |
| Soil dermal contact, noncancer, construction worker | -- | 9.69 E-6 | $day^{-1}$ | Calculated |
| Soil dermal contact, cancer, construction worker | -- | 1.38 E-7 | $day^{-1}$ | Calculated |
| Inhalation, soil-dust, outdoor, noncancer, construction worker | -- | 2.28 E-1 | unitless | Calculated |
| Inhalation, soil-dust, outdoor, cancer, construction worker | -- | 3.26 E-3 | unitless | Calculated |

Note: Exposure parameters for maintenance workers and commerical workers are based on outdoor and indoor commercial/industrial worker exposure factors, respectively, from USEPA, 2002b.

**TABLE 6-10**
**TOXICITY CRITERIA FOR SURFACE FLUX**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Compound | Cancer IUR $1/(\mu g/m^3)$ | | Non-Cancer RfC $(mg/m^3)$ | |
|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 7.4 E-6 | I | -- | |
| 1,1,1-Trichloroethane | -- | | 5.0 E+0 | I |
| 1,1,2,2-Tetrachloroethane | 5.8 E-5 | I | -- | |
| 1,1,2-Trichloroethane | 1.6 E-5 | I | -- | |
| 1,1-Dichloroethane | 1.6 E-6 | CA | -- | |
| 1,1-Dichloroethene | -- | | 2.0 E-1 | I |
| 1,1-Dichloropropene | -- | | 2.0 E-2 | S |
| 1,2,3-Trichloropropane | -- | | 3.0 E-4 | I |
| 1,2,4-Trichlorobenzene | -- | | 4.0 E-3 | P |
| 1,2,4-Trimethylbenzene | -- | | 7.0 E-3 | P |
| 1,2-Dibromoethane | 6.0 E-4 | I | 9.0 E-3 | I |
| 1,2-Dichlorobenzene | -- | | 2.0 E-1 | H |
| 1,2-Dichloroethane | 2.6 E-5 | I | 2.4 E+0 | A |
| 1,2-Dichloropropane | 1.0 E-5 | CA | 4.0 E-3 | I |
| 1,3,5-Trimethylbenzene | -- | | 7.0 E-3 | P |
| 1,3-Dichlorobenzene | -- | | 2.0 E-1 | S |
| 1,3-Dichloropropane | -- | | 4.0 E-3 | S |
| 1,4-Dichlorobenzene | 1.1 E-5 | CA | 8.0 E-1 | I |
| 1,4-Dioxane | 7.7 E-6 | CA | 3.6 E+0 | A |
| 2,2-Dichloropropane | -- | | 4.0 E-3 | S |
| 2-Hexanone | -- | | 3.0 E-2 | I |
| 2-Methyl-1-propanol | -- | | 3.0 E+1 | S |
| 4-Methyl-2-pentanone (MIBK) | -- | | 3.0 E+0 | I |
| Acetone | -- | | 3.1 E+1 | A |
| Acetonitrile | -- | | 6.0 E-2 | I |
| Benzene | 7.8 E-6 | I | 3.0 E-2 | I |
| Benzyl chloride | -- | | 1.0 E-3 | P |
| Bromodichloromethane | -- | | 1.0 E+0 | S |
| Bromoform | 1.1 E-6 | I | -- | |
| Bromomethane | -- | | 5.0 E-3 | I |
| Carbon disulfide | -- | | 7.0 E-1 | I |
| Carbon tetrachloride | 6.0 E-6 | I | 1.0 E-1 | I |
| Chlorobenzene | -- | | 5.0 E-2 | P |
| Chlorobromomethane | -- | | 4.0 E-2 | S |
| Chloroethane | -- | | 1.0 E+1 | I |
| Chloroform | 2.3 E-5 | I | 9.8 E-2 | A |
| Chloromethane | 1.8 E-6 | H | 9.0 E-2 | I |
| cis-1,2-Dichloroethene | -- | | 6.0 E-2 | S |

**TABLE 6-10**
**TOXICITY CRITERIA FOR SURFACE FLUX**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Compound | Cancer IUR 1/(µg/m$^3$) | | Non-Cancer RfC (mg/m$^3$) | |
|---|---|---|---|---|
| cis-1,3-Dichloropropene | 4.0 E-6 | I | 2.0 E-2 | I |
| Cymene (Isopropyltoluene) | -- | | 4.0 E-1 | S |
| Dibromochloromethane | 2.7 E-5 | CA | -- | |
| Dibromochloropropane | 6.0 E-3 | P | 2.0 E-4 | I |
| Dibromomethane | -- | | 4.0 E-3 | S |
| Dichloromethane (Methylene chloride) | 4.7 E-7 | I | 1.1 E+0 | A |
| Ethanol | -- | | 1.0 E+2 | S |
| Ethylbenzene | 2.5 E-6 | CA | 1.0 E+0 | I |
| Freon-11 (Trichlorofluoromethane) | -- | | 7.0 E-1 | H |
| Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane) | -- | | 3.0 E+1 | H |
| Freon-12 (Dichlorodifluoromethane) | -- | | 2.0 E-1 | H |
| Heptane | -- | | 7.0 E+0 | S |
| Hexachlorobutadiene | 2.2 E-5 | I | -- | |
| Isopropylbenzene | -- | | 4.0 E-1 | I |
| m & p-Xylenes | -- | | 1.0 E-1 | I |
| Methyl ethyl ketone (2-Butanone) | -- | | 5.0 E+0 | I |
| Methyl iodide | -- | | 1.7 E-1 | S |
| MTBE (Methyl tert-butyl ether) | 2.6 E-7 | CA | 3.0 E+0 | I |
| Naphthalene | 3.4 E-5 | CA | 3.0 E-3 | I |
| n-Butylbenzene | -- | | 4.0 E-1 | S |
| n-Propylbenzene | -- | | 4.0 E-1 | S |
| o-Xylene | -- | | 1.0 E-1 | I |
| sec-Butylbenzene | -- | | 4.0 E-1 | S |
| Styrene | -- | | 1.0 E+0 | I |
| tert-Butylbenzene | -- | | 4.0 E-1 | S |
| Tetrachloroethene | 5.9 E-6 | CA | 2.7 E-1 | A |
| Toluene | -- | | 5.0 E+0 | I |
| Total Xylenes | -- | | 1.0 E-1 | I |
| trans-1,2-Dichloroethene | -- | | 6.0 E-2 | P |
| trans-1,3-Dichloropropene | 4.0 E-6 | I | 2.0 E-2 | I |
| Trichloroethene | 2.0 E-6 | CA | -- | |
| Vinyl acetate | -- | | 2.0 E-1 | I |
| Vinyl chloride | 4.4 E-6 | I | 1.0 E-1 | I |

Key:
A = ATSDR
H = HEAST (USEPA 1997)
I = IRIS (USEPA 2011)
CA = Cal/EPA (from NDEP 2011a)
P = USEPA EPA PPRTV (from NDEP 2011a)
S = NDEP Surrogate (from NDEP 2011a)

**TABLE 6-11**
**NON-CANCER TOXICITY CRITERIA FOR SOIL**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Inhalation - Chronic | | Inhalation - Subchronic | | Oral[(1)] - Chronic | | Oral[(1)] - Subchronic | | Oral BIO | Dermal ABS[(2)] |
|---|---|---|---|---|---|---|---|---|---|---|
| | Value ($mg/m^3$) | Reference | Value ($mg/m^3$) | Reference | Value (mg/kg/day) | Reference | Value (mg/kg/day) | Reference | | |
| **Inorganics** | | | | | | | | | | |
| Ammonia (as N) | 1.0 E-1 | USEPA 2011 | 1.0 E-1 | Chronic | NA | | NA | | 1.0 | NA |
| Perchlorate | NA | | NA | | 7.0 E-4 | USEPA 2011 | 7.0 E-4 | Chronic | 1.0 | NA |
| **Organic Compounds** | | | | | | | | | | |
| Benzo(a)anthracene | NA | | NA | | 3.0 E-2 | pyrene as surrogate | 3.0 E-2 | Chronic | 1.0 | 0.13 |
| Benzo(a)pyrene | NA | | NA | | 3.0 E-2 | pyrene as surrogate | 3.0 E-2 | Chronic | 1.0 | 0.13 |
| Benzo(b)fluoranthene | NA | | NA | | 3.0 E-2 | pyrene as surrogate | 3.0 E-2 | Chronic | 1.0 | 0.13 |
| Benzo(k)fluoranthene | NA | | NA | | 3.0 E-2 | pyrene as surrogate | 3.0 E-2 | Chronic | 1.0 | 0.13 |
| Butylbenzyl phthalate | NA | | NA | | 2.0 E-1 | USEPA 2011 | 2.0 E-1 | Chronic | 1.0 | 0.1 |
| Chrysene | NA | | NA | | 3.0 E-2 | pyrene as surrogate | 3.0 E-2 | Chronic | 1.0 | 0.13 |
| Dibenzo(a,h)anthracene | NA | | NA | | 3.0 E-2 | pyrene as surrogate | 3.0 E-2 | Chronic | 1.0 | 0.13 |
| Indeno(1,2,3-cd)pyrene | NA | | NA | | 3.0 E-2 | pyrene as surrogate | 3.0 E-2 | Chronic | 1.0 | 0.13 |

**Notes**

Values obtained from NDEP (2011a).

NA = Not applicable. Data is either not applicable for this chemical or not available.

BIO = bioavailability

ABS = dermal absorption efficiency

(1) Vanadium required the adjustment of the oral toxicity criteria for the dermal soil exposure pathway (USEPA 2004e).

(2) Dermal absorption factors obtained from USEPA 2004e.

**TABLE 6-12**
**CANCER TOXICITY CRITERIA FOR SOIL**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical | Inhalation | | Oral[(1)] | | Oral BIO | Dermal ABS[(2)] |
|---|---|---|---|---|---|---|
| | Value $(\mu g/m^3)^{-1}$ | Reference | Value $(mg/kg\text{-}day)^{-1}$ | Reference | | |
| **Inorganics** | | | | | | |
| Ammonia (as N) | NA | | NA | | 1.0 | NA |
| Perchlorate | NA | | NA | | 1.0 | NA |
| **Organic Compounds** | | | | | | |
| Benzo(a)anthracene | 1.1 E-4 | Cal/EPA | 7.3 E-1 | USEPA 1993 | 1.0 | 0.13 |
| Benzo(a)pyrene | 1.1 E-3 | Cal/EPA | 7.3 E+0 | USEPA 2011 | 1.0 | 0.13 |
| Benzo(b)fluoranthene | 1.1 E-4 | Cal/EPA | 7.3 E-1 | USEPA 1993 | 1.0 | 0.13 |
| Benzo(k)fluoranthene | 1.1 E-4 | Cal/EPA | 7.3 E-2 | USEPA 1993 | 1.0 | 0.13 |
| Butylbenzyl phthalate | NA | | NA | | 1.0 | 0.10 |
| Chrysene | 1.1 E-5 | Cal/EPA | 7.3 E-3 | USEPA 1993 | 1.0 | 0.13 |
| Dibenzo(a,h)anthracene | 1.2 E-3 | Cal/EPA | 7.3 E+0 | USEPA 1993 | 1.0 | 0.13 |
| Indeno(1,2,3-cd)pyrene | 1.1 E-4 | Cal/EPA | 7.3 E-1 | USEPA 1993 | 1.0 | 0.13 |

**Notes**

Values obtained from NDEP (2011a).

NA = Not applicable. Data is either not applicable for this chemical (*i.e.* , not carcinogenic) or not available.

BIO = bioavailability - NOTE: The basis for the arsenic oral bioavailability is presented in Closure Plan.

ABS = dermal absorption efficiency

(1) No COPCs required oral toxicity criteria adjustment for the dermal soil exposure pathway (USEPA 2004e).

(2) Dermal absorption factors obtained from USEPA 2004e.

**TABLE 6-13**
**CHEMICAL RISK SUMMARY FOR RESIDENTIAL RECEPTORS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Receptor | HI | Target Organ | Target Organ HIs | ILCR |
|---|---|---|---|---|
| Future On-Site Resident | | | | |
| Soil, Dermal, Homegrown Produce and Dust | 0.14 | | | 5 E-7 |
| Volatile Inhalation (from Flux)(1) | 0.00011-0.0053 | -- | -- | 3 E-8 - 1 E-6 |
| Combined | 0.14-0.14 | | | 6 E-7 - 2 E-6 |

| Chemical | Soil Conc. (mg/kg) | Oral HQ | Dermal HQ | Homegrown Produce HQ | Indoor Dust Inhal HQ | Outdoor Dust Inhal HQ | Total HI | Oral ILCR | Dermal ILCR | Homegrown Produce ILCR | Indoor Dust Inhal ILCR | Outdoor Dust Inhal ILCR | Total ILCR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Inorganics* | | | | | | | | | | | | | |
| Ammonia (as N) | 2.3 | NA | NA | NA | 6.3 E-9 | 1.9 E-9 | 8.2 E-9 | NA | NA | NA | NA | NA | NA |
| Perchlorate | 7.3 | 1.3 E-1 | NA | NA | NA | NA | 1.3 E-1 | NA | NA | NA | NA | NA | NA |
| *Polynuclear Aromatic Hydrocarbons* | | | | | | | | | | | | | |
| Benzo(a)anthracene | 0.013 | 5.5 E-6 | 2.0 E-6 | 9.3 E-8 | NA | NA | 7.6 E-6 | 1 E-8 | 6 E-9 | 6 E-10 | 2 E-13 | 5 E-14 | 2 E-8 |
| Benzo(a)pyrene | 0.013 | 5.6 E-6 | 2.0 E-6 | 7.4 E-8 | NA | NA | 7.7 E-6 | 1 E-7 | 6 E-8 | 5 E-9 | 2 E-12 | 5 E-13 | 2 E-7 |
| Benzo(b)fluoranthene | 0.027 | 1.2 E-5 | 4.2 E-6 | 1.4 E-7 | NA | NA | 1.6 E-5 | 3 E-8 | 1 E-8 | 1 E-9 | 4 E-13 | 1 E-13 | 4 E-8 |
| Benzo(k)fluoranthene | 0.0022 | 9.4 E-7 | 3.4 E-7 | 1.1 E-8 | NA | NA | 1.3 E-6 | 3 E-10 | 1 E-10 | 8 E-12 | 3 E-14 | 9 E-15 | 4 E-10 |
| Chrysene | 0.021 | 9.0 E-6 | 3.3 E-6 | 1.6 E-7 | NA | NA | 1.2 E-5 | 2 E-10 | 1 E-10 | 1 E-11 | 3 E-14 | 8 E-15 | 4 E-10 |
| Dibenzo(a,h)anthracene | 0.013 | 5.4 E-6 | 2.0 E-6 | 4.5 E-7 | NA | NA | 7.8 E-6 | 1 E-7 | 6 E-8 | 3 E-8 | 2 E-12 | 5 E-13 | 2 E-7 |
| Indeno(1,2,3-cd)pyrene | 0.0063 | 2.7 E-6 | 9.7 E-7 | 3.6 E-8 | NA | NA | 3.7 E-6 | 7 E-9 | 3 E-9 | 2 E-10 | 8 E-14 | 2 E-14 | 1 E-8 |
| *Semi-Volatile Organic Compounds* | | | | | | | | | | | | | |
| Butylbenzyl phthalate | 26.3 | 1.7 E-3 | 4.7 E-4 | 2.4 E-4 | NA | NA | 2.4 E-3 | NA | NA | NA | NA | NA | NA |
| **Total** | | 0.13 | 0.00049 | 0.00024 | 6.3 E-9 | 1.9 E-9 | **0.14** | 3 E-7 | 1 E-7 | 4 E-8 | 4 E-12 | 1 E-12 | **5 E-7** |

HQ = hazard quotient
HI - hazard index
ILCR = incremental lifetime cancer risk
(1) Note that risk estimates for surface flux data were done on a sample-by-sample basis, therefore, risks are presented as a range. See Appendix I for sample-specific risk estimates.

**TABLE 6-14**
**CHEMICAL RISK SUMMARY FOR CONSTRUCTION WORKER RECEPTORS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Receptor | HI | ILCR |
|---|---|---|
| Future On-Site Construction Worker | | |
| Soil, Dermal and Dust | 0.034 | 1 E-8 |
| Volatile Inhalation (from Flux)[(1)] | 0.000012-0.0058 | 1 E-10 - 4 E-9 |
| Combined | 0.034-0.040 | 1 E-8 - 2 E-8 |

| Chemical | Soil Concentration (mg/kg) | Oral HQ | Dermal HQ | Outdoor Inhal HQ | Total HI | Oral ILCR | Dermal ILCR | Outdoor Inhal ILCR | Total ILCR |
|---|---|---|---|---|---|---|---|---|---|
| *Metals* | | | | | | | | | |
| Ammonia (as N) | 2.3 | NA | NA | NA | NA | NA | NA | NA | NA |
| Perchlorate | 7.3 | 3.4 E-2 | 0.0 E+0 | NA | 3.4 E-2 | NA | NA | NA | NA |
| *Polynuclear Aromatic Hydrocarbons* | | | | | | | | | |
| Benzo(a)anthracene | 0.013 | 1.4 E-6 | 5.5 E-7 | 2.3 E-6 | 4.3 E-6 | 4 E-10 | 2 E-10 | 4 E-13 | 6 E-10 |
| Benzo(a)pyrene | 0.013 | 1.4 E-6 | 5.5 E-7 | 2.4 E-7 | 2.2 E-6 | 4 E-9 | 2 E-9 | 4 E-12 | 6 E-9 |
| Benzo(b)fluoranthene | 0.027 | 2.9 E-6 | 1.1 E-6 | 4.9 E-6 | 9.0 E-6 | 9 E-10 | 4 E-10 | 9 E-13 | 1 E-9 |
| Benzo(k)fluoranthene | 0.0022 | 2.4 E-7 | 9.3 E-8 | 4.0 E-7 | 7.3 E-7 | 7 E-12 | 3 E-12 | 7 E-14 | 1 E-11 |
| Chrysene | 0.021 | 2.3 E-6 | 8.9 E-7 | 3.8 E-5 | 4.1 E-5 | 7 E-12 | 3 E-12 | 7 E-14 | 1 E-11 |
| Dibenzo(a,h)anthracene | 0.013 | 1.4 E-6 | 5.3 E-7 | 2.1 E-7 | 2.1 E-6 | 4 E-9 | 2 E-9 | 4 E-12 | 6 E-9 |
| Indeno(1,2,3-cd)pyrene | 0.0063 | 6.7 E-7 | 2.6 E-7 | 1.1 E-6 | 2.1 E-6 | 2 E-10 | 8 E-11 | 2 E-13 | 3 E-10 |
| *Semi-Volatile Organic Compounds* | | | | | | | | | |
| Butylbenzyl phthalate | 26.3 | 4.2 E-4 | 1.3 E-4 | NA | 5.5 E-4 | NA | NA | NA | NA |
| **Total** | | 0.034 | 0.000131 | 0.000047 | **0.034** | 1 E-8 | 4 E-9 | 1 E-11 | **1 E-8** |

HQ = hazard quotient
HI - hazard index
ILCR = incremental lifetime cancer risk
(1) Note that risk estimates for surface flux data were done on a sample-by-sample basis, therefore, risks are presented as a range. See Appendix I for sample-specific risk estimates.

**TABLE 6-15**
**CHEMICAL RISK SUMMARY FOR COMMERCIAL (INDOOR) WORKER RECEPTORS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Receptor | HI | ILCR |
|---|---|---|
| Future On-Site Commercial Worker | | |
| Soil and Dust | 0.0052 | 4 E-8 |
| Volatile Inhalation (from Flux)[(1)] | 0.000014-0.00070 | 4 E-9 - 1 E-7 |
| Combined | 0.0052 - 0.0059 | 4 E-8 - 2 E-7 |

| Chemical | Soil Concentration (mg/kg) | Oral HQ | Indoor Dust Inhal HQ | Total HI | Oral ILCR | Indoor Dust Inhal ILCR | Total ILCR |
|---|---|---|---|---|---|---|---|
| *Metals* | | | | | | | |
| Ammonia (as N) | 2.3 | NA | 2.2 E-9 | 2.2 E-9 | NA | NA | NA |
| Perchlorate | 7.3 | 5.1 E-3 | NA | 5.1 E-3 | NA | NA | NA |
| *Polynuclear Aromatic Hydrocarbons* | | | | | | | |
| Benzo(a)anthracene | 0.013 | 2.1 E-7 | NA | 2.1 E-7 | 2 E-9 | 5 E-14 | 2 E-9 |
| Benzo(a)pyrene | 0.013 | 2.1 E-7 | NA | 2.1 E-7 | 2 E-8 | 5 E-13 | 2 E-8 |
| Benzo(b)fluoranthene | 0.027 | 4.4 E-7 | NA | 4.4 E-7 | 3 E-9 | 1 E-13 | 3 E-9 |
| Benzo(k)fluoranthene | 0.0022 | 3.6 E-8 | NA | 3.6 E-8 | 3 E-11 | 8 E-15 | 3 E-11 |
| Chrysene | 0.021 | 3.4 E-7 | NA | 3.4 E-7 | 3 E-11 | 8 E-15 | 3 E-11 |
| Dibenzo(a,h)anthracene | 0.013 | 2.1 E-7 | NA | 2.1 E-7 | 2 E-8 | 5 E-13 | 2 E-8 |
| Indeno(1,2,3-cd)pyrene | 0.0063 | 1.0 E-7 | NA | 1.0 E-7 | 8 E-10 | 2 E-14 | 8 E-10 |
| *Semi-Volatile Organic Compounds* | | | | | | | |
| Butylbenzyl phthalate | 26.3 | 6.4 E-5 | NA | 6.4 E-5 | NA | NA | NA |
| **Total** | | 0.005 | 2.2 E-9 | **0.0052** | 4 E-8 | 1 E-12 | **4 E-8** |

HQ = hazard quotient
HI - hazard index
ILCR = incremental lifetime cancer risk
(1) Note that risk estimates for surface flux data were done on a sample-by-sample basis, therefore, risks are presented as a range. See Appendix I for sample-specific risk estimates.

**TABLE 6-16**
**CHEMICAL RISK SUMMARY FOR MAINTENANCE (OUTDOOR) WORKER RECEPTORS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Receptor | HI | ILCR |
|---|---|---|
| Future On-Site Maintenance Worker | | |
| Soil, Dermal, and Dust | 0.0094 | 1 E-7 |
| Volatile Inhalation (from Flux)[(1)] | 0.000011-0.00052 | 3 E-9 - 9 E-8 |
| Combined | 0.0094 - 0.0099 | 1 E-7 - 2 E-7 |

| Chemical | Soil Conc. (mg/kg) | Oral HQ | Dermal HQ | Outdoor Inhal HQ | Total HI | Oral ILCR | Dermal ILCR | Outdoor Inhal ILCR | Total ILCR |
|---|---|---|---|---|---|---|---|---|---|
| *Metals* | | | | | | | | | |
| Ammonia (as N) | 2.3 | NA | NA | 4.9 E-9 | 4.9 E-9 | NA | NA | NA | NA |
| Perchlorate | 7.3 | 9.2 E-3 | 0.0 E+0 | NA | 9.2 E-3 | NA | NA | NA | NA |
| *Polynuclear Aromatic Hydrocarbons* | | | | | | | | | |
| Benzo(a)anthracene | 0.013 | 3.8 E-7 | 3.3 E-7 | NA | 7.1 E-7 | 3 E-9 | 3 E-9 | 1 E-13 | 6 E-9 |
| Benzo(a)pyrene | 0.013 | 3.8 E-7 | 3.3 E-7 | NA | 7.1 E-7 | 3 E-8 | 3 E-8 | 1 E-12 | 6 E-8 |
| Benzo(b)fluoranthene | 0.027 | 8.0 E-7 | 6.9 E-7 | NA | 1.5 E-6 | 6 E-9 | 5 E-9 | 2 E-13 | 1 E-8 |
| Benzo(k)fluoranthene | 0.0022 | 6.5 E-8 | 5.6 E-8 | NA | 1.2 E-7 | 5 E-11 | 4 E-11 | 2 E-14 | 9 E-11 |
| Chrysene | 0.021 | 6.2 E-7 | 5.3 E-7 | NA | 1.2 E-6 | 5 E-11 | 4 E-11 | 2 E-14 | 9 E-11 |
| Dibenzo(a,h)anthracene | 0.013 | 3.7 E-7 | 3.2 E-7 | NA | 6.9 E-7 | 3 E-8 | 2 E-8 | 1 E-12 | 5 E-8 |
| Indeno(1,2,3-cd)pyrene | 0.0063 | 1.8 E-7 | 1.6 E-7 | NA | 3.4 E-7 | 1 E-9 | 1 E-9 | 5 E-14 | 3 E-9 |
| *Semi-Volatile Organic Compounds* | | | | | | | | | |
| Butylbenzyl phthalate | 26.3 | 1.2 E-4 | 7.6 E-5 | NA | 1.9 E-4 | NA | NA | NA | NA |
| **Total** | | 0.009 | 0.00008 | 4.9 E-9 | **0.0094** | 7 E-8 | 6 E-8 | 3 E-12 | **1 E-7** |

HQ = hazard quotient
HI - hazard index
ILCR = incremental lifetime cancer risk
(1) Note that risk estimates for surface flux data were done on a sample-by-sample basis, therefore, risks are presented as a range. See Appendix I for sample-specific risk estimates.

**TABLE 6-17**
**ASBESTOS RISK SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


***Asbestos Risk Calculations*** ***Risk = ($C_{soil}$ *URF*($ET_{out}$ +($ET_{in}$ *$ATT_{in}$))*EF*ED) / (PEF*AT)***

| *ESTIMATED RISK* | Units | *CHRYSOTILE* | | | | *AMPHIBOLE* | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction | Outdoor Worker | Indoor Worker | Onsite Resident | Construction | Outdoor Worker | Indoor Worker | Onsite Resident |
| Estimated Risk (Total Structures) | Unitless | 2 E-9 | 6 E-10 | 3 E-10 | 1 E-9 | 0 E+0 | 0 E+0 | 0 E+0 | 0 E+0 |
| 95% UCL (Total Structures) | Unitless | 1 E-8 | 3 E-9 | 1 E-9 | 6 E-9 | 7 E-7 | 2 E-7 | 8 E-8 | 4 E-7 |
| ***ESTIMATED AIR CONCENTRATIONS*** | | | | | | | | | |
| Estimated Airborne Concentration, $C_{air}$ (best estimate)[A] | $f/m^3$ | 1.13E+01 | 1.35E-01 | 1.35E-01 | 1.45E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Estimated Airborne Concentration (upper bound)[B] | $f/m^3$ | 5.34E+01 | 6.40E-01 | 6.40E-01 | 6.89E-01 | 3.37E+01 | 4.04E-01 | 4.04E-01 | 4.35E-01 |

[A] *Estimated Airborne Concentration = Estimated $C_{soil}$ * 1/PEF*

[B] *Estimated Airborne Concentration = 95% UCL (upper bound) * 1/PEF*

**TABLE 7-1**
**UNCERTAINTY ANALYSIS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Source of Uncertainty | May Underestimate Risk | May Overestimate Risk | May Under or Overestimate Risk |
|---|---|---|---|
| **Environmental Sampling and Analysis** | | | |
| Sampling and laboratory analyses may have been inadequate to fully characterize the concentrations at the site. | | | Moderate |
| Systematic or random errors in the chemical analyses may yield erroneous data. | | | Low |
| The risk estimates are based on the COPCs only. Other chemicals were not quantified. | Moderate | | |
| There was one result that was rejected through data validation (an ammonia result for GNBF19-11). The rejection was due to a very low matrix spike/matrix spike duplicate (MS/MSD) recovery. | Low | | |
| Although radon flux sampling was performed, the results were not evaluated in the human health risk assessment based on results of recent radon testing performed in groundwater and indoor air samples. | Low | | |
| **Exposure Assumptions** | | | |
| Fate and transport modeling did not take into account biodegradation or other degradation processes. | | Moderate | |
| Modeling did not take into account interactions that may occur among the different chemicals which may influence their migration. | | Moderate | |
| Only primary receptors of concern were evaluated. Other populations (*e.g.* , students) were not assessed. | Low | | |
| Only primary exposure pathways were evaluated. Other pathways were not assessed. | Low | | |
| Residential receptors were evaluated; however, the planned development of the Site is as a high school. Potential residential exposures are considered more conservative, and therefore, protective and representative of any potential school receptors. | | Moderate | |

**TABLE 7-1**
**UNCERTAINTY ANALYSIS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Source of Uncertainty | May Underestimate Risk | May Overestimate Risk | May Under or Overestimate Risk |
|---|---|---|---|
| Some of the exposure point concentrations used in the exposure assessment were based on modeled, rather than measured, levels in various media (*e.g.* , air). | | | Moderate |
| Reasonable maximum exposure values were combined to arrive at the ADD and LADD estimates. There is a low probability that all of the various upper bound assumptions used in the exposure assessment would occur in conjunction with the 95 percent UCL chemical concentration. | | Moderate | |
| Exposure point concentrations and the amount of media intake were assumed to be constant over time. | | Low | |
| **Toxicological Data** | | | |
| Sub-chronic RfDs are appropriate to characterize non-cancer effects for short-term expo-sures (*i.e.* , construction workers). However, sub-chronic RfDs were not available and therefore, chronic RfDs were used. | | Moderate | |
| RfDs are derived and extrapolated from laboratory animal studies that expose animals to relatively high intakes. Errors are inherent in the extrapolation of data from animals to humans, from high to low doses, and from one exposure route to another. | | | Moderate |
| RfDs used to estimate non-carcinogenic risk are derived from NOAELs which are based on the sensitive endpoints in the sensitive species. As a result, extrapolation of toxicity data from animals to humans is uncertain. There may be differences in metabolism, uptake, or distribution of chemicals in the body between animals and humans. To account for this, NOAELs are divided by uncertainty factors spanning several orders of magnitude to establish the RfD. The combination of these two conservative assumptions may establish RfDs which greatly overprotect human health. | | Moderate | |

**TABLE 7-1**
**UNCERTAINTY ANALYSIS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Source of Uncertainty | May Underestimate Risk | May Overestimate Risk | May Under or Overestimate Risk |
|---|---|---|---|
| CSFs used for the animal carcinogens are the 95% UCL derived from the linearized multistage model using animal chronic bioassay data, which tends to greatly overestimate carcinogenic risk in humans. The linearized multistage model ignores many known factors that have been documented to protect humans against the carcinogenic actions of chemicals, such as DNA repair and immunosurveillence. | | High | |
| RfDs, CSFs and defensible carcinogenicity data were not available for some COPCs, which were therefore not quantitatively evaluated. | Low | | |
| **Aggregation of Exposure Units** | | | |
| Aggregating the exposure areas or extrapolating from Site analytical results to estimated concentrations for individual 1/8-acre exposure areas. | Low | | |

**TABLE 9-1**
**IMPACTS TO GROUNDWATER MODELING RESULTS SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| COPC | Depth to Ground-water (ft bgs) | Baseline Rainfall | | Normal Post-Development | | Enhanced Recharge | | Maximum Measured Groundwater Concentration[(1)] (µg/L) | Residential Water BCL (µg/L) |
|---|---|---|---|---|---|---|---|---|---|
| | | Maximum Migration Depth (ft bgs) | Maximum Soil Moisture Conc. at Groundwater Interface (µg/L) | Maximum Migration Depth (ft bgs) | Maximum Soil Moisture Conc. at Groundwater Interface (µg/L) | Maximum Migration Depth (ft bgs) | Maximum Soil Moisture Conc. at Groundwater Interface (µg/L) | | |
| Ammonia | 25 | GW | 1,108,000 | GW | 638,000 | GW | 166,800 | 13.5 | 730 |
| Perchlorate | 25 | GW | 2,000,000 | GW | 2,000,000 | GW | 588,000 | 7,600 | 18 |

(1) From 2009 Round Groundwater Monitoring Report for the BMI Common Areas (Eastside).

**TABLE 10-1**
**DATA QUALITY ASSESSMENT**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


Table 10-1a: Sample Size Results for Arsenic with Background = 27.6 mg/kg

| Number of samples = 53 | | s = 1.40 | | |
|---|---|---|---|---|
| Threshold = 7.2 mg/kg | | α = 5% | α = 10% | α = 15% |
| MDD = 10% (2.8 mg/kg) | β = 15% | 4 | 3 | 2 |
| | β = 20% | 3 | 2 | 2 |
| | β = 25% | 3 | 2 | 1 |
| MDD = 20% (5.5 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 30% (8.3 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |

Table 10-1b: Sample Size Results for Benzo(a)pyrene with BCL = 0.0622 mg/kg

| Number of samples = 50 | | s = 0.0091 | | |
|---|---|---|---|---|
| Threshold = 0.0622 mg/kg | | α = 5% | α = 10% | α = 15% |
| MDD = 10% (0.00622 mg/kg) | β = 15% | 19 | 14 | 11 |
| | β = 20% | 17 | 12 | 9 |
| | β = 25% | 15 | 10 | 8 |
| MDD = 20% (0.0124 mg/kg) | β = 15% | 6 | 4 | 3 |
| | β = 20% | 5 | 4 | 3 |
| | β = 25% | 5 | 3 | 2 |
| MDD = 30% (0.0187 mg/kg) | β = 15% | 4 | 2 | 2 |
| | β = 20% | 3 | 2 | 2 |
| | β = 25% | 3 | 2 | 1 |

Table 10-1c: Sample Size Results for beta-BHC with BCL = 0.316 mg/kg

| Number of samples = 51 | | s = 0.0042 | | |
|---|---|---|---|---|
| Threshold = 0.316 mg/kg | | α = 5% | α = 10% | α = 15% |
| MDD = 10% (0.0316 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 20% (0.0632 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 30% (0.0948 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |

**TABLE 10-1**
**DATA QUALITY ASSESSMENT**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


Table 10-1d: Sample Size Results for Chromium with BCL = 100,000 mg/kg

| Number of samples = 53 | | s = 7.5 | | |
|---|---|---|---|---|
| Threshold = 100,000 mg/kg | | α = 5% | α = 10% | α = 15% |
| MDD = 10% (10,000 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 20% (20,000 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 30% (30,000 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |

Table 10-1e: Sample Size Results for Chromium (VI) with BCL = 229 mg/kg

| Number of samples = 53 | | s = 0.25 | | |
|---|---|---|---|---|
| Threshold = 229 mg/kg | | α = 5% | α = 10% | α = 15% |
| MDD = 10% (22.9 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 20% (45.8 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 30% (68.7 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |

Table 10-1f: Sample Size Results for Total Cyanide with BCL = 1,220 mg/kg

| Number of samples = 51 | | s = 0.78 | | |
|---|---|---|---|---|
| Threshold = 1,220 mg/kg | | α = 5% | α = 10% | α = 15% |
| MDD = 10% (122 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 20% (244 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 30% (366 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |

**TABLE 10-1**
**DATA QUALITY ASSESSMENT**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


Table 10-1g: Sample Size Results for Formaldehyde with BCL = 10.6 mg/kg

| Number of samples = 51 | | s = 0.18 | | |
|---|---|---|---|---|
| Threshold = 10.6 mg/kg | | α = 5% | α = 10% | α = 15% |
| MDD = 10% (1.06 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 20% (2.12 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 30% (3.18 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |

Table 10-1h: Sample Size Results for Lead with BCL = 400 mg/kg

| Number of samples = 53 | | s = 36.0 | | |
|---|---|---|---|---|
| Threshold = 400 mg/kg | | α = 5% | α = 10% | α = 15% |
| MDD = 10% (40 mg/kg) | β = 15% | 8 | 6 | 5 |
| | β = 20% | 7 | 5 | 4 |
| | β = 25% | 7 | 5 | 3 |
| MDD = 20% (80 mg/kg) | β = 15% | 3 | 2 | 2 |
| | β = 20% | 3 | 2 | 1 |
| | β = 25% | 3 | 2 | 1 |
| MDD = 30% (120 mg/kg) | β = 15% | 2 | 2 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |

Table 10-1i: Sample Size Results for Perchlorate with BCL = 54.8 mg/kg

| Number of samples = 50 | | s = 6.30 | | |
|---|---|---|---|---|
| Threshold = 54.8 mg/kg | | α = 5% | α = 10% | α = 15% |
| MDD = 10% (5.48 mg/kg) | β = 15% | 13 | 9 | 7 |
| | β = 20% | 11 | 8 | 6 |
| | β = 25% | 10 | 7 | 5 |
| MDD = 20% (10.96 mg/kg) | β = 15% | 4 | 3 | 2 |
| | β = 20% | 4 | 3 | 2 |
| | β = 25% | 4 | 2 | 2 |
| MDD = 30% (16.4 mg/kg) | β = 15% | 3 | 2 | 1 |
| | β = 20% | 3 | 2 | 1 |
| | β = 25% | 2 | 2 | 1 |

**TABLE 10-1**
**DATA QUALITY ASSESSMENT**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


Table 10-1j: Sample Size Results for 2,3,7,8-TCDD with BCL = 0.0000039 mg/kg

| Number of samples = 35 | | s = 0.00000036 | | |
|---|---|---|---|---|
| Threshold = 0.0000039 mg/kg | | α = 5% | α = 10% | α = 15% |
| MDD = 10% (0.00000039 mg/kg) | β = 15% | 9 | 6 | 5 |
| | β = 20% | 8 | 5 | 4 |
| | β = 25% | 7 | 5 | 4 |
| MDD = 20% (0.00000078 mg/kg) | β = 15% | 3 | 2 | 2 |
| | β = 20% | 3 | 2 | 1 |
| | β = 25% | 3 | 2 | 1 |
| MDD = 30% (0.0000012 mg/kg) | β = 15% | 2 | 2 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |

Table 10-1k: Sample Size Results for Vanadium with BCL = 390 mg/kg

| Number of samples = 53 | | s = 9.4 | | |
|---|---|---|---|---|
| Threshold = 390 mg/kg | | α = 5% | α = 10% | α = 15% |
| MDD = 10% (39 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 20% (78 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |
| MDD = 30% (117 mg/kg) | β = 15% | 2 | 1 | 1 |
| | β = 20% | 2 | 1 | 1 |
| | β = 25% | 2 | 1 | 1 |

α = alpha
β = beta
s = standard deviation of sample data

# APPENDIX A

# NDEP COMMENTS AND BRC'S RESPONSE TO COMMENTS AND REDLINE/STRIKEOUT TEXT

# APPENDIX A-1

## NDEP Draft Comments Dated January 12, 2011 on the Human Health Risk Assessment and Closure Report for the Galleria North-School Site Sub-Area, BMI Common Areas (Eastside), Clark County, Nevada, Dated November 2010

Included in yellow below is BRC's original 1/6/11 response to the NDEP 1/5/11 draft comments on 12/15/10 report version. Included in light blue below is the NDEP updated 1/19/11 and 1/12/11 set of comments. Included in magenta below is BRC's response to the NDEP's updated comments. Included in light green below is the NDEP response to BRC's updated response. Note 1/19/11 includes new minor comment 38 for admin record not requiring revision.

1. Page 1-2, footnote 2 states "Under this alternative, the Site could be developed in accordance with the current development plan without the need for institutional controls within the Site." NDEP expectation is that Environmental Covenants will be attached to all sub-areas to assure appropriate management of soil beneath 10 feet bgs and any groundwater issues.

***Response:*** *The footnote has been revised to read: "Under this alternative, the Site could be developed in accordance with the current development plan and the recorded Environmental Covenant for the Site that assures appropriate management of soils beneath 10 feet bgs (post-graded), should they need to be disturbed in the future."*

NDEP Review: Response Adequate. Errata for text on pages ES-1, ES-4, and 1-1 should match text provided by NDEP for Mohawk HRA sections pertaining to NFA issues on 12/30/10.

***Review Response:*** *Agreed. These changes will be made to the Galleria North-School Site report as well (consistent with the changes to the Mohawk report).*

NDEP Review: Response Adequate.

2. Section 2.2, Page 2-6, top of page states "The extent to which these former seeps historically affected contaminant transport (*e.g.*, by means of enhanced surface water transport to the Wash or upward migration into overlying soils) is unknown." This component of the CSM has not been appropriately considered in the HRA evaluation (e.g. Section 5.2 Comparison of Concentrations/Activities in Surface and Subsurface Soils) especially as a potential explanation for the presence of metals above background at the site. Rather than making the assumption as on page 5-8 that it is "doubtful that such widespread higher concentrations in subsurface soils are a result of Site contamination" NDEP would like to discuss this issue further. NDEP preliminary review of box plots indicates that these are consistent with site related metals. CSM should also be used to explain contaminant distribution and magnitude present in scraped areas.

***Response:*** *Agreed that further discussion is warranted on this issue. See response to comment 10c for further explanation. It is important to note that 29 of the 32 metals failed the background comparison statistics. This is many more than have failed these statistics in other areas of the site, particularly in sub-areas in the southern portion of the Eastside property, which are closer to the existing background datasets. Contamination does not explain these comparison failures, especially given the discussion provided in response to comments 10 and 14.*

NDEP Review: See response to comment 10b below.

3. Page 3-20, 1st paragraph, ½ way down states "It is assumed that concentrations have been reduced similarly to the dioxins/furans/PCB congeners concentrations" needs clarification. This is not how the data were used in the RA, just an "assumption" that concentrations in the RA are overestimated for these chemicals.

***Response:*** *The statement was in reference to the fact that although this area was scraped and re-analyzed for dioxins/furans/PCB congeners, which showed a reduction in concentration from 307 ppt (TCDD TEQ) to 7.7 ppt; the sample location was not re-analyzed for metals, PAHs, and organochlorine pesticides, which also had detected and/or elevated (in comparison to other results for the site) levels. However, as noted in the report, the data from the original pre-scrape sample for this location were included in the human health risk assessment; only the dioxins/furans/PCB congener original data were excluded (and replaced with the post-scrape data). The sentence has been revised on page 3-21 to read: "It is likely that the low concentrations for these constituents have also been reduced."*

NDEP Review: Response Adequate.

4. Section 4.7. Sections 4.7.1 through 4.7.6 belong in section 4.6.

***Response:*** *These sections have been moved to Section 4.6.*

NDEP Review: Response Adequate.

5. Page 5-2, 2nd full paragraph. Provide better justification that this approach to field duplicates is reasonable by reviewing the data more closely. We expect the conclusion is reasonable.

***Response:*** *As stated in this paragraph "The field duplicates were compared to the primary sample during the course of data validation. The variances were not out of the line with the variance in results across the Site. Therefore, as distinct soil chemical measurements, they are treated as unique samples in the analyses." A footnote has been added on page 5-2 that reads: "Field duplicates are shown in Appendix B and indicated with the "FD" qualifier under the column entitled "Sample Type"".*

NDEP Review: Response Adequate.

6. Section 5.1, page 5-2, last paragraph. This paragraph refers to a 2005 shallow McCullough background dataset whereas page 3-9 refers to a 2007 shallow McCullough background dataset. Please clarify which dataset is being used as part of this HHRA.

***Response:*** *These background data were collected in 2005; however, the report was finalized in 2007, thus the use (and confusion) of two different dates. The report has been revised to reflect the use of the entire Qal background dataset, as discussed with NDEP, and reference to the BRC Background Soil Compilation Report is provided. In addition, the background dataset is included with the revised report.*

NDEP Review: Response adequate, however, NDEP notes that our review would be expedited by inclusion of background data in this report. Please note for future reports.

7. Table 7 and text on page 3-9. The text states that the 2007 shallow McCullough background dataset is being used in this HHRA. The 2010 background soil compilation report outlines (in Section 3.0 of that report) that the shallow soils data that fall under the McCullough category also includes three sample locations (BG01 through BG03) from the Environ investigations. These data points are not included as part of the background comparisons in this HHRA and should be clarified.

***Response:*** *Agreed. These data have been added to the shallow Qal McCullough background dataset.*

NDEP Review: Response adequate, however, NDEP notes that our review would be expedited by inclusion of background data in this report. Please note for future reports.

8. Table 7, Background Comparison Summary. Given the marginal failure of the slippage test due to one high value reported for U-235/236, this sample should be revisited from a data validation standpoint. Perhaps, in addition, understand how this sample (and some other relatively high U-235 results) compare to the U-234 and U-238 results. Although NDEP asks for some analysis by secular equilibrium, there is also an issue of relative abundance – relative abundance constraints do not seem to have been satisfied with at least one of these samples, if the data are also similar to background.

***Response:*** *As per NDEP guidance, a significance level of 0.025 is used for all background comparison statistics. Accordingly, It should also be noted that the laboratory has informed us that results for uranium-235/236 generally hover around the noise level of the analysis. That is, there is higher uncertainty for uranium-235/236 results due to the fact that typically there is essentially no activity in these samples. A discussion concerning this issue has been added on page 4-25.*

NDEP Review: Response Adequate.

9. DVSR blank contamination issues. The sub-area-wide (Galleria sub-area) DVSR appears to have instances where a combination of reported values and PQLs are being used in instances of blank contamination. Metals and radionuclides affected for the Galleria sub-area are beryllium, cadmium, tin, Ra-228, Th-230, and U-238. For the North School site, only U-238 is affected (Sample IDs GNC1-JD11 and GNC1-JD10). This is similar to the blank contamination reporting issues for Mohawk and Warm Springs. NDEP requests a summary review of the impacts on COPC selection and risk estimates.

***Response:*** *This issue has been discussed and addressed previously with NDEP. BRC follows USEPA and NDEP guidance for data validation of metals, as well as requirements outlined in SOP-40. BRC submits all DVSRs to NDEP and has received approval on all DVSRs submitted for the project using this validation methodology. As has been explained previously, and as approved by NDEP in the DVSRs, metals (and radionuclide) data qualified due to blank contamination, where the reported result is greater than the PQL, are reported as non-detects using the reported value, while results that are below the PQL are adjusted upward and the PQL is used as the non-detect value. This is why it is possible to have instances where there may be a combination of reported values and PQLs being used. Again, this is consistent with USEPA and NDEP guidance and how metals have been validated throughout duration of the project.*

*As far as potential impacts, keeping in mind that USEPA and NDEP guidance have been followed, the metals that are most affected by this issue (as was demonstrated for the Warm Springs Rd ROW) have low (or non-detect) site concentrations and high risk-based levels, thus the affect, if any, would be negligible. This is especially true given this issue only affects non-detect results.*

*BRC feels that we have adequately addressed this issue and given that <u>all</u> data collected for the project have undergone this validation approach, and any changes would involve significant effort and have no impact on decision making for the project, this issue does not need further discussion or evaluation.*

NDEP Review: NDEP previous discussion with BRC indicates that BRC could resolve this issue in one of two ways: 1) by responding to the original comment rather than merely quoting National Functional Guidelines and previous guidance; or 2) by reviewing significance of issue as it relates to impact on background evaluation and risk calculations. Note NDEP original comment indicated that review should focus on values near or above background or human risk levels (e.g. BCLs). The comment is generally responsive, however, additional specific review to verify that metals are well below BCLs should be included.

***Review Response:*** *Agreed. Consistent with Mohawk, BRC has verified that the detection limits are below comparison levels. This issue of raising the reporting limit to the PQL affects 10 metals (antimony, arsenic, boron, cadmium, mercury, molybdenum, selenium, thallium, tin, and tungsten). In eight out of the 10 metals, the maximum ratio of the detection limit to the BCL is well below one-tenth. The two metals where the ratio is greater than one-tenth the comparison level, but still below the comparison level, are arsenic (comparing to its maximum shallow*

*McCullough background value instead of the BCL) and thallium. However, this issue only affects two out of 55 arsenic samples and only one out of 55 thallium samples. So the affect this has on the risk assessment results is negligible to none.*

NDEP Review: Response adequate. NDEP requests this information be provided in appropriate portion of Sections 4.0 and Section 7.0 of the HRA text. Additionally, include a description in these sections that explains qualitatively how use of PQL instead of SQL affects any analyses in addition to risk estimates (e.g. background comparisons and any others affected) where applicable.

10. General comments on statistical analysis (Section 5).
    a. Several metals are eliminated based on background comparisons, when the main driver for these results is the greater frequency of non-detects. In our experience, it is more customary to carry these through the RA, but BRC eliminates them instead. We have made this comment previously, but perhaps this requires discussion with NDEP before finalizing a path forwards for these metals (e.g., Sb, Se, Ag, Tl, W in this dataset, and maybe a few others).

***Response:*** *The detection frequencies for these metals are 0 percent for antimony and thallium, and 2 percent (one detect in 55 samples) for selenium. BRC does not consider it unreasonable to not include these metals in the risk assessment; however, we are willing to discuss the issue further. It is also important to note that detection limits are defined in the QAPP, approved by NDEP, and were evaluated against risk-based standards during the preparation of the QAPP.*

*As discussed with NDEP in the December 9, 2010 meeting, the procedures for selecting COPCs has been extensively modified in the revised report.*

NDEP Review: See response to 10b below.

    b. Background comparisons have been performed, but the next step is to compare surface data to subsurface data for those metals that failed background comparisons. It is not clear that this is reasonable, and if it is, the explanation is not sufficient. For example, consider the barium data. All subsets of barium Site data are greater than background, but the barium Site surface and subsurface data are similar. This does not seem, on the face of it, to be sufficient justification for removal of barium from the RA process. Further discussion is needed to understand the CSM for this site, which might help put this in perspective. In the meantime, it is not clear that it is appropriate for BRC to add this COPC selection step.

***Response:*** *As noted above, the procedures for selecting COPCs has been extensively modified in the revised report, consistent with discussion with NDEP in the December 9, 2010 meeting. The surface versus sub-surface pair-wise comparison tests have been removed from the document. Instead information about clay content in Site soils versus those in background soils have been added to the report.*

NDEP Review: NDEP has reviewed new Section 5.4 and has the following comments.

i. The discussion on pp. 5-7 and 5-8 is not consistent with the February 8, 2010 DBS&A report *Evaluation of Arsenic Occurrence in the Western Hook Development Subarea*. The Western Hook report does not provide support for clay mineral accumulation of arsenic in site soils.

ii. In order to rely on the following statement "[a]ccordingly, it is BRC's opinion that the shallow Qal McCullough lithology may not be entirely or adequately representative as background soils for the Site," NDEP needs additional data to support this conclusion. Additionally, given that both the Site and background dataset are both derived from same source material in McCullough Range, it is not clear why the mineral content would be different.

iii. Since the Qal and TMCf lithologies are distinctly different, BRC should provide additional justification for including TMCf in embedded tables on pg. 5-8.

iv. It is not clear from this section which specific COPCs are recommended by BRC for exclusion and which footnote in Table 9 pertains to section 5.4.

iv. As currently presented, this section does not present adequate information or analysis for NDEP to concur that affected metals should not be carried forward into the risk assessment.

***Review Response:*** *Agreed. This section has been extensively revised, including the addition of the geochemical evaluation prepared by Shaw Environmental.*

c. In addition, the Site surface and subsurface comparisons have been made based on a paired test (the Wilcoxon Signed Rank test). It is not appropriate to pair these data. This is in opposition, for example, to the notion of treating field duplicates as independent data. Surface and subsurface data are more removed from each other than field duplicates, in which case they should also be treated as independent. Then all 31 surface and 24 subsurface samples should be included in the analysis, if the analysis is to be performed at all (see General Statistics Comment #2 above).

***Response:*** *See response to comment 10b above.*

NDEP Review: Response Adequate.

11. The uranium metal results fail background tests, particularly in the subsurface. However, the isotopic data do not. This requires some explanation.

***Response:*** *A footnote has been added to Table 7 regarding this issue.*

NDEP Review: Response to RTCs 11 and 12: These comments address the adequacy of the uranium-235/6 data, considering the presence of a few unusually large concentrations in the

reported data. The uranium isotopes are expected to exist in secular equilibrium, which was confirmed by reproducing the secular equilibrium test results presented in Section 5.1. However, the uranium isotopes should also exist consistent with concentration ratios proportional to their natural relative abundance, which for isotopes U-234, U-235, and U-238 is about 20:1:20, which is not the case for some samples. The explanation offered is that the U-235/6 data "generally hover around the noise level of the analysis". We agree with this statement in general, and note that the 20:1:20 ratio is difficult to achieve under such circumstances, however, for sample GNC1-JS11 the ratio is about 1:1:1. U-235/6 is not included in the secular equilibrium tests, because it is not part of the uranium or thorium chains. And, the background comparisons for U-235/6 suggest that the U-235/6 site concentrations are greater than background concentrations (see below). Consequently, this is of concern as it has the potential to affect chemical of potential concern (COPC) selection and the subsequent risk calculations.

To complete a detailed review we have rerun the secular equilibrium and background comparison tests for U-235/6. We have not reviewed the laboratory reports to confirm the quality of the data.

As noted, the secular equilibrium test results presented by BRC were successfully reproduced. The summary statistics were also successfully reproduced, which also implies that we had a proper subset of the data. However, we could not reproduce the background comparison results. We also attempted to run the background comparison tests for Ra-226, and experienced similar results.

Specifically, we extracted the BRC/TIMET background radionuclide data for the McCullough lithology from the Background Soil Compilation Summary report and extracted radionuclides from the "HHRA Soil" tab in the dataset provided with the Galleria report for background comparisons in EnviroGiSdT. The p-values for the statistical tests could not be reproduced for Radium-226 and Uranium-235/236. However, the summary statistics for both radionuclides matched those presented in the summary statistics tables in the Galleria report. It is not known if the results impact the overall conclusion of the Deliverable without additional analysis and re-calculation. However, it is noted that the fact that the statistical tests could not be reproduced indicates the likelihood of differences in input data used.

<u>Radium-226</u>:

| Two-Sample t-test | Gehan Test | Quantile Test (0.9) | Slippage Test |
|---|---|---|---|
| 0.1096 | 0.1125 | 0.2448 | 0.3537 |

<u>Uranium-235/236</u>:

| Two-Sample t-test | Gehan Test | Quantile Test (0.9) | Slippage Test |
|---|---|---|---|
| 0.0764 | 0.1712 | 0.0465 | **0.00397** |

It would be helpful if BRC could explain exactly how they used the EnviroGiSdT software for the background comparisons, so we can understand why the results presented in the Deliverable are different than the results we have produced. With additional time NDEP can revisit the laboratory reports to better understand the quality of the data, to determine if the BRC response (regarding the noise level of the analysis) is supported in this case.

***Review Response:*** *The EnviroGiSdT software was used as directed by Neptune and no modifications were made to the software code.*

12. There are a few high hits in the U-235 data that need to be addressed. These do not seem to satisfy basic constraints related to relative abundance of isotopes of uranium, and needs to be revisited.

***Response:*** *The high values of uranium-235/236 are primarily non-detect values. See response to comment #8 above.*

NDEP Review: See review of comment #11 above.

13. The dioxin TEQ file (Table B-2 is not live). There is a sample location with a TCDD TEQ at 49.1 ppt. The BCL screening level is 50 ppt. Dioxin was not selected as a COPC (but was a chemical in which excavation efforts were conducted). The concern is that this value is close to the 50 ppt BCL screening level and this table does not include the co-planar PCBs. In general, it appears from Table 4 of the document, that co-planar PCBs have not been compared to anything. Table 9 of the document, footnote #3, it says that the TCDD TEQ incorporates co-planar PCBs but this is not evident in Table B-2. BRC should confirm inclusion of the coplanar PCBs in the TCDD TEQ and if this has not been done, to update the HRA accordingly.

***Response:*** *As noted in the text (on page 3-7) and in Table 4 (footnote #4), and in Table 9 (footnote #3) TCDD TEQs are calculated using dioxins, furans, and PCB congeners. Dioxins/furans and PCB congeners are presented in different tables in Appendix B since there are analyzed by different methods. The Appendix B tables merely present the Site results, for hardcopy printing. They are not used for any calculation purposes (and in fact include qualifiers precluding their use in any calculations) and this is never suggested or implied in the report. PCB congeners have been included in comparisons, by including them in the TCDD TEQs, consistent with USEPA guidance. This issue has been made clearer in Section 1.1 of the report (in the paragraph discussing dioxins/furans).*

*In addition, the calculation of TCDD TEQs is now included in the report.*

*BRC would also like to point out that USEPA recently came out with a " Draft Recommended Interim Preliminary Remediation Goals for Dioxin in Soil at CERCLA and RCRA Sites" (December 30, 2009--Public Review Draft). In this document they recommend an interim PRG of 72 ppt for residential land use.*

NDEP Review: NDEP has been able to confirm that the dioxin TEQs provided in Table B-2 include the PCB co-planar values, however, NDEP is still unable to find the "live spreadsheet" to verify the dioxin TEQs plus PCB co-planar TEQs for the total sample location-specific dioxin TEQ. Table B-2 still does not include the TEF values used for dioxin congeners and only

presents the dioxin data with the total dioxin TEQ. It is noted that there is a different table in Appendix B with co-planar PCBs but it also does not include the TEQ calculations. The RTC states that the TCDD TEQs are now included in the report, but they could not be located. NDEP requests BRC to point out where this is in the report and ensure that all future deliverable provide this information.

***Review Response:*** *The 'live' TCDD TEF calculations are included as a separate worksheet in the database file (BRC GN-School Site Sub-Area HHRA-Closure Report_Data.xls) included on the report CD in Appendix B.*

NDEP Review: Response pending.

14. It is not clear what level of review of Appendix I has occurred to determine, in light of the data collected, that the sub-area is homogeneous and can be treated as a single population. In review of the figures provided in Appendix I, the text states that homogeneity was assumed for the site data such that the EPC may be used for all areas. However, the data do not appear to be homogenous when the standard deviations are examined for Al, As, Be, Ba, Co, Cr VI, Mg, Mn, Mo, to name a few. In addition, the text states that there were no "hot spot" areas, however this has not been confirmed.

***Response:*** *The Appendix J figures were reviewed, collectively with other data presentations provided in the report. The Appendix J figures showing the distribution of the data were reviewed considering other lines of evidence showing the homogeneity of the data. Some variability of the data is expected, if there was perfect homogeneity then only one sample would be needed to represent the site. This variability is demonstrated by the background datasets for the project. As shown on the probability and boxplots in Appendix G, the data for these particular metals generally follow a normal distribution, and their variability are similar to the background data. The exposure point concentration is the site average, represented by the 95 percent UCL. Given these lines of evidence, this is considered reasonable and appropriate as representative for the entire site. Nonetheless, the distribution plots have been removed from the report, and the intensity plots have been revised to indicate that residential soil BCLs are used for the plots.*

*The data were reviewed for the presence of hot spots, and as discussed in Section 3.5, page 3-21, one location was evaluated. No other potential hot spots, considering concentrations, clusters, and co-locations, were identified.*

NDEP Review: Response adequate. This text should be added to report.

15. For the resident, the combined soil and indoor air (flux) data show risk of $2 \times 10^{-6}$. It appears that beta-HCH via the vegetable ingestion pathway is the main driver from direct soil exposure while 1,2-dibromethane is the driver for the flux data. The highest risk due to indoor air is $1 \times 10^{-6}$ (highest flux location).

***Response:*** *Agreed. The driving chemicals and pathways are included in the report.*

NDEP Review: Response Adequate.

16. It should be noted that there are still hard-wired tables such as the TCDD TEQs and Table 10 with the EPCs). This is not necessarily a deal breaker but something that has been discussed previously and limits or slows down our ability to QA.

***Response:*** *In response to earlier comments BRC is now including the TCDD TEQ calculations in the risk assessment report (within the data file on the report CD in Appendix B). These calculations for the Galleria North School Site are attached. It should be noted that these calculations are done using both the WHO 1998 and WHO 2005 TEFs; however, based on what NDEP has required up to this point only the TEQs calculated using the WHO 1998 TEFs are used in the risk assessment.*

*Regarding the EPCs, these values are generated using Neptune's GISdT program, as discussed in the report, and as directed by NDEP. The output from that program is simply a listing of values, which are what are input into Table 10. The program output itself is hardwired.*

NDEP Review: See Review of Comment #13 above.

***Review Response:*** *Please see our response to Comment #13 as well.*

17. The DU tables still do not assess the impact of the quality issues on the uncertainty in the data used for the risk assessment. This was recently discussed on the Warm Springs teleconference but this report was received prior to that discussion. However, this is a relatively minor issue.

***Response:*** *At the conclusion of the Warm Springs teleconference, NDEP was going to review the DU Tables and provide details on what NDEP would like to see. BRC has not yet received these additional details as to what is missing in the DU tables. However, BRC has revised the data usability tables based on the Mohawk RLSO report received from NDEP.*

NDEP Review: Response Adequate.

18. SPLP testing data was not specifically used in evaluation and several analytes were missing. There also appear to be some detection limit issues with SPLP lab results that should be discussed.

***Response:*** *Agreed. Further discussion of the SPLP data is provided on pages 3-22, 4-28 and 9-8.*

NDEP Review: Response Adequate at pages 3-22 and 9-8, however, no page 4-28 exists in 12/16/10 version of HRA.

***Review Response:*** *Agreed. The page numbers are 3-23, 9-7, and* ***4-6****.*

NDEP Review: Response Adequate.

19. NDEP requests additional information on how ERM worked out leaching model program stability issues.

***Response:*** *It should be noted that ERM's challenges with the leaching model program are historical, and have not happened recently with ERM's newer version of the model. As discussed with NDEP and Paul Hackenberry, to avoid past challenges, we have not added additional compounds to the model library, instead selecting from chemicals that are pre-loaded in the library and modifying the chemical input parameters before running the model. This in no way affects the model results. Further, model results are reproducible—i.e., model runs have been performed on a second machine by another modeler to verify the results. Accordingly, model stability is not an issue for BRC sites.*

NDEP Review: Response Adequate.

New Comments 20 through 37 below based on review of 12/15 HHRA version.

20. Please provide footnotes for all abbreviations and symbols used on the Tables in the main document and appendices.

***Response:*** *As discussed with NDEP on January 10, 2011, all abbreviations and acronyms are provided the upfront material in the report. BRC does not believe that adding footnotes to each and every table is warranted. If the NDEP has specific examples of non-standard or strange abbreviations that appear in specific tables, BRC will insert the appropriate footnotes for those tables.*

NDEP Review: Response adequate. NDEP will identify any specific examples where additional footnotes are needed, if necessary.

21. p ES-3 Summary Risk Table embedded in text and Tables 22 through 25. The correct ILCRs and HIs are as follows:

| Receptor | ILCR | | HI | |
|---|---|---|---|---|
| | Lower Bound | Upper Bound | Lower Bound | Upper Bound |
| Resident | $6 \times 10^{-7}$ | $2 \times 10^{-6}$ | Ok | Ok |
| Commercial | Ok | $2 \times 10^{-7}$ | Ok | Ok |
| Construction | Ok | Ok | 0.072 | 0.073 |

It appears that BRC is manually calculating the range as presented in summary in the upper left hand corner of the calculation spreadsheets (generally cells B4, 5 or 6, C4, 5, or 6, and E4, 5 or 6) and this may be the source of errors. For example, in cell B4 of Table 23, the HI value of 0.0058 has been manually entered. The correct value is 0.00058 which has lead to the error in the upper bound HI for the construction worker. It is recommended that these cells be linked to the actual calculation spreadsheets to avoid these errors in the future.

***Response:*** *Agreed. The correct risk values have been provided in a text and tables.*

NDEP Review: Response adequate.

22. Executive Summary; Potential Impacts to Groundwater; p ES-4; last paragraph of section. This paragraph may require revision in response to NDEP comments on Section 9.0.

***Response:*** *Please see responses below.*

23. Section 4.6.2.3 The following text was inserted: "…results associated with MS/MSD and/or LCS/LCSD recoveries that were only slightly lower than the lower acceptance limit (i.e., 50 to 75 percent recoveries for inorganics and *the higher of greater than 30 percent or one-half the statistically-derived lower limit for organics*) were accepted as usable without further evaluation." [emphasis added]

    However, for MS/MSD the text states "No organic results were associated with recoveries below the lower laboratory limit" and for LCS/LCSD, the only out of control data were for 1,2,3,4,6,7-HpCDD but those were at 78% recovery. Therefore, the italicized text (above) should be deleted as a usability criterion as it was not employed and there is no precedent for it.

***Response:*** *The text has been deleted as suggested.*

NDEP Review: Response adequate.

24. Section 5.0, 5th Bullet. NDEP's understanding from the December 9, 2010 meeting was that frequency of detection was not going to be used in the COPC selection process. In addition, Section 5.5 notes that this was not used in the COPC selection process. Therefore, the 5th bullet and Section 5.5 should be deleted.

***Response:*** *The bullet and section 5.5 have been deleted.*

NDEP Review: Response adequate.

25. Section 5.3, imbedded table. Please change title of second column to "Maximum Concentration Greater than One-Tenth the BCL. Also, benzo(k)fluoranthene should be removed from this table as, according to Table 8, the maximum concentration did not exceed one-tenth the BCL.

***Response:*** *The suggested revisions have been made to the report on page 5-8.*

NDEP Review: Response adequate.

26. Section 6.1.2. Similar to recent Mohawk vapor intrusion work, revision to reference EPA 2002 VI guidance and compare location to soil gas collection at Station 3 as part of Side-by-Side study should be made to this document.

***Response:*** *The revisions that were made in the Mohawk report have also been made in Section 6.1.2 of the report.*

NDEP Review: Response adequate.

27. Section 8.1. Please update the ILCRs and HIs per New Comment 21 above.

***Response:*** *See response to comment 21 above.*

NDEP Review: Response adequate.

28. Sections 9.1.1 and 9.1.2; pp 9-1 and 9-2, NDEP provides the following comments:
    a. Section 5.0 only screens soil analytical data against residential soil BCLs which would be appropriate for ingestion, absorption, and inhalation exposure pathways. However, the soil leaching to groundwater transport mechanism is different and thus LBCLs should be used for screening soil analytical data to develop a list of COPCs specific to that pathway. Table 4 presents screening for a DAF of both 1 and 20; but, this information does not appear to be used herein. Furthermore, NDEP notes that 21 chemicals exceed the DAF of 1.
    b. Following the NDEP guidance (NDEP, 2010) DAF values should be calculated for the "Normal" and "Enhanced Post-Development Scenarios", with the most conservative value used for the LSSL screening.

***Response:*** *After we received this comment, BRC and the NDEP have discussed this comment. It is BRC's opinion that this approach is not consistent with the Closure Plan or the thoroughly discussed COPC selection process that has been decided upon for numerous sub-areas. It is BRC's opinion that the RAS process under way for Eastside groundwater will properly address groundwater impacts. Therefore, as discussed with NDEP on January 10, 2011, no changes have been made to the report in response to this comment.*

NDEP Review: Response adequate.

29. Section 9.2; p 9-4; 1st sentence on page. The NDEP requests that supporting laboratory data for soil physical and chemical properties be provided in an Appendix. Without this information NDEP cannot verify the calculations or conclusions provided by BRC.

***Response:*** *The physical property data are included as a separate worksheet in the database file (BRC GN-School Site Sub-Area HHRA-Closure Report_Data.xls) included on the report CD in Appendix B.*

NDEP Review: Response adequate.

30. Section 9.2; p 9-5; 1st sentence on page. For the base case modeled the text is acceptable; however, BRC must check the DBS&A modeling report for the post-development scenarios to verify that the depth to water for the Galleria North School Site Sub-Area remains at 25 to 33 feet. A potentially higher water table would mean a shorter unsaturated soil column, and thus, change model assumptions about the soil column.

***Response:*** *Similar to Mohawk, groundwater modeling conducted by DBS&A using conservative post-development assumptions indicates that average post-development groundwater depths for the majority of the Galleria HS site would be 25 feet or greater. However, BRC also notes that based on the leachate modeling conducted, BRC determined that compounds fall into two classes - those (such as nitrate) that leach out and those (such as metals) that do not, regardless of site conditions and depth to groundwater. BRC further reiterates that the subject of impacts to groundwater will be addresses comprehensively in the parallel RAS being developed for Eastside groundwater. BRC believes that this is the proper forum for addressing groundwater impacts. Lastly, it is worth noting that this Site did not have any disposal ponds.*

31. Section 9.4; p 9-6; 3rd bullet. "…Lack of an appropriate model validation opportunity." NDEP acknowledges the lack of model validation; however, NDEP guidance on unsaturated zone modeling (NDEP, 2010) provides for comparison to SPLP testing as a check on model results. Such a comparison is made in Section 9.5 on page 9-8. No response is required for this document, however, NDEP provides this comment for inclusion in future Deliverables.

***Response:*** *Agreed.*

NDEP Review: Response adequate.

32. Section 9.5; p 9-7; 2nd paragraph. Please provide a reference for the "naturally-occurring/background concentrations" of nitrate.

***Response:*** *Due to changes in the document, nitrate is not considered a COPC and was not included in the revised modeling.*

NDEP Review: Response adequate.

33. Section 9.5; p 9-8; top of page, similar to NDEP's comments on the Mohawk Health Risk Assessment, please provide the Summers model calculations to support the conclusion of little affect via leachate mixing with groundwater. In doing so consider the following:
    a. Saturated hydraulic conductivity from DBS&A (2009) minimum value from calibrated model was 10 ft/day and in the vicinity of Galleria North School Site Sub-Area may have been as high as 30 ft/day as opposed to 3.28 ft/day input to the SESOIL model.
    b. Width of contaminated zone perpendicular to flow set at 32.8 ft, this value appears low.
    c. Horizontal hydraulic gradient was recently reported as 0.02 (DBS&A, 2010).

***Response:*** *Similar to the response for Mohawk, no changes have been made to the report based on discussions with NDEP on January 3, 2011.*

NDEP Review: Response adequate.

34. Section 9.5; p 9-7and p 9-8. If the reference herein of modeling COPCs in soil migrating to groundwater being overly conservative is meant to apply to the base case for recharge (0.08 inches/year), BRC is referred to the guidance for soil leaching (NDEP, 2010). Of note in that guidance is that the base case precipitation was based on recharge studies in adjacent basins and was not site specific to the BMI Industrial Complex and Common Areas. Recent laboratory column testing by Tronox suggests the recharge could be less than 0.08 in/year and could be nil. In this scenario one would not expect to see these chemicals leaching under the base case, but would expect to see them leach under the post-development and enhanced recharge scenarios. Using the nil recharge argument, then the conclusions of the last paragraph on page 9-8 would not logically follow and one might expect soil leaching of certain COPCs due to development. Please discuss and include this concept in the Section 9.5 Results.

***Response:*** *Similar to the response for Mohawk, BRC understands that, based on recent studies conducted elsewhere in the BMI Complex, that the base case recharge rate of 0.08 inches/year may be conservative – i.e., it could be less than 0.08 inches/year. Nonetheless, BRC believes that its conclusions relating to leachate modeling, as presented, are still valid, especially considering the conservatism inherent in the potential recharge rates assumed due to development activities (such as leaking pipes, etc.) are taken into account. BRC further notes that groundwater impacts for the entire Eastside are the subject of a separate Remedial Alternative Study (RAS) wherein all of these issues will be addressed.*

NDEP Review: Response adequate.

35. Table 16. Zinc should be removed from the chemical list as it is not a COPC.

***Response:*** *Agreed.*

NDEP Review: Response adequate.

36. Appendix E

a. The tables in Appendix E should be consistent with the text in Section 4 of the HRA. For example, Section 4.6.2.3 identifies out-of-control limits for ammonia, antimony and tungsten for MS/MSD and out-of-control limits for 1,2,3,4,6,7-heptachlorodibenzo-p-dioxin and cyanide for LCS/LCSD. However only 1,2,3,4,6,7-heptachlorodibenzo-p-dioxin is listed in Table E-11 (Data Usability Evaluation for Low MS and LCS Recoveries).

***Response:*** *The tables have been revised to be consistent with the text.*

NDEP Review: Response adequate.

b. Table E-6 (Data Usability Evaluation for Organochloride Pesticides) and Table E-13 (Data Usability Evaluation for Surrogate Recoveries) The DU decision states that surrogate (recovery) does not affect COPC selection. This is not correct. The BCL for endosulfan should be used for endosulfan sulfate and the BCL for endrin should be used for endrin aldehyde and endrin ketone. Then the rationale for usability can be based on the fact that the BCL is sufficiently larger than the sample results.

***Response:*** *The BCLs for endosulfan and endrin have been applied as suggested.*

NDEP Review: Response adequate.

c. Table E-8 (Data Usability Evaluation for Volatile Organic Compounds in Soil), Some of the VOCs listed as not having BCLs do have BCLs and these notations should be corrected. Some discussion should be given to why the data quality issue (e.g., calibration violation, low internal standard recovery) does not affect COPC identification.

***Response:*** *The VOCs have been reviewed for BCLs and the reasons will be amended.*

NDEP Review: Response adequate.

d. Table E-10 (Data Usability Evaluation for VOCs in Surface Flux) There are no BCLs for surface flux data. The table incorrectly compares the VOC concentration in the Summa canister (µg/$m^3$) with the ambient air BCL (should be in µg/$m^3$ units but µg/kg is incorrectly listed for this column). Also, please explain why "flux data evaluated sample by sample" is given as the rationale for usability.

***Response:*** *The ambient air BCLs are not used to review the surface flux VOCs.*

NDEP Review: Response adequate.

e. Table E-3 is blank. BRC should confirm that this was intended or if a table is missing from the appendix.

***Response:*** *A note has been provided in Table E-3 that it is blank because no data points required further examination.*

NDEP Review: Response adequate.

37. Appendix J
    a. Table J-2. NDEP notes that the precipitation for the Normal and Enhanced Scenarios for the Galleria North School Site Sub-Area is lower than used for the recent Mohawk SESOIL model, please explain this inconsistency.
    b. Tables J-3 and J-5. Although the average soil physical property data are provided in Tables J-3 and J-5, the supporting data are not provided to substantiate the values used herein. NDEP has provided this comment repeatedly in previous Deliverables.
    c. Table J-3. Cation exchange capacity has been measured at various locations around the BMI Industrial Complex and Common Areas, these numbers could be used to validate the model default and/or replace the model default value.

***Response:*** *As noted in response to comment 29, the physical property data are included as a separate worksheet in the database file (BRC GN-School Site Sub-Area HHRA-Closure Report_Data.xls) included on the report CD in Appendix B.*

*Regarding the precipitation being lower for the School site versus Mohawk, this is because the unsaturated zone soil column is shorter at the School site, thus less precipitation is needed in order to match the recharge rates for the normal and enhanced scenarios.*

*Regarding cation exchange capacity, the model default value is zero, and is only used for metals. Since these tend not to migrate, no changes to the model default are recommended.*

NDEP Review: Response adequate.

38. Table 29

    Review of DQA analysis. The standard deviation for arsenic could not be reproduced. We calculated a standard deviation of 1.3463 whereas BRC used a value of 1.4 in the DQA analysis. It is suggested that proper rounding should be implemented for statistical analysis in future Deliverables. No revision is required.

# APPENDIX A-2

## Response to NDEP Draft Comments Dated December 2, 2010 on the Human Health Risk Assessment and Closure Report for the Galleria North-School Site Sub-Area, BMI Common Areas (Eastside), Clark County, Nevada, Dated November 2010

1. Page 1-2, footnote 2 states "Under this alternative, the Site could be developed in accordance with the current development plan without the need for institutional controls within the Site." NDEP expectation is that Environmental Covenants will be attached to all sub-areas to assure appropriate management of soil beneath 10 feet bgs and any groundwater issues.

***Response:*** *The footnote has been revised to read: "Under this alternative, the Site could be developed in accordance with the current development plan with the need for an Environmental Covenant for the Site that will assure appropriate management of soils beneath 10 feet bgs (post-graded), should they need to be disturbed in the future."*

2. Section 2.2, Page 2-6, top of page states "The extent to which these former seeps historically affected contaminant transport (*e.g.*, by means of enhanced surface water transport to the Wash or upward migration into overlying soils) is unknown." This component of the CSM has not been appropriately considered in the HRA evaluation (e.g. Section 5.2 Comparison of Concentrations/Activities in Surface and Subsurface Soils) especially as a potential explanation for the presence of metals above background at the site. Rather than making the assumption as on page 5-8 that it is "doubtful that such widespread higher concentrations in subsurface soils are a result of Site contamination" NDEP would like to discuss this issue further. NDEP preliminary review of box plots indicates that these are consistent with site related metals. CSM should also be used to explain contaminant distribution and magnitude present in scraped areas.

***Response:*** *Agreed that further discussion is warranted on this issue. See response to comment 10c for further explanation. It is important to note that 29 of the 32 metals failed the background comparison statistics. This is many more than have failed these statistics in other areas of the site, particularly in sub-areas in the southern portion of the Eastside property, which are closer to the existing background datasets. Contamination does not explain these comparison failures, especially given the discussion provided in response to comments 10 and 14.*

3. Page 3-20, 1st paragraph, ½ way down states "It is assumed that concentrations have been reduced similarly to the dioxins/furans/PCB congeners concentrations" needs clarification. This is not how the data were used in the RA, just an "assumption" that concentrations in the RA are overestimated for these chemicals.

***Response:*** *The statement was in reference to the fact that although this area was scraped and re-analyzed for dioxins/furans/PCB congeners, which showed a reduction in concentration from 307 ppt (TCDD TEQ) to 7.7 ppt; the sample location was not re-analyzed for metals, PAHs, and organochlorine pesticides, which also had detected and/or elevated (in comparison to other*

*results for the site) levels. However, as noted in the report, the data from the original pre-scrape sample for this location were included in the human health risk assessment; only the dioxins/furans/PCB congener original data were excluded (and replaced with the post-scrape data). The sentence has been revised to read: "It is likely that concentrations for these constituents have also been reduced."*

4. Section 4.7. Sections 4.7.1 through 4.7.6 belong in section 4.6.

***Response:*** *These sections have been moved to Section 4.6.*

5. Page 5-2, 2nd full paragraph. Provide better justification that this approach to field duplicates is reasonable by reviewing the data more closely. We expect the conclusion is reasonable.

***Response:*** *As stated in this paragraph "The field duplicates were compared to the primary sample during the course of data validation. The variances were not out of the line with the variance in results across the Site. Therefore, as distinct soil chemical measurements, they are treated as unique samples in the analyses." A footnote has been added on page 5-2 that reads: "Field duplicates are shown in Appendix B and indicated with the "FD" qualifier under the column entitled "Sample Type"".*

6. Section 5.1, page 5-2, last paragraph. This paragraph refers to a 2005 shallow McCullough background dataset whereas page 3-9 refers to a 2007 shallow McCullough background dataset. Please clarify which dataset is being used as part of this HHRA.

***Response:*** *These background data were collected in 2005; however, the report was finalized in 2007, thus the use (and confusion) of two different dates. This has been corrected in the report; that is, references to the data have been revised to read 2003 and 2005 shallow McCullough background data, while reference to the report is 2007.*

7. Table 7 and text on page 3-9. The text states that the 2007 shallow McCullough background dataset is being used in this HHRA. The 2010 background soil compilation report outlines (in Section 3.0 of that report) that the shallow soils data that fall under the McCullough category also includes three sample locations (BG01 through BG03) from the Environ investigations. These data points are not included as part of the background comparisons in this HHRA and should be clarified.

***Response:*** *Agreed. These data have been added to the shallow Qal McCullough background dataset.*

8. Table 7, Background Comparison Summary. Given the marginal failure of the slippage test due to one high value reported for U-235/236, this sample should be revisited from a data validation standpoint. Perhaps, in addition, understand how this sample (and some other relatively high U-235 results) compare to the U-234 and U-238 results. Although NDEP

asks for some analysis by secular equilibrium, there is also an issue of relative abundance – relative abundance constraints do not seem to have been satisfied with at least one of these samples, if the data are also similar to background.

***Response:*** *As per NDEP guidance, a significance level of 0.025 is used for all background comparison statistics. Accordingly, Table 7 indicates there was no failure of any of the statistical tests, including the slippage test. It should also be noted that the laboratory has informed us that results for uranium-235/236 generally hover around the noise level of the analysis. That is, there is higher uncertainty for uranium-235/236 results due to the fact that typically there is essentially no activity in these samples. A discussion concerning this issue has been added on page 4-24.*

9. DVSR blank contamination issues. The sub-area-wide (Galleria sub-area) DVSR appears to have instances where a combination of reported values and PQLs are being used in instances of blank contamination. Metals and radionuclides affected for the Galleria sub-area are beryllium, cadmium, tin, Ra-228, Th-230, and U-238. For the North School site, only U-238 is affected (Sample IDs GNC1-JD11 and GNC1-JD10). This is similar to the blank contamination reporting issues for Mohawk and Warm Springs. NDEP requests a summary review of the impacts on COPC selection and risk estimates.

***Response:*** *This issue has been discussed and addressed previously with NDEP. BRC follows USEPA and NDEP guidance for data validation of metals, as well as requirements outlined in SOP-40. BRC submits all DVSRs to NDEP and has received approval on all DVSRs submitted for the project using this validation methodology. As has been explained previously, and as approved by NDEP in the DVSRs, metals (and radionuclide) data qualified due to blank contamination, where the reported result is greater than the PQL, are reported as non-detects using the reported value, while results that are below the PQL are adjusted upward and the PQL is used as the non-detect value. This is why it is possible to have instances where there may be a combination of reported values and PQLs being used. Again, this is consistent with USEPA and NDEP guidance and how metals have been validated throughout duration of the project.*

*As far as potential impacts, keeping in mind that USEPA and NDEP guidance have been followed, the metals that are most affected by this issue (as was demonstrated for the Warm Springs Rd ROW) have low (or non-detect) site concentrations and high risk-based levels, thus the affect, if any, would be negligible. This is especially true given this issue only affects non-detect results.*

*BRC feels that we have adequately addressed this issue and given that <u>all</u> data collected for the project have undergone this validation approach, and any changes would involve significant effort and have no impact on decision making for the project, this issue does not need further discussion or evaluation.*

10. General comments on statistical analysis (Section 5).
    a. Several metals are eliminated based on background comparisons, when the main driver for these results is the greater frequency of non-detects. In our experience, it is more

customary to carry these through the RA, but BRC eliminates them instead. We have made this comment previously, but perhaps this requires discussion with NDEP before finalizing a path forwards for these metals (e.g., Sb, Se, Ag, Tl, W in this dataset, and maybe a few others).

***Response:*** *The detection frequencies for these metals are 0 percent for antimony and thallium, and 2 percent (one detect in 55 samples) for selenium. BRC does not consider it unreasonable to not include these metals in the risk assessment; however, we are willing to discuss the issue further. It is also important to note that detection limits are defined in the QAPP, approved by NDEP, and were evaluated against risk-based standards during the preparation of the QAPP.*

*As discussed with NDEP in the December 9, 2010 meeting, the procedures for selecting COPCs has been extensively modified in the revised report.*

b. Background comparisons have been performed, but the next step is to compare surface data to subsurface data for those metals that failed background comparisons. It is not clear that this is reasonable, and if it is, the explanation is not sufficient. For example, consider the barium data. All subsets of barium Site data are greater than background, but the barium Site surface and subsurface data are similar. This does not seem, on the face of it, to be sufficient justification for removal of barium from the RA process. Further discussion is needed to understand the CSM for this site, which might help put this in perspective. In the meantime, it is not clear that it is appropriate for BRC to add this COPC selection step.

***Response:*** *As noted above, the procedures for selecting COPCs has been extensively modified in the revised report, consistent with discussion with NDEP in the December 9, 2010 meeting. The surface versus sub-surface pair-wise comparison tests have been removed from the document. Instead information about clay content in Site soils versus those in background soils have been added to the report.*

c. In addition, the Site surface and subsurface comparisons have been made based on a paired test (the Wilcoxon Signed Rank test). It is not appropriate to pair these data. This is in opposition, for example, to the notion of treating field duplicates as independent data. Surface and subsurface data are more removed from each other than field duplicates, in which case they should also be treated as independent. Then all 31 surface and 24 subsurface samples should be included in the analysis, if the analysis is to be performed at all (see General Statistics Comment #2 above).

***Response:*** *See response to comment 10b above.*

11. The uranium metal results fail background tests, particularly in the subsurface. However, the isotopic data do not. This requires some explanation.

***Response:*** *A footnote has been added to Table 7 regarding this issue.*

12. There are a few high hits in the U-235 data that need to be addressed. These do not seem to satisfy basic constraints related to relative abundance of isotopes of uranium, and needs to be revisited.

***Response:*** *The high values of uranium-235/236 are primarily non-detect values. See response to comment #8 above.*

13. The dioxin TEQ file (Table B-2 is not live). There is a sample location with a TCDD TEQ at 49.1 ppt. The BCL screening level is 50 ppt. Dioxin was not selected as a COPC (but was a chemical in which excavation efforts were conducted). The concern is that this value is close to the 50 ppt BCL screening level and this table does not include the co-planar PCBs. In general, it appears from Table 4 of the document, that co-planar PCBs have not been compared to anything. Table 9 of the document, footnote #3, it says that the TCDD TEQ incorporates co-planar PCBs but this is not evident in Table B-2. BRC should confirm inclusion of the coplanar PCBs in the TCDD TEQ and if this has not been done, to update the HRA accordingly.

***Response:*** *As noted in the text (on page 3-7) and in Table 4 (footnote #4), and in Table 9 (footnote #3) TCDD TEQs are calculated using dioxins, furans, and PCB congeners. Dioxins/furans and PCB congeners are presented in different tables in Appendix B since there are analyzed by different methods. The Appendix B tables merely present the Site results, for hardcopy printing. They are not used for any calculation purposes (and in fact include qualifiers precluding their use in any calculations) and this is never suggested or implied in the report. PCB congeners have been included in comparisons, by including them in the TCDD TEQs, consistent with USEPA guidance. This issue has been made clearer in Section 1.1 of the report (in the paragraph discussing dioxins/furans).*

*In addition, the calculation of TCDD TEQs is now included in the report.*

*BRC would also like to point out that USEPA recently came out with a " Draft Recommended Interim Preliminary Remediation Goals for Dioxin in Soil at CERCLA and RCRA Sites" (December 30, 2009--Public Review Draft). In this document they recommend an interim PRG of 72 ppt for residential land use.*

14. It is not clear what level of review of Appendix I has occurred to determine, in light of the data collected, that the sub-area is homogeneous and can be treated as a single population. In review of the figures provided in Appendix I, the text states that homogeneity was assumed for the site data such that the EPC may be used for all areas. However, the data do not appear to be homogenous when the standard deviations are examined for Al, As, Be, Ba, Co,

Cr VI, Mg, Mn, Mo, to name a few. In addition, the text states that there were no "hot spot" areas, however this has not been confirmed.

***Response:*** *The Appendix I figures were reviewed, collectively with other data presentations provided in the report. The Appendix I figures showing the distribution of the data were reviewed considering other lines of evidence showing the homogeneity of the data. Some variability of the data is expected, if there was perfect homogeneity then only one sample would be needed to represent the site. This variability is demonstrated by the background datasets for the project. As shown on the probability and boxplots in Appendix G, the data for these particular metals generally follow a normal distribution, and their variability are similar to the background data. The exposure point concentration is the site average, represented by the 95 percent UCL. Given these lines of evidence, this is considered reasonable and appropriate as representative for the entire site. Nonetheless, the distribution plots have been removed from the report, and the intensity plots have been revised to indicate that residential soil BCLs are used for the plots.*

*The data were reviewed for the presence of hot spots, and as discussed in Section 3.5, page 3-20, one location was evaluated. No other potential hot spots, considering concentrations, clusters, and co-locations, were identified.*

15. For the resident, the combined soil and indoor air (flux) data show risk of $2 \times 10^{-6}$. It appears that beta-HCH via the vegetable ingestion pathway is the main driver from direct soil exposure while 1,2-dibromethane is the driver for the flux data. The highest risk due to indoor air is $1 \times 10^{-6}$ (highest flux location).

***Response:*** *Agreed. The driving chemicals and pathways are included in the report.*

16. It should be noted that there are still hard-wired tables such as the TCDD TEQs and Table 10 with the EPCs). This is not necessarily a deal breaker but something that has been discussed previously and limits or slows down our ability to QA.

***Response:*** *In response to earlier comments BRC is now including the TCDD TEQ calculations in the risk assessment report (within the data file on the report CD in Appendix B). These calculations for the Galleria North School Site are attached. It should be noted that these calculations are done using both the WHO 1998 and WHO 2005 TEFs; however, based on what NDEP has required up to this point only the TEQs calculated using the WHO 1998 TEFs are used in the risk assessment.*

*Regarding the EPCs, these values are generated using Neptune's GISdT program, as discussed in the report, and as directed by NDEP. The output from that program is simply a listing of values, which are what are input into Table 10. The program output itself is hardwired.*

17. The DU tables still do not assess the impact of the quality issues on the uncertainty in the data used for the risk assessment. This was recently discussed on the Warm Springs

teleconference but this report was received prior to that discussion. However, this is a relatively minor issue.

***Response:*** *At the conclusion of the Warm Springs teleconference, NDEP was going to review the DU Tables and provide details on what NDEP would like to see. BRC has not yet received these additional details as to what is missing in the DU tables. However, BRC has revised the data usability tables based on the Mohawk RLSO report received from NDEP.*

18. SPLP testing data was not specifically used in evaluation and several analytes were missing. There also appear to be some detection limit issues with SPLP lab results that should be discussed.

***Response:*** *Agreed. Further discussion of the SPLP data is provided on pages 3-22, 4-28 and 9-8.*

19. NDEP requests additional information on how ERM worked out leaching model program stability issues.

***Response:*** *It should be noted that ERM's challenges with the leaching model program are historical, and have not happened recently with ERM's newer version of the model. As discussed with NDEP and Paul Hackenberry, to avoid past challenges, we have not added additional compounds to the model library, instead selecting from chemicals that are pre-loaded in the library and modifying the chemical input parameters before running the model. This in no way affects the model results. Further, model results are reproducible—i.e., model runs have been performed on a second machine by another modeler to verify the results. Accordingly, model stability is not an issue for BRC sites.*

REDLINE/STRIKEOUT TEXT

## EXECUTIVE SUMMARY

Basic Remediation Company LLC (BRC) has prepared this Human Health Risk Assessment (HHRA) and Closure Report for the Galleria North -School Site Sub-Area (Site) of the Basic Management, Inc. (BMI) Common Areas (Eastside) in Clark County, Nevada. The Site is a portion of the ~~Eastside sub-area defined as the~~ Galleria North sub-area that has been defined within Eastside. The purpose of this report is to support a request for a No Further Action Determination (NFAD) by the Nevada Division of Environmental Protection (NDEP) for the Site.

-The HHRA evaluates the potential for adverse human health impacts that may occur as a result of potential exposures to residual concentrations of chemicals in soil, groundwater, and air following remediation of the Site. If the residual risks do not pose an unacceptable risk to human health and the environment, then an NFAD will be requested from the NDEP. Upon issuance of an NFAD by the NDEP, re~~ to allow~~ development of the Site is expected to proceed in a manner consistent with the Environmental Covenant that is attached to the property. This report also describes the various remediation actions that were performed and presents the subsequent confirmation data collected in 2009 and 2010 at the Site.

## BACKGROUND

An initial confirmation sampling investigation was conducted at the Site in 2009 in accordance with BRC's ~~a NDEP-approved~~ Sampling and Analysis Plan (SAP, approved by the NDEP on December 12, 2008), with follow--up sampling in 2010. The SAP addressed sampling procedures such that remaining contaminants and their potential impacts to future Site uses (as discussed in Section 1.1 of the *BRC Closure Plan* for the BMI Common Areas [BRC, Environmental Resources Management (ERM), and Daniel B. Stephens & Associates, Inc. (DBS&A) 2007[1]]) can be determined. The Site investigation involved collection of soil matrix and surface flux samples from~~placed~~ throughout the Site. The sampling plan performed for this purpose, as described in Section ~~Section~~ 4 of the SAP (BRC 2008), was consistent with the approach presented in Section 2 of the *Statistical Methodology Report* (NewFields 2006). The *Statistical Methodology Report* describes the statistical methods that are used to confirm the final soils closure at each of the Eastside sub-areas of the BMI Common Areas. Several subsequent rounds

[1] The BRC Closure Plan was finalized and approved by NDEP in 2007. Subsequent to this date, revisions were ~~have been~~ made to Section 9 of the Closure Plan (Risk Assessment Methodology–Human Health). The latest revision to Section 9 is March 2010. No other sections of the Closure Plan have been revised since 2007.

of soil remediation and confirmation sampling were performed. The final number of samples collected was determined to be adequate for the completion of a statistically robust dataset upon which to perform an HHRA.

## CONCEPTUAL SITE MODEL

The conceptual site model ~~(CSM)~~ for the Site considers current and potential future land-use conditions. Currently, the Site is undeveloped. Current receptors that may be exposed to Site chemicals of potential concern (COPCs) include on-site trespassers, occasional on-site workers, and off-site residents. ~~Under the prospective redevelopment plan, the Site is proposed to be used for construction of a high school, with associated parking, buildings, and recreational fields. However, the analysis assumes unrestricted future land use.~~ Future receptors identified as "on-site receptors" are defined as receptors located within the current Site boundaries (Figure 1), while future "off-site receptors" are those located outside the current Site boundaries. Under the prospective redevelopment plan, the Site is proposed for use by a high school or a middle school (with associated parking, buildings, and recreational fields), and residential redevelopment. However, the HHRA assumes unrestricted future land use. Therefore, future receptors may include on-site residents, school staff, students, and visitors, outdoor maintenance workers, construction workers, trespassers, and off-site residents.

-Due to the requirement for use of default reasonable maximum exposure parameters for future receptors, exposures to future receptors are greater than current exposures. Accordingly, only future receptors were assessed in the HHRA. Potential exposures to off-site residents were qualitatively evaluated.

The HHRA conforms to the methodology included in Section 9 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010). This methodology includes the evaluation of residential receptors, but not specifically school receptors. However, potential residential exposures are considered more conservative~~,~~ and, therefore, are protective of any potential school receptors.

The entire Site will be enhanced by restoration and redevelopment once remediation is complete. Therefore, there is no exposure to ecological receptors, because the Site~~site~~ will be prepared for human use in ~~a~~ high school or middle school and residential setting.

## DATA REVIEW AND USABILITY EVALUATION

A data review and usability evaluation was performed to identify appropriate data for use in the HHRA. The results of the data usability evaluation indicate that the data collected in 2009 and 2010 are adequate in terms of quality and quantity for use in a risk assessment.

## HUMAN HEALTH RISK ASSESSMENT

An HHRA was conducted to determine if chemical concentrations in Site soils are~~: (1)~~ either: (1) representative of background conditions; or (2) do not pose an unacceptable risk to human health and the environment under current and potential~~anticipated~~ future use conditions. The HHRA followed the ~~basic~~ procedures outlined in U.S. Environmental Protection Agency (USEPA) and the NDEP guidance documents. As noted above, the HHRA also conforms to the methodology presented ~~included~~ in Section 9 of the NDEP-approved *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010) and includes all COPCs for the Site. Radionuclides were not included as COPCs because~~as~~ they were consistent with background conditions. Results of the HHRA are summarized below.

**TABLE ES-1: SUMMARY OF HUMAN HEALTH RISK ASSESSMENT CALCULATIONS**

| | Future On-Site Resident | Construction Worker | Commercial (Indoor) Worker | Maintenance (Outdoor) Worker |
|---|---|---|---|---|
| Non-Cancer HI[1] | 0.14~~31~~ | 0.040~~079~~ | 0.0059~~012~~ | 0.0099~~020~~ |
| Chemical Cancer Risk[2] | 2~~1~~ × $10^{-6}$ | 2 × $10^{-8}$ | 2~~1~~ × $10^{-7}$ | 2 × $10^{-7}$ |
| Asbestos Risk[3] | 0 to 4 × $10^{-7}$ | 0 to 7 × $10^{-7}$ | 0 to 8 × $10^{-8}$ | 0 to 2 × $10^{-7}$ |

1 – HI = hazard index; the value presented is the total cumulative non-cancer HI; unless noted with an '(TO)' which indicates the value is the maximum target organ specific HI.
2 – Cancer risk is the maximum theoretical upper-bound incremental lifetime cancer risk (ILCR).
3 – Asbestos risks represent the cumulative asbestos risks for chrysotile and amphibole fibers. However, the risk estimates are dominated by amphibole, which fiber type was not detected at the Site in the confirmation samples. Asbestos risks were calculated for the entire Site and not divided by exposure area.

Indoor air exposures are evaluated on a sample-~~-~~by-~~-~~sample basis, per NDEP requirements, using the surface flux data measurements. Because of this, the minimum and maximum surface flux risks and HI estimates are summed with the soil risk and HI estimates to provide a range of cumulative risks and HIs. The risk estimates shown above incorporate the maximum surface flux risks. Primary risk contributors are discussed in the main body of the report.

In addition, BRC has performed a more detailed Site-specific evaluation of vapor intrusion potential at a comparison study area within the Eastside property. Given the results of this study,

and based on the results of the tiered approach followed from USEPA's Vapor Intrusion Guidance (2002d), it has been demonstrated that there is no likelihood of adverse vapor intrusion into any indoor spaces that may be constructed on the Site.

The NDEP has recently determined that HHRAs for Eastside property sub-areas do not need to evaluate the pathway of radon migration from groundwater to indoor air for sub-areas with a separation distance of at least 15 feet between any current or future building structure base and the high water table (letter dated November 9, 2010, from Greg Lovato, NDEP, to Mark Paris, BRC). Therefore, given the depth to groundwater at the Site is at least 25 feet below ground surface (bgs), the intrusion of radon into indoor air is not evaluated in the HHRA.

## EVALUATION OF UNCERTAINTIES

Risk estimates are values that have uncertainties associated with them. These uncertainties, which arise at every step of a risk assessment, are evaluated in the report to provide an indication of the uncertainty associated with a risk estimate. Uncertainties from different sources are compounded in the HHRA. Because the uncertainties are compounded and because the exposure assumptions and toxicity criteria used are considered conservative, the risk estimates calculated in this HHRA are likely to overestimate rather than underestimate potential risks. A detailed discussion of these uncertainties is provided in the Uncertainty Analysis (Section 7) of the report.

## POTENTIAL IMPACTS TO GROUNDWATER

Potential impacts to groundwater of residual chemicals in soil were evaluated, as was ~~and considering~~ the potential impact to groundwater from the prospective future land use of the Site ~~were also evaluated~~. Potential impacts were evaluated using the SESOIL vertical unsaturated zone migration models. Because future redevelopment will likely result in increased surface water infiltration due to sources such as buried water lines, sewer lines, irrigation lines and/or over-watering of parks, playing fields, and lawns, three surface water infiltration scenarios were evaluated: (1) baseline, pre-development conditions; (2) normal post-development conditions; and (3) post-development enhanced recharge due to overwatering of open space.

The model predicts that ~~modeled~~ inorganic COPCs will ~~are predicted to~~ exceed their respective comparison levels. However, based upon the differences between the modeled predictions and the lower, actual, ~~in the model predicted results and~~ observed measurements in groundwater, it is probable that processes not accounted for in the model are reducing/attenuating~~attenuating~~ concentrations as they migrate through the vadose zone. That is,~~Based on~~ the model is overpredicting the migration potential of COPCs in the vadose zone. Therefore, because of the

long elapsed time since any use in the vicinity of the Site and ~~(there was~~ no use on the Site itself~~)~~, it is unlikely that the concentrations of constituents detected in Site soils represent a risk to groundwater quality.

**SUMMARY**

Based on the results of the 2009/2010 sampling, the HHRA, and the conclusions presented there from in this report, exposures to residual levels of chemicals in soil at the Galleria North -School Site sub-area should not result in adverse health effects to any of the future receptors evaluated, or to groundwater quality beneath the Site. As a result, an NFAD ~~(acknowledging the likely conditions identified in Section 1)~~ for the Galleria North -School Site sub-area is warranted, given the following provisos~~conditions~~:

1. The NFAD does not pertain to groundwater. BRC retains the responsibility to address any environmental impacts to groundwater beneath the Site, pursuant to the *Settlement Agreement and Administrative Order on Consent, Phase 3* (NDEP 2006). As such, additional investigation may be necessary on the Site as it relates to BRC's responsibilities for groundwater. BRC must be granted access to the Site~~site~~ for activities such as well or soil boring installations or other investigative or remedial efforts.

2. The soils beneath 10 feet bgs of the Recorded Environmental Covenant redevelopment ~~current~~ grading plan for the Site have not been evaluated to date. Accordingly, the NFAD does not pertain to soil below the top 10 feet of the redevelopment~~current~~ grading plan for the Site. The property owner should note that these soils should not be disturbed without additional investigation or evaluation. BRC understands that this provision will be reflected in an Environmental Covenant for the Site.

~~3.~~ The property owner should ensure that activities at the Site do not exacerbate existing, sub-surface, environmental conditions.

3. The redevelopment grading plan (Figure 2) that has been prepared for redevelopment of the Site has been incorporated as an Environmental Covenant for the Site to control subsurface excavation.

4. Site~~site~~ use is otherwise suitable for purposes of residential, recreational, civic, commercial, or industrial use (residential use being protective and representative of any potential school use).

# 1.0 INTRODUCTION

Basic Remediation Company LLC (BRC) has prepared this Human Health Risk Assessment (HHRA) and Closure Report for the Galleria North -School Site Sub-Area (Site; Figure 1) of the Basic Management, Inc. (BMI) Common Areas (Eastside) in Clark County, Nevada. The purpose of this report is to support a request for a No Further Action Determination (NFAD) by the Nevada Division of Environmental Protection (NDEP) for the Site. As presented in Section XVII.1.a. of the *Settlement Agreement and Administrative Order on Consent: BMI Common Areas, Phase 3* (AOC3; NDEP 2006), the NDEP acknowledges that discrete Eastside areas may be issued an NFAD as remedial actions are completed for selected environmental media. Any such NFAD request shall identify the remedial actions and other work completed at the property in question, the results of such remedial actions and other work, the proposed land use(s), and the reasons supporting the eligibility of the property~~Property~~ for an NFAD. This report provides this information for the Site.

BRC recognizes that the following conditions will be included in a Recorded Environmental Covenant (Instrument 201102030002818 Clark County Recorders Office) ~~likely be necessary~~ as a condition to receiving an NFAD from the NDEP~~part of the NFAD~~:

1. The NFAD does not pertain to groundwater. BRC retains the responsibility to address any environmental impacts to groundwater beneath the Site, pursuant to the AOC3. As such, additional investigation may be necessary on the Site as it relates to BRC's responsibilities for groundwater. BRC must be granted access to the Site~~site~~ for activities such as well or soil boring installations or other investigative or remedial efforts.

2. The soils beneath 10 feet below ground surface (bgs) of the redevelopment~~current~~ grading plan for the Site have not been evaluated to date. Accordingly, the NFAD does not pertain to soil below the top 10 feet of the redevelopment~~current~~ grading plan for the Site. The property owner should note that these soils should not be disturbed without additional investigation or evaluation. ~~BRC understands that this provision will be reflected in an Environmental Covenant for the Site.~~

~~3.~~ The property owner should ensure that activities at the Site do not exacerbate existing, sub-surface, environmental conditions.

3. The grading plan (Figure 2), which has been prepared for redevelopment of the Site, has been incorporated as an Environmental Covenant for the Site to control subsurface excavation.

4. Site~~site~~ use is otherwise suitable for purposes of residential, recreational, civic, commercial, or industrial use (residential use being protective and representative of any potential school use).

As stated in Section VI of the NDEP's *Record of Decision, Remediation of Soils and Sediments in the Upper and Lower Ponds at the BMI Complex* (ROD; NDEP 2001), cleanup of the Site proceeded under Alternative 4B (soils transferred from the Site to a dedicated Corrective Action Management Unit [CAMU] within the BMI Complex),[2] as identified and described in Section 9 of the Remedial Alternatives Study (RAS) for the Eastside. The *Remedial Alternatives Study for Soils and Sediments in the Upper and Lower Ponds at the BMI Complex* (Environmental Resources Management [ERM] 2000) was submitted to the NDEP in March~~,~~ 2000. The RAS is documented via issuance of the ROD, dated November 2, 2001, by the NDEP.

This report is consistent in format with prior closure reports for other study areas, and incorporates comments received from the NDEP on those reports. This revision of the report, Revision 2~~1~~, incorporates comments received from the NDEP, dated January 12, 2011, on Revision 1 of the report, dated December 2010;~~draft~~ comments received from the NDEP, dated December 2, 2010, on Revision 0 of the report, dated November 2010 (as well as ~~; and~~ discussions during a December 9, 2010, meeting between BRC and the NDEP); and discussions and comments/resolutions between BRC and the NDEP conducted subsequent to the December 2010 revision of the report regarding approaches for background comparisons for metals. The NDEP comments and BRC's response to these comments are included in Appendix A. Also included in Appendix A is a redline/strikeout version of the text showing the revisions from the December~~November~~ 2010 versions of the report. An electronic version of the entire report, as well as original format files (MS Word and MS Excel) of all text, tables, modeling, and risk calculations are included on the report compact disc (CD) in Appendix B.

## 1.1 PURPOSE OF THE RISK ASSESSMENT

The purpose of the HHRA is to evaluate the potential for adverse human health impacts that may occur as a result of potential exposures to residual concentrations of chemicals in soil, groundwater, and air following remediation, and to assess whether any additional remedial actions are necessary in order to request~~obtain~~ an NFAD from the NDEP to allow redevelopment

[2] Under this alternative, the Site could be developed in accordance with the current development plan and~~with~~ the recorded~~need for an~~ Environmental Covenant for the Site that assures~~will assure~~ appropriate management of soils beneath 10 feet bgs (post-graded), should they need to be disturbed in the future.

of the Site to proceed. The results of the risk assessment provide risk managers an understanding of the potential human health risks associated with background conditions and additional risks associated with past Site activities.[3] Pending issuance of an NFAD by the NDEP, redevelopment of the Site is expected to proceed in a manner consistent with the Recorded Environmental Covenant attached to the property.

As presented in Section 2.5 of the *Sampling and Analysis Plan for the Galleria North Sub-Area, BMI Common Areas (Eastside) Clark County, Nevada* (BRC 2008; hereinafter "SAP"; approved by the NDEP on December 12, 2008), the only remediation conducted at the Site prior to sampling in accordance with the SAP involved tamarisk and debris removal. When~~However,~~ the sampling conducted in accordance with the SAP was performed,~~identified~~ areas within the Site that warranted remediation were identified, as discussed in Section 3.3. These areas~~It is BRC's intent that media requiring mitigation will~~ have been addressed~~ prior to conducting the risk assessment. This has been accomplished~~. The overall goal of the risk assessment presented in this report, therefore, is to confirm that residual chemical concentrations are: (1) either representative of background conditions; or (2) do not pose an unacceptable risk to human health and the environment under current and potential~~anticipated~~ future land use conditions. Findings of the HHRA are intended to support the Site~~site~~ closure process.

For human health protection, BRC's goal is to remediate ~~the~~ Site soils such that they are suitable for residential uses, assuring health-~~-~~protective conditions at 1/8$^{th}$-acre exposure areas. The 1/8$^{th}$-~~-~~acre area corresponds to the size of a typical residential lot size, as presented in the U.S. Environmental Protection Agency (USEPA) guidance (~~-~~1989) and is applicable to future Site conditions. It should be noted that ~~although 1/8$^{th}$ -acre areas are the target for exposure,~~ sampling has not occurred on every 1/8$^{th}$-acre exposure area. Rather, the statistical protocol presented in the NDEP-approved *BRC Closure Plan* (BRC, ERM, and Daniel B. Stephens & Associates, Inc. [DBS&A] 2007) and *Statistical Methodology Report* (NewFields 2006) was followed, which~~many of these 1/8$^{th}$-acre exposure areas, instead assumptions of similar populations across~~

[3] The HHRA ~~human health risk assessment~~ presents incremental risks; that is, the risk in addition to background risk caused by Site contamination. Background risk is the risk to which a population is normally exposed, and does not include risks from Site contamination. Total risk includes both incremental and background risks. Because naturally-occurring constituents are typically included in a risk assessment (i.e., metals and radionuclides) the incremental risk will have some element of total risk included. However, because risks are only calculated for a sub-set of metal and radionuclides, a 'total' risk is not calculated. In instances where the incremental risk is calculated to exceed a cancer risk of $10^{-5}$ (typically when radionuclides are included in the risk assessment calculations), then a background risk, only including those naturally-occurring constituents included in the risk assessment, will also be calculated to provide context to the risk assessment results.

~~the Site (or areas larger than 1/8th -acre, as supported by the data)~~ allows estimates to be applied to 1/8th-acre exposure areas based on similar populations across the Site. The decision can hence be made simultaneously for many 1/8th-acre exposure areas based on the data and documentation that the exposure areas can be aggregated. This can result in aggregation across the entire Site if concentration distributions appear to be relatively homogeneous and representative of a single population, or within separate sub-areas of the Site if those sub-areas exhibit different distributions. Note that an assumption was made in the SAP for the Galleria North sub-area (see Section 3.4 of that document) that the concentration distribution across the entire Site is relatively homogeneous. This assumption was evaluated prior to performing the risk assessment, and was found to be valid for the Site (~~see~~ Section 6.1.1).

Project-specific risk level and remediation goals consistent with USEPA precedents and guidelines for residential uses have been established, as summarized below. It should be noted that: (1) all comparisons to risk or chemical-specific goals are made on an exposure area basis consistent with likely exposure assumptions; ~~,~~ and (2) these comparisons are demonstrated through the use of spatial statistical analysis to apply to each 1/8th-acre exposure area.

Human health risks are represented by estimated theoretical upper-bound cancer risks and non-cancer hazards derived in accordance with standard USEPA and NDEP methods. If the carcinogenic risks or non-cancer hazards exceed USEPA acceptable levels or NDEP risk goals, then remedial action alternatives must be considered. The acceptable risk levels defined by USEPA for the protection of human health, as identified in Section 9.1.1 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), are:

- Post-NFAD chemical and radionuclide concentrations in Site soils are targeted to have an associated residual, cumulative theoretical upper-bound incremental lifetime cancer risk (ILCR) level point of departure of $10^{-6}$. This is the target risk goal for the project. For cases where the NDEP identifies this goal to be unfeasible, it is BRC's understanding that the NDEP will re-evaluate the goal in accordance with USEPA (1991a) guidance ~~[USEPA 1991a])~~. In no case will the residual, cumulative theoretical upper--bound carcinogenic risk levels exceed those allowed per USEPA guidance.

- Post-NFAD chemical concentrations in Site soils are targeted to have an associated cumulative, non-carcinogenic hazard index (HI) of 1.0 or less. If the screening HI is determined to be greater than 1.0, target organ-specific HIs will be calculated for primary and secondary organs. The final risk goal will be to achieve target organ-specific non-carcinogenic HIs of less than 1.0.

- Where background levels exceed risk level goals or chemical-specific remediation goals, metal concentrations~~metals~~ and radionuclide activities~~radionuclides~~ in Site soils are targeted to have risks no greater than those associated with background conditions.

In addition to the risk goals discussed above, chemical-specific remediation goals have been established for lead and dioxins/furans. The target goal for lead is 400 milligrams per kilogram (mg/kg) for residential land use, which is a residential soil concentration identified by USEPA (based on the Integrated Exposure Uptake Biokinetic Model [IEUBK] model) as protective of a residential scenario (USEPA 2004a).

For dioxins/furans and polychlorinated biphenyl (PCB) congeners, the USEPA toxicity equivalency (TEQ) procedure, developed to describe the cumulative toxicity of these compounds, is used. This procedure involves assigning individual toxicity equivalency factors (TEFs) to the 2,3,7,8 substituted dioxin/furan and PCB congeners. TEFs are estimates of the toxicity of dioxin-like compounds relative to the toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), which is assigned a TEF of 1.0. Calculating the TEQ of a mixture involves multiplying the concentration of individual congeners by their respective TEF. One-half the detection limit is used for calculating the TEQ for individual congeners that are non-detect in a particular sample. The sum of the TEQ concentrations for the individual congeners is the TCDD TEQ concentration for the mixture. TEFs from USEPA (2000a) are used. Consistent with the Agency for Toxic Substances and Disease Registry (ATSDR) *Update to the ATSDR Policy Guideline for Dioxins and Dioxin-Like Compounds in Residential Soil* (2008a), the target goal for residential land use is the ATSDR screening value and the NDEP residential Basic Comparison Level (BCL; NDEP 2011a~~2010a~~) of 50 parts per trillion (ppt) TCDD TEQ.

## 1.2 METHODOLOGY AND REGULATORY GUIDANCE

This risk assessment follows ~~the basic~~ procedures outlined in USEPA *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual* (RAGS; USEPA 1989), and conforms to Section 9 (Risk Assessment Methodology–Human Health) of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010) which was approved by the NDEP on July 16, 2007. Various NDEP guidance documents are also relied on for the risk assessment (as referenced throughout this report). In addition, the NDEP's BCLs (NDEP 2011a~~2010a~~) are used for comparison of Site~~site~~ characterization data to provide for an initial screening evaluation, ~~to~~ assist in the evaluation of data usability, and aid in determination of extent of contamination. A full list of guidance documents consulted is provided in Section 6~~,~~ and the Reference~~s~~ section at the end of this document.

This report also relies upon methodology and information provided in the NDEP-approved *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010). The main text of the *BRC Closure Plan* provides discussions of the following elements relative to the BMI Common Areas project as a whole:

- The project history, including cleanup goals and project objective (Closure Plan Sections 1 and 2);
- The list of Site~~site~~-related chemicals (SRCs; Closure Plan Section 3);
- The conceptual site model (CSM) addressing potential contaminant sources, the nature and extent of chemical of potential concern (COPC) occurrence, and potential exposure pathways (Closure Plan Section 4; a CSM discussion specific to the Site is provided in Section 5 of this report);
- Data verification and validation procedures (Closure Plan Section 5);
- The procedures used to evaluate the usability and adequacy of data for use in the risk assessment (Closure Plan Sections 6 and 9 [2010 revision]);
- The data quality objectives (DQOs; Closure Plan Section 7[4]);
- The RAS process for the Site (Closure Plan Section 8);
- Risk assessment procedures that will be used for Site closure (Closure Plan Section 9 for human health [2010 revision] and Section 10 for ecological); and
- Data quality assessment (Closure Plan Section 5).

As discussed in this report, the risk assessment for the Site is conducted primarily using the data collected during implementation of the Site-specific SAP ~~(BRC 2008),~~ and subsequent confirmation sampling events, which have been designed to produce data representative of the conditions to which current (non-remediation workers) and~~or~~ future users would be exposed.

[4] As noted in the *BRC Closure Plan*, per discussions with the NDEP, the DQO process is addressed, on an Eastside sub-area by sub-area basis (for soils), in the respective sub-area SAPs developed for each sub-area relating to the soils cleanup. Therefore, the DQO process for the Site is presented in the SAP and is not repeated here. This DQO process was incorporated in the data usability/data adequacy evaluation for the Site data used in the risk assessment.

## 1.3 REPORT ORGANIZATION

The closure report ~~risk assessment~~ is composed of 12~~several~~ sections, as ~~that are~~ outlined below:

- ~~.~~ This section (Section 1) presents the purpose of the risk assessment~~,~~ and the methods used in this assessment.

Section 2 presents Site background ~~on the Site~~, the environmental setting for the Site, and a summary of previous investigations. Section 2 also presents the CSM for the risk assessment. This includes identification of potentially exposed populations, and the potential pathways of human exposure.

- Section 3 presents the confirmation data collected in 2009 and 2010, as well as discussions on the various remedial actions ~~that were~~ conducted at the Site.

- Section 4 presents ~~the~~ data evaluation procedures ~~used~~, including statistical analysis of background concentrations, and data usability and quality.

Section 5 presents the selection of COPCs recommended for further assessment, including comparisons of Site metals and radionuclides to background conditions.

- Section 6 presents the HHRA. This includes relevant statistical analyses, determination of representative exposure point concentrations, applicable fate and transport modeling, exposure assessment, toxicity assessment, and risk characterization.

In Section 7, the uncertainties associated with the risk assessment are discussed. ~~In each risk estimate, a degree of uncertainty is introduced as a result of the limitations of the exposure and toxicity information, the modeling approaches, and the data used to conduct the evaluation.~~

- A summary of the risk assessment results is provided in Section 8.

- The results of the analysis of potential impacts to groundwater are presented in Section 9.

- The data quality assessment for the risk assessment is presented in Section 10.

- A summary of the HHRA and Closure Report is provided in Section 11; and

- A~~, with a~~ list of references is provided in Section 12.

Smaller tables with supporting information are inserted in the text at the place of reference. The text is~~,~~ followed by the larger tables, and figures~~,~~ and appendices.

# 2.0 SITE DESCRIPTION

This section ~~Section~~ presents a description of the Site, including Site background and history, the environmental setting, and a summary of previous investigations. The area known as the "BMI Common Areas," of which the Galleria North -School Site sub-area is a part, is delineated in Appendix A of the AOC3 ~~(NDEP 2006)~~. The subject Site is near the BMI Industrial Complex, in Clark County, Nevada, approximately 13 miles southeast~~south of the city~~ of Las Vegas, within the City of Henderson (CoH) corporate limits, ~~and adjacent to and~~ northeast of the City Hall~~of Henderson~~ (Figure 1). The total extent of the Site is 44 acres. The Site is a portion of the ~~Eastside~~ sub-area within Eastside that was previously defined as the Galleria North sub-area in Section 1 and Figure 1-2 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010). The Site is ~~located~~ south of the CoH northern~~City of Henderson (City)~~ Rapid Infiltration Basins (RIBs), east of the CoH~~City~~ Water Reclamation Facility (WRF), and north of the Upper Ponds portion of Eastside. The Weston Hills residential development is approximately 600 feet east of the Site.

The Site is essentially undeveloped desert with the exception of a former effluent conveyance ditch, a portion of which traverses the western portion of the Site along the boundary shared with the City WRF. From 1942 through 1976, various plant wastewaters were discharged into this conveyance ditch (named the Beta Ditch). A segment of the Pittman Lateral pipeline passes south and adjacent to the Site. This east-west trending subsurface feature is a major water supply conduit for the Las Vegas Valley. Since 1976, when wastewater discharge to the Beta Ditch ceased, the Site has been vacant and unused.

## 2.1 SITE HISTORY

Approximately 400 of the more than 2,200 acres comprising the~~The~~ BMI Common Areas contained a network of ditches, canals, flumes, and unlined ponds that were used for the disposal of aqueous waste from the original magnesium plant and, later, other industrial plants and the adjacent municipality ~~adjacent to it~~. Effluent wastes discharged to the ponds of the BMI Common Areas from the war-time Basic Magnesium operations can be characterized as salts from the production process (chloride salts of a variety of metals and radionuclides).~~);~~ organic solids,~~;~~ and inorganic solids and dissolved components of various types. Chlorinated organic chemicals were included in the effluent. Notable processes that contributed to the waste stream from the plants that succeeded Basic Magnesium included effluents from the manufacture of the following types of products: chlorine and sodium hydroxide (caustic soda); a variety of chlorate and~~,~~ perchlorate compounds, and halogenated boron compounds; manganese dioxide; titanium

and related compounds; and a variety of pesticides. Among these wastes were salts,~~;~~ organic and inorganic chemicals,~~;~~ and metals. A more detailed description of these processes and their effluents is found in Sections 2.2 and 2.3 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010).

## 2.2 ENVIRONMENTAL SETTING

The BMI Common Areas and Complex are located in Clark County, Nevada, and are situated approximately 2~~two~~ miles west of the River Mountains and 1~~one~~ mile north of the McCullough Range. The local surface topography slopes in a westerly to northwesterly direction from the River Mountains and in a northerly to northeasterly direction from the McCullough Range. Near the BMI Common Areas and Complex, the surface topography slopes north toward the Las Vegas Wash. The ~~According to the Nevada Bureau of Mines and Geology (NBMG) *Las Vegas SE Folio Geologic Map (1977) and the Geologic Map of the Henderson Quadrangle, Nevada* (NBMG 1980), the~~ River Mountains and McCullough Range consist of volcanic rocks: dacite in the River Mountains and andesite in the McCullough Range (Umhoefer et al. 2010).

The Site (Figure 3~~2~~) comprises approximately 44 acres of undeveloped land with ~~very~~ little surface relief that is gently sloping to the northeast. The Site is currently undeveloped, except for the previously noted Beta Ditch segment along the western edge of the Site. As depicted on Figure 3~~2~~, the Site has no other features of historical use; this Site has historically been undeveloped~~ and is not known to have been associated with industrial operations at the BMI Complex~~. The native soils ~~within the ponds~~ are compacted, poorly ~~-~~sorted, non-plastic, light brown to red silty sand with varying amounts of gravel.

### 2.2.1 Site Location, Climate and Physical Attributes

The Site is in the northeastern quarter of Section 5, Township 22 South, Range 63 East Mount Diablo Base and Meridian ~~(MDBM)~~. The Site is in the Las Vegas Valley, a broad alluvial valley that occupies a structural basin in the Basin and Range Physiographic Province. The valley is about 1,550 square miles in size, and the structural and topographical axis is aligned approximately northwest to southeast. The eastern edge of the valley is about 5 ~~five~~ miles west of Lake Mead, a major multipurpose artificial reservoir on the Colorado River. The Las Vegas Valley is surrounded mostly by mountains, ranging from 2,000 to 10,000 feet higher than the valley floor. The valley floor ranges in elevation from about 3,000 feet above mean sea level (msl), in the west at the mountain front, to 1,500 feet above msl, in the east at the Wash (Clark

County GIS Management Office 2003~~Southern Nevada Water Authority 1996~~). The surrounding mountain ranges are:

- Sheep Range to the north;
- Frenchman and Sunrise Mountains to the northeast;
- River Range to the east;
- McCullough Range to the south; and
- Spring Mountains and Sierra Nevada mountain range~~Mountains~~ of California to the west.

The Site is approximately 0.7 mile south of the Las Vegas Wash (Figure 1) within the CoH corporate limits, ~~and adjacent to and~~ northeast of the City Hall~~city of Henderson~~, and approximately 13 miles southeast of the city of Las Vegas. The Site is located south of the CoH northern RIBs, east of the CoH WRF, and north of the Upper Ponds portion of Eastside. The Weston Hills residential development is located approximately 600 feet east of the Site.

The Site is situated ~~located~~ in a natural desert area, where evaporation/evapotranspiration rates are ~~very~~ high, due to ~~influence by~~ high temperatures, high winds, and low humidity. Precipitation in this area averages approximately 0.4 inch per month or 4.8 inches per year (Western Regional Climate Center~~WRCC~~ 2008). As discussed in the *Sources/Sinks and Input Parameters for Groundwater Flow Model Revised Technical Memorandum* (DBS&A 2009), in arid settings, recharge from precipitation is typically a small percentage of annual precipitation. Based on values from Scanlon *et al*. (2006), recharge as a percentage of annual precipitation for the Site area was estimated to be between 0.1 ~~percent~~ and 5 percent. Recharge is thus estimated to be between 0.0048 ~~inch~~ and 0.24 inch per year.

According to the Southern Nevada Water Authority's ~~(SNWA)~~ document entitled *Extent and Potential Use of the Shallow Aquifer and Wash Flow in Las Vegas Valley, Nevada* (1996), annual potential evapotranspiration exceeds 86 inches. Pan evaporation data measured from 1985 through 1988 were as high as 17 inches per month; the months with the highest evaporation (May through September) coincide with those months with the highest intensity of rainfall (Law Engineering 1993). However, evaporation and evapotranspiration are functions of vegetation type and density and other Site~~site~~-specific conditions (especially anthropogenic conditions). Therefore, Site~~site~~-specific evaporation/evapotranspiration may vary from these regional conditions. These climatic parameters may be appreciably influenced by future redevelopment (~~development (*i.*~~*e.*g., vegetation removal~~destruction~~, pavement extent, and construction).

Wind flow patterns are fairly consistent from one month to another, but vary slightly between measurement stations (McCarran International Airport and a station within the BMI Complex~~west of 14th Street~~ adjacent to the employee parking lot at the Titanium Metals Corporation [TIMET] plant entrance). For the McCarran station, the prevailing wind direction is from the southwest. The TIMET station also showed a predominant wind direction from the southwest, with southeasterly components. Wind velocity at both locations tends to be the highest in the spring and early summer months (April through July).

### 2.2.2 Geology/Hydrology

As is common throughout the Las Vegas Valley, Site soils are primarily sand and gravel, with occasional cobbles. This is consistent with the depositional environment of an alluvial fan. The Site is located on alluvial fan sediments, with a surface that slopes to the north-northeast at a gradient of approximately 0.02 foot per foot ~~(ft/ft)~~ towards the Las Vegas Wash. Regional drainage is generally to the east.

The uppermost strata beneath the Site consist primarily of alluvial sands and gravels derived from the River Mountains and from the volcanic source rocks in the McCullough Range, located ~~to the~~ southeast and southwest of the Site, respectively. These uppermost alluvial sediments were deposited within the last 2 ~~two~~ million years and are of Quaternary Age~~age~~, and are thus mapped and referred to as the Quaternary alluvium (Qal; Carlsen *et al*. 1991). The Qal is typically on the order of 50 feet thick at the Site with variations due, in part, to the non-uniform contact between the Qal and the underlying Tertiary Muddy Creek Formation (TMCf).

The TMCf underlies the Qal. The Muddy Creek formation, of which the TMCf is the uppermost part, is a lacustrine deposition from the Tertiary Age, and it underlies much of the Las Vegas Valley. It is more than 2,000 feet thick in places. The lithology of the TMCf underlying the Site is typically fine-grained (sandy silt and clayey silt), although layers with increased sand content are sporadically encountered. These TMCf materials have typically low permeability, with hydraulic conductivities on the order of $10^{-6}$ to $10^{-8}$ centimeters per second (Weston 1993). The TMCf in the vicinity of the Site was encountered to the maximum explored depth of 430 feet bgs. Lithologic cross sections are shown on Figures 4~~3~~ and 5~~4~~.

Two distinct, laterally continuous water-bearing zones are present within the upper 400 feet of the Site subsurface: (1) an upper, unconfined water-bearing zone primarily within the Qal referred to herein as the alluvial aquifer (Aa); and (2) a deep, confined water-bearing zone that occurs in a sandier depth interval within the silts of the deeper TMCf. Both of these water-

bearing zones contain high concentrations of total dissolved solids ~~(TDS)~~. Between these two distinct water-bearing zones, a series of saturated sand stringers was~~were~~ sporadically and unpredictably encountered during drilling.

The Aa is an unconfined, shallower, water-bearing zone that occurs across the Site. For the most part, water in the Aa occurs in the Qal. The water surface in the Aa generally follows topography, with the water surface sloping towards the Las Vegas Wash. The depth from the surface to first groundwater at the Site is approximately 25 feet bgs (~~see~~ Figure 3~~2~~). Wells completed in the Aa are not highly productive, with sustainable flows typically less than 5~~five~~ gallons per minute.

### 2.2.3 Surface Water

Surface water flow occurs for brief periods of time during periodic precipitation events. The Las Vegas Wash collects storm water, shallow groundwater, urban runoff, and treated municipal wastewater~~sewage effluent~~. It is the receiving water body for all major Las Vegas area discharges. In dry weather, flow in the Wash comprises mainly treated effluent from the Clark County Water Reclamation District ~~(76 million gallons per day)~~ and the City of Las Vegas Water Pollution Control Facility ~~(80 million gallons per day)~~. The CoH~~City of Henderson~~ contributes ~~a~~ smaller amounts. Aggregate flow is in excess of 160~~amount (8.4~~ million gallons per day~~)~~ (Las Vegas Wash Coordination Committee 2000). Discharge from these sources is sufficient to maintain surface flows in the Wash throughout the year. In winter, low-intensity rains fall over broad areas; in the spring and fall, thunderstorms provide short periods of high-intensity rainfall. The latter creates ~~create~~ high run-off conditions. Run-off is also affected by human development, which tends to (1) create conduits for surface water flow~~,~~ and (2) decrease infiltration into native soils by covering them with man-made structures or materials (*e.g.*, pavement).

Under current conditions, it is unlikely that ephemeral surface waters generated within the ~~non-pond areas of the~~ Site will migrate via overland transport to the Las Vegas Wash from the Site due to (1) the distance to the Wash (greater than 4,000 feet~~)~~~~);~~ and (2) the intervening presence of the northern RIBs between the Site and the Wash. However, the presence of the drainage ditch in the western portion of the Site suggests the current potential for rainfall to be carried from that portion of the Site to the Wash. After redevelopment, when the ditch has been removed, there will be an even lower likelihood that ephemeral surface waters generated within the Site will migrate via overland transport to the Las Vegas Wash from the Site because of the proposed design of the future ~~due to the large distance to the Wash, the intervening presence of other developed properties, and~~ storm water facilities and~~features as part of~~ the regional requirement

that nuisance flows not be discharged directly into the Las Vegas Wash unless they do so under existing conditions. (Flows from future development do not meet this criterion).

Groundwater seeps currently exist at various locations north of the BMI Common Areas near the Las Vegas Wash. No seeps currently exist within the Site. Evidence that they~~, however they may~~ have existed within the Site ~~occurred~~ in the past 70 years is equivocal. In the series of aerial photographs ~~. An evaluation of historical aerial photos~~ taken regularly over the 70-year period between 1941~~1964~~ and 2011, those from the mid- to late-1960s appear to show a dark feature that could be water. It is not possible to definitively interpret these photographs, and no photographs taken before or after this time period show the same dark feature. There is no chemical or hydrological evidence~~1970 indicates~~ that seeps ~~may~~ have existed on the Site. On the contrary, as evaluated and discussed in Section 5.2, these short-lived seeps, if present, do not appear to have affected soil chemistry~~historically appeared~~ at ~~various locations in the northern portions of~~ the Site ~~and at nearby off-site locations in association with past effluent infiltration at the Eastside ponds and with infiltration of municipal wastewater at the southern RIBs. Evidence of seeps was not observed in aerial photographs after 1972~~. The estimated locations of any hypothesized~~location of these presumed~~ historical seeps in the ~~immediate~~ Site vicinity are ~~is~~ depicted on Figure 3~~2~~.

## 2.3 SUMMARY OF HISTORICAL INVESTIGATIONS

Several historical field investigations were conducted at the Site to characterize the nature and extent of chemical occurrence in Site soils and groundwater. Based on these sampling events, BRC identified portions of the Site that warranted remediation for protection of human health and the environment,[5] and subsequently performed remediation in those areas. The SAP presents a detailed analysis of data collected during the historical field investigations conducted at the Galleria North sub-area. Of those investigations, the following sampling events included sampling within the Site boundaries:

- The BMI Common Areas Environmental Conditions Investigation (ECI) conducted during March and April 1996 (dataset 1a). The soil investigation activities were performed in accordance with a work plan approved by the NDEP in February 1996 (ERM 1996a). The soil sampling results for the investigation activities were presented in the ECI report (ERM 1996b), which was approved by the NDEP in March 1997. Data validation results are

[5] It should be noted that this determination was based on comparison of chemical detections to then-applicable human-health risk-based screening levels.

presented in the Data Validation Summary Report (DVSR) for dataset 1a (ERM 2006a), which was approved by the NDEP on September 12, 2006.~~;~~

- The BMI Exclusion Areas Characterization conducted during April and May 1996 (dataset 1b). The soil investigation activities were performed in accordance with a work plan approved by the NDEP in February 1996 (ERM 1996c). The soil sampling results for the investigation activities were presented in the Environmental~~Exclusion Areas~~ Characterization Report for the exclusion areas~~report~~ (ERM 1997). Data validation results are presented in the DVSR for dataset 1b (ERM 2006b), which was approved by the NDEP on October 10, 2006.~~;~~

- Supplemental soil investigation conducted in May/June 2001 (dataset 20c). These data were not collected under a formal NDEP-approved work plan. Data validation results are presented in the DVSRs for dataset 20c (ERM 2007), which same dataset was approved by the NDEP on February 5, 2007.~~;~~

The Site-related data from the above investigations were also presented in Appendix B of the SAP. During these investigations, soil samples at various depths were collected and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), organochlorine pesticides, organophosphorus~~organophosphorous~~ pesticides, ~~polychlorinated biphenyls (~~PCBs~~)~~, chlorinated herbicides, dioxins/furans, aldehydes, glycols/alcohols, organic acids, metals, perchlorate, radionuclides, and/or asbestos. The data from these investigations have been validated, as noted above. Data validations are presented in the respective DVSRs for each of the datasets, and all~~which~~ have been approved by the NDEP.

Previous~~Historical~~ investigations focused on the portion of the Galleria North sub-area that contained the Upper Ponds and ditches; only five of these sampling locations were within the Site boundaries. Furthermore, several of the samples collected during previous investigations ~~samples~~ were composite samples and were collected at least 9 ~~nine~~ years ago; few of the previous samples were~~have been~~ analyzed for all of the major chemicals or chemical families now mandated; ~~and~~ several analyses used different analytical methods than established in the current analytical program for the BMI Common Areas; and spatial coverage of the Site was~~is~~ incomplete. Therefore, because of these various factors, the data collected as part of the SAP in 2009 and 2010 (as discussed in Section 3) are considered more representative of current Site

conditions[6] than data collected from previous investigations,~~,~~[7] and these recent 2009/2010 data are therefore relied upon for risk assessment purposes as described in this report.

## 2.4 HISTORICAL REMEDIAL ACTIVITIES

Prior to 2009, remedial activities had not been conducted within the Site boundaries. However, in 2007, BRC conducted a broad-scale removal of tamarisk plants and debris across the Eastside property. The~~These~~ tamarisk removal efforts covered the majority of the Site (approximately 30 acres; see Figure 3~~2~~) and involved ~~the~~ removal of minimal amounts of Site~~site~~ soil incorporated in the plant roots. In March-April 2000, an interim remedial measure (IRM) was conducted in the adjacent Sunset North Commercial and Upper Ponds sub-areas. This IRM area is also shown on Figure 3~~2~~.

## 2.5 CONCEPTUAL SITE MODEL

The CSM is a tool used in risk assessment to describe relationships between chemicals and potentially exposed human receptor populations, thereby delineating the relationships between the suspected sources of chemicals identified at the Site, the mechanisms by which the chemicals might be released and transported in the environment, and the means by which the receptors could come in contact with the chemicals. The CSM provides a basis for defining DQOs, guiding Site ~~site~~ characterization, and developing exposure scenarios. The Site history, land uses, climate, physical attributes, including geology and hydrogeology, and various field investigations are ~~fully~~ described in Sections 2.1 through 2.4 of this HHRA. The ~~site~~ history and environmental conditions of the BMI Common Areas are described in Sections 2 and 4 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), and in the Sitewide ~~Wide~~ CSM (in preparation).

The HHRA evaluates current and potential future land-use conditions. The Site is currently undeveloped. The potential on-site and off-site receptors are currently trespassers, occasional on-site workers, and off-site residents. Exposures to current receptors are being managed through Site~~site~~ access control.

Under the prospective redevelopment plan, the Site will have a ~~high~~ school land use, including parking lots, buildings, streets, and recreational fields, and/or residential land use. The entire Site

[6] This determination is also based on the data usability evaluation summarized in Section 4.2.
[7] ~~This determination is also based on the data usability evaluation summarized in Section 4.2.~~

will be enhanced by restoration and redevelopment once remediation is complete. Therefore, exposures to ecological receptors will be mitigated or removed. Future receptors identified as "on-site receptors" are defined as receptors located within ~~the~~ current Site boundaries (Figure 1), while future "off-site receptors" are those located outside ~~the~~ current Site boundaries. Many potential human receptors are possible at the Site in the period during and after redevelopment. The potentially exposed populations and their potential routes of exposure are discussed in Section 2.5.3.

The current development plan for the Site is shown on Figure 6 ~~5~~ (note the high school overlay on this figure was prepared subsequent to the development plan shown). This is an example and actual features may change in the future. To construct the high school and associated features, the land will be cut and/or filled, paved with roads or foundations, and nurtured with imported top soils[8] as needed. Figure 2 ~~6~~ shows the Redevelopment Grading Plan~~current grading plan~~ for the Site, indicating which areas will be filled and which areas will be cut.

The CSM includes the planned redevelopment of the Site. All potential transfer pathways are included in the CSM. The human health aspects of the CSM for the Site are presented on Figure 7.

Numerous release mechanisms influence chemical behavior in environmental media. Under both current and future land use conditions at the Site, the principal release mechanisms involved are:

- Vertical migration in the vadose zone;
- Storm/surface water runoff into surface water and sediments;
- Fugitive dust generation and transport;
- Vapor emission and transport; and
- Uptake by plants.

[8] ~~Note:~~ Imported soil data are~~will~~ not ~~be~~ included in risk assessment calculations. However, the chemical data for fill material from a given site ~~the Site~~ may be useful for evaluating sub-areas to receive fill from that site. Because no soil will be exported from the Galleria North School Site sub-area, the Site data will not be used for this purpose.~~fill.~~

Although these release mechanisms are identified here, no quantitative modeling is presented in this section~~Section~~. Instead, those primary release mechanisms identified for particular receptors are presented in this section~~Section~~, and are quantitatively evaluated in Section 6.

### 2.5.1 Impacted Environmental Media

Environmental media at the Site consist of five categories: surface soil, subsurface soil, groundwater, indoor air, and ambient outdoor air. Samples relative to Site baseline conditions have been collected at the Site for soil. Generally, impacted soil is the source of chemical exposures for other media at the Site.

Because the background ~~general~~ water quality ~~(*i.e.*, high salt concentrations)~~ of ~~the~~ groundwater beneath the Site and in the surrounding area is generally poor (viz., high salt concentrations) and because BRC will place Environmental Covenants in the form of a deed restriction to prevent future users from utilizing groundwater beneath the Site, the use of private water wells by residents, businesses, or parks for drinking water, irrigation water, or other non-potable uses (*e.g.*, washing cars, filling swimming pools) will not occur in the post-redevelopment phase. Therefore, exposure pathways relating to this type of use are incomplete, as defined by USEPA (1989).

Although direct exposures to groundwater will not occur; indirect exposures are possible. The primary indirect exposure pathway from groundwater is the infiltration of VOCs from soil and groundwater to indoor air. In addition, residual levels of chemicals in soil may leach and impact groundwater quality beneath the Site.

### 2.5.2 Inter-Media Transfers

Exposure to Site chemicals may be direct, as in the case of impacted surface soil, or indirect following inter-media transfers. Impacted soil is the initial source for inter-media transfers at the Site, which can be primary or secondary. For example, upward migration of VOCs from impacted subsurface soil into ambient air thereby reaching a point of human inhalation represents a secondary inter-media transfer.

These inter-media transfers represent the potential migration pathways that may transport one or more chemicals to an area away from the Site where a human receptor could be exposed. Discussions of each of the identified potential transfer pathways are presented below. Figure 7 presents a conceptualized diagram of the inter-media transfers and fate and transport modeling for the Site.

Five initial transfer pathways for which chemicals can migrate from impacted soil to other media have been identified. The first of these pathways is volatilization from soil and upward migration from soil into ambient air. Ambient air can be both indoor and outdoor air. The pathway of volatilization from both soil and groundwater and upward migration into ambient air was evaluated using the surface flux measurements collected. The secondary transfer pathway is downward migration of chemicals from soil to groundwater. The third transfer pathway is migration of chemicals in surface soil via surface runoff to sediments or surface water bodies. However, as discussed in Section 2.2.3 because of the intervening City RIBs, it is unlikely that surface waters (which are ephemeral) will drain to the Las Vegas Wash from the Site. Therefore, the surface water pathway was not evaluated in this risk assessment. The fourth transfer pathway is on-site fugitive dust generation. Finally, chemicals in soil can be transferred to plants grown on the Site via uptake through the roots. The plant uptake pathway is ~~typically~~ evaluated for residential receptors.

### 2.5.3 Potential Human Exposure Scenarios

The following section summarizes land use and the human exposure scenarios that are assessed herein.

#### *2.5.3.1 Current and Future Land Use*

Current receptors that may use the Site include trespassers, occasional on-site workers, and off-site residents. Current exposures to native soils at the Site are ~~likely to be~~ minimal, but ~~. In addition,~~ exposures to future receptors will be much greater ~~than current exposures~~. For example, future receptors evaluated in the HHRA include on-site residents who are assumed to be exposed to soil at the Site for 350 days per year for 30 years, which is much greater than any current exposure scenario~~exposures~~. In addition, as discussed above, exposures to current receptors are limited~~being managed~~ through Site~~site~~ access control. Therefore, a current land use scenario is not quantitatively evaluated in this risk assessment.

USEPA risk assessment guidance (~~USEPA~~ 1989) states that potential future land use should be considered in addition to current land use when evaluating the potential for human exposure at a site~~Site~~. As indicated above, under the prospective redevelopment plan, the Site will be used for a ~~high~~ school, including parking lots, buildings, recreational fields, and streets~~. The entire Site will be enhanced by restoration~~ and/or for a residential redevelopment ~~once remediation is complete~~.

The entire Eastside property will be redeveloped in several phases. Throughout the redevelopment process, the sub-areas of the Site will be redeveloped sequentially. Future receptors identified as "on-site receptors" are defined as receptors located within the current Site boundaries (Figure 1), while future "off-site receptors" are those located outside the current Site boundaries. "On-site receptors" are those future receptors that will be located within the sub-area under evaluation. "Off-site receptors" are those future receptors that will be located outside ~~of~~ the sub-area under evaluation that may have complete exposure pathways associated with sources within the sub-area. As noted above, remediation of the Site is to on-site residential standards. Consequently, risks to off-site receptors are addressed qualitatively in this risk assessment.

*2.5.3.2 Identification of Potentially Exposed Populations and Pathways*

Many potential human receptors are possible at the Site in the period during and after redevelopment. The potentially exposed populations and their potential routes of exposure are presented on Figure 7 and summarized below. For a complete exposure pathway to exist, each of the following elements must be present (USEPA 1989):

- A source and mechanism for chemical release;
- An environmental transport medium (*i.e.*, air, water, soil);
- A point of potential human contact with the medium; and
- A route of exposure (*e.g.*, inhalation, ingestion, dermal contact).

As presented in Section 9 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), the following are the primary exposure pathways for each of the potential receptors following remediation and redevelopment at the Site.

- Adult and child residents[9]
  - Incidental~~incidental~~ soil ingestion*

[9] The Closure Plan methodology includes ~~the~~ evaluation of residential receptors, but not school receptors. However, potential residential exposures are considered more conservative, and therefore, protective and representative of any potential school receptors. For example, residential versus school exposure rates are assumed to be similar, whereas, the exposure duration for a residential receptor is 30 years (for both child [0~~zero~~ to 6~~six~~ years of age] and adult [7~~seven~~ to 30 years of age]) versus 4~~four~~ years for a high school student. Worker receptor exposures as defined in the Closure Plan are considered applicable for a school site scenario.

  - External~~external~~ exposure from soil†
  - Dermal~~dermal~~ contact with soil
  - Consumption~~consumption~~ of homegrown produce*
  - Outdoor~~outdoor~~ inhalation of dust*‡
  - Indoor~~indoor~~ inhalation of dust*‡
  - Outdoor~~outdoor~~ and indoor inhalation of VOCs from soil and groundwater

- Indoor commercial workers
  - Incidental~~incidental~~ soil ingestion*
  - External~~external~~ exposure from soil†
  - Indoor~~indoor~~ inhalation of VOCs from soil and groundwater

- Outdoor maintenance workers
  - Incidental~~incidental~~ soil ingestion*
  - External~~external~~ exposure from soil†
  - Dermal~~dermal~~ contact with soil
  - Outdoor~~outdoor~~ inhalation of dust*‡
  - Outdoor~~outdoor~~ inhalation of VOCs from soil and groundwater

- Construction workers
  - Incidental~~incidental~~ soil ingestion*
  - External~~external~~ exposure from soil†
  - Dermal~~dermal~~ contact with soil
  - Outdoor~~outdoor~~ inhalation of dust*‡
  - Outdoor~~outdoor~~ inhalation of VOCs from soil and groundwater

*Includes radionuclide exposures~~.~~
†Only radionuclide exposures~~.~~
‡Includes asbestos exposures~~.~~

Although trespassers/recreational users and downwind off-site residents are another potential receptor identified in the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), exposures for these receptors are less than those evaluated above. As noted in Sections 9.1.1 and 9.7.1 of the Closure Plan, potential exposures for trespassers/recreational users will only be evaluated in areas of the BMI Common Areas that are designated as recreational end use (specifically the Western Hook-Open Space sub-area shown on Figure 1). Also, as noted in Section 9.5.4 of the Closure Plan, off-site dust levels based on USEPA's model

are much lower than those generated for on-site, construction-related activities. Therefore, risks evaluated for an on-site construction worker, as ~~are~~ performed in this HHRA, are considered protective of off-site residents. Thus, trespassers/recreational users and downwind off-site receptors are not evaluated further in this report.

# 3.0 CONFIRMATION DATA PROCESS AND SUMMARY

Based on the historical data for the Site, no remediation was proposed prior to implementing the sampling prescribed~~presented~~ in the SAP. Decisions for excavation during SAP implementation were based on the initial data (discussed below) in accordance with the Risk Assessment Methodology provided in the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010). The following is the initial scope of work for investigating the Site and meeting the SAP objectives. Much of the discussion below regarding confirmation soil sampling is taken from the *Statistical Methodology Report* (NewFields 2006).

## 3.1 INITIAL CONFIRMATION SOIL SAMPLING

As per Section 2 of the *Statistical Methodology Report*, the initial confirmation sampling at the Site was conducted on the basis of combined random and biased (judgmental) sampling, as follows:

- **Stratified Random Locations:** For this purpose, the Site was covered by a 3-acre cell grid network. Within each 3-acre cell, a sampling location was randomly selected. Sampling locations were randomly selected within both full and partial grid cells if they were greater than 50 percent of the total grid cell area (based on the project-wide grid cell network and the Site boundaries; those partial grid cells that contain less than 50 percent of their area within the Site were included in the adjacent sub-area SAPs). The main objective of this stratified random sampling was to provide uniform coverage of the Site.

- **Biased Locations:** Additional sampling locations were selected within or near small-scale contamination points of interests, including but not limited to previous debris locations, ponds, and berms. For this purpose, the randomly selected location within a corresponding 3-acre cell was adjusted ~~in order~~ to cover a nearby point of interest. In the event that currently unknown impacted areas were identified during remediation, the presence of these areas were drawn to the NDEP's attention, ~~and~~ the need for additional biased sampling points to address those areas was evaluated, and the sampling program modified as needed.

A Site reconnaissance ~~of the Site~~ was performed in July and ~~/~~August 2008 to check ~~the Site~~ for environmentally significant features such as debris piles or stained soil. Ten debris piles were observed within the Site boundaries during the ~~site~~ reconnaissance (identified as station numbers 17 through 23, 45, 46, and 53 in Table 3 of the SAP; labeled accordingly on Figure 8 of this HHRA). Biased sampling locations were selected at each of the debris piles/soil staining

location. In some cases, random sampling locations were shifted slightly to address the debris locations. A final reconnaissance was performed prior to sampling to check for any additional environmentally significant features since the initial reconnaissance; if found, these additional features would also have been sampled. No such features were found. Biased sampling was also conducted along the length of the Beta Ditch, at approximately~~an approximate~~ 200-foot linear spacing
(six locations within the Site). Figure 8 and accompanying Table 3-1 (see Tables section) show the sampling locations ~~collected~~ within the Site. Rationale for each of the biased sampling locations is presented below:

- GNC1-JS09 through -JS11 were included to provide coverage within debris areas observed at the Site; and

- GNC1-JD07~~JD06~~ through -JD11 were included to provide coverage within the Beta Ditch.

Elevated detections of dioxins/furans/PCB congeners were reported in initial SAP samples collected from the southern~~lower~~ half of the Site. In response, an additional four biased samples (GNC1-JA04 through -JA07) were collected from the Site for dioxins/furans/PCB congener~~congeners~~ analyses in August 2009. These sampling locations were outside the boundaries of Site soil removal actions initially performed in accordance with the Removal Action Work Plan (RAWP, BRC 2009) (~~see~~ Section 3.3.1), and triggered an additional removal action at location GNC1-JA04.

The following discusses the multi-depth soil samples that were collected and analyzed for the ~~Site-related chemical (~~SRC~~)~~ list at each selected location. Samples were collected at:

1. Existing surface (0 foot~~ft~~ bgs) and 10 feet~~ft~~ bgs for sample locations in relatively flat (un-graded) locations;

2. Existing surface (0 foot~~ft~~ bgs), post-grading surface (post-redevelopment as shown on Figure 2), and post-grade 10 feet~~ft~~ bgs for sample locations with substantial grading (that is, cut depths greater than 2 ~~two~~ feet[10]) and the uppermost sampled soil is expected to be used as surface fill;

[10] Because sample collection was over a 2-~~two~~ to 3-~~three~~ foot depth interval, ~~sample~~ locations with an anticipated cut depth less than 3 ~~three~~ feet were only sampled at the surface and one post-grade subsurface depth. The sample depth designation (~~i~~*.e.*g., 10 feet bgs) is based on the center depth of the sample collection interval.

3. Existing surface (0 foot~~ft~~ bgs) and 10 feet ~~ft~~ bgs for sample locations with minimal grading (that is, cut depths less than 2 ~~two~~ feet) and the uppermost sampled soil is expected to be used as surface fill (at any Eastside location); and

4. Existing surface (0 foot~~ft~~ bgs) and 10 feet~~ft~~ bgs for sampling ~~sample~~ locations in an area expected to be covered by fill material.

Additionally, at one sampling ~~sample~~ location (GNC1-BF20), soil physical parameter data were collected at 20 feet and every subsequent 10-foot interval ~~feet~~ until groundwater was reached.

The analytical sample results were then divided into surface (0- to 2-foot ~~ft~~ depth), subsurface (2- to ~~ft~~ 10-foot ~~ft~~ depth), and deep (>10-foot ~~ft~~ depth) layers, according to the following rules:

- **Rule 1: IF** the sample was collected in a relatively flat (un-graded) part of the Site (*i.e.*, an area not targeted for substantial grading), **THEN** the depth of the collected soil sample is used to designate its soil layer grouping.

- **Rule 2: IF** the sample was collected in a part of the Site targeted for substantial grading, **AND** the sampled soil is located in an area expected to be covered by fill material (*e.g.*, exposed excavated surfaces of ponds), **THEN** the current surface soil sample is classified as a surface (0- to 2-foot ~~ft~~ depth) sample, and the soil layer grouping of the remaining deeper sampled soil is determined based on the difference between its elevation and the final (post-graded) surface elevation in that part of the Site.

- **Rule 3: IF** the sample is collected in a part of the Site targeted for substantial grading, **AND** the cut depth is expected to be greater than 2 feet, **AND** the sampled soil is expected to be used as surface fill (*e.g.*, soil within a berm)~~) **AND** the cut depth is expected to be greater than two feet~~, **THEN** the current surface soil sample is classified as a fill material sample, a final (post-graded) surface sample is classified as a surface (0- to 2-foot ~~ft~~ depth) sample, and the soil layer grouping of the remaining deeper sampled soil is determined based on the difference between its elevation and the final (post-development, graded) surface elevation in that part of the Site.

- **Rule 4: IF** the sample is collected in a part of the Site targeted for substantial grading, **AND** the cut depth is expected to be less than 2 feet, **AND** the sampled soil is expected to be used as surface fill (*e.g.*, soil within a berm)~~) **AND** the cut depth is expected to be less than two feet~~, **THEN** the current surface soil sample is classified as both a fill material sample and as a surface (0- to 2-foot ~~ft~~ depth) sample, and the soil layer grouping of the remaining deeper

sampled soil is determined based on the difference between its elevation and the final (post-graded) surface elevation in that part of the Site.

A schematic example of these rules is shown on Figure 9. The Redevelopment Grading Plan for the ~~current~~ Site ~~grading plan~~ is shown on Figure 2.[11]~~6. It should be noted that this is the most current plan available, but not necessarily the final grading plan.~~ The sample-specific collection depths are presented in Table 3-1 (Tables section).

As noted above, soil samples were generally collected over a 2- to 3-foot depth interval. This was because of volume of soil required for completion of all analyses. The 10 feet bgs (and deeper) samples were collected in 2- to 3-foot intervals centered on 10 feet (or centered on the deeper sampling depth as indicated in Table 3-1). Confirmation samples, which usually have a shortened analyte list, were collected over a smaller sampling interval. Contamination by the historical manufacturing processes upgradient is usually found predominantly in surface soils. The objective of remedial actions at the Site was to remove surface soils that were impacted by surface releases of off-site chemicals. Therefore, higher concentrations are expected – and have been generally observed – in surface samples. However, to adequately characterize the vertical extent of possible contamination, one or more deeper samples were also collected at each sampling location, as described above.

~~.~~As discussed in Section 6.1.1, given the potential for change to the prospective~~uncertainties in the current~~ grading plan, these samples were classified into two different exposure depths~~:~~, surface and all (surface and subsurface) depths. These different soil exposure depth classifications are considered to represent all possible exposure potential for all receptors, and thus a reasonable worst-~~-~~case scenario has been assessed.

Although some samples are designated as Fill samples, the grading across the Site ~~site~~ is anticipated to be primarily shallow grading with limited 'cut' areas. The separate evaluation of fill data ~~separately~~ is done primarily to determine if~~whether~~ fill material from a particular sub-area can be used elsewhere. Given~~However, given~~ the limited amount of cut areas across the Site~~site~~, the few samples designated as 'Fill,'~~;~~ that more fill areas exist than cut areas, and that the limited amount of fill material will likely be used with the Site, the separate evaluation of the fill data ~~separately~~ was not conducted for the Site.

[11] Note that the grading plan is reflected in an Environmental Covenant for the Site as a condition to receiving an NFAD from NDEP.

Initial sampling for the Site was conducted in January and ~~/~~February 2009~~; as previously noted~~. All soil samples were tagged in the database with numeric designations of their corresponding assigned soil layer grouping based on the ~~these~~ rules presented above. During these initial sampling events (Table 3-1), 51~~53~~ soil samples were collected from 23~~24~~ locations (including field duplicates, but not including deep samples collected for soil physical parameter data).[12] This included 15 "random"[13] and eight ~~nine~~ "biased" sample locations. At these locations, BRC initially collected 28~~29~~ surface samples (one at each location, and duplicates at five locations in accordance with the duplicate frequency specified in the *BRC Quality Assurance Project Plan* (QAPP; BRC~~)~~ and ERM 2009a) and 23~~24~~ subsurface soil samples. Three of the surface soil samples also represent Fill samples ~~(see discussion above regarding fill samples)~~. All sampling~~sample~~ results are presented electronically on the report CD in Appendix B, and in Tables B-1 through B-12.

## 3.2 CHEMICALS SELECTED FOR ANALYSIS

The analyte list for soil samples collected during the initial 2009 investigation comprised the BRC project SRC list, and was consistent with the analytical program presented in Section 3 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010)[14] and Table 3-2 (Tables section), with the following exceptions for this Site:

- Asbestos and dioxins/furans were only analyzed for in surface soil samples.[15]
- USEPA Method 8141A for organophosphorus pesticides was not conducted. There have been only 47 detections of these compounds in over 10,000 soil sample records (<0.5 percent) from throughout the Eastside, and no detections in any soil sample records associated with prior sampling within the Site. The few detections are well below the NDEP BCLs.

[12] Note that in Table 3-4, which summarizes the analyses performed on Site samples, the number of samples reported in that table for a given analysis does not always equal 51~~.53.~~ This is due to (1) inclusion in the final dataset of supplemental samples collected to assess the extent of chemical impacts in certain areas; (2) certain analytes were not included in the subsurface samples, as noted in the following section; and (3) rejected data are not included in the statistical summary in Table 3-4.

[13] As noted before, in some cases, random sampling locations were shifted slightly to address debris locations.

[14] Specific analytes and analyte-specific reporting limits for each analysis are listed in Table 4 of the QAPP.

[15] Note that all samples collected at the Site were discrete samples, with the exception of asbestos samples, which were composite samples collected as per the NDEP-approved Standard Operating Procedure [SOP]-12 as provided in the *Field Sampling and Standard Operating Procedures* [FSSOP; BRC, ERM and MWH 2009]).

- USEPA Method 8151A for chlorinated herbicides was not conducted. There have been no detections of these compounds in over 1,400 soil sample records from throughout the Eastside. Detection limits are below the NDEP BCLs.

- HPLC Method for organic acids was not conducted. There have been only three detections of these compounds in 567 soil sample records (<0.5 percent) from throughout the Eastside. Moreover, the NDEP has not established BCLs for these compounds.

- USEPA Method 8015B for non-halogenated organics (e.g., methanol and glycols) was not conducted. There have been only five detections of these compounds in 420 soil sample records (1 percent) from throughout the Eastside. The few detections have been well below the NDEP BCLs.

- USEPA Method 8015 for total petroleum hydrocarbons (TPH) was not conducted. There have been only three detections of these compounds in over 299 soil sample records (1 percent) from throughout the Eastside. The few detections have been below 100 mg/kg, which is the typical low-end aesthetic threshold used for these compounds There are no indications of possible TPH source areas (e.g., abandoned vehicles, dumping of oils/hydraulic fluids) at the Site. While TPH was not analyzed for, its components were via other methods. In addition, TPH cannot be included in a risk assessment while its components can.

~~The analyte list for soil samples collected during the initial 2009 investigation comprised the BRC project SRC list, and was consistent with the analytical program presented in Section 3 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010)[16] and Table 2, with the following exceptions for this Site:~~

- ~~Asbestos, dioxins/furans and PCBs were only analyzed for in surface soil samples (note that all samples collected at the Site were discrete samples, with the exception of asbestos which were composite samples collected as per the NDEP-approved Standard Operating Procedure [SOP]-12 as provided in the *Field Sampling and Standard Operating Procedures* [FSSOP; BRC, ERM and MWH 2009]).~~

- ~~Only acetaldehyde and formaldehyde were analyzed for by USEPA Method 8315A (chloroacetaldehyde, dichloroacetaldehyde, and trichloroacetaldehyde removed based on the~~

[16] ~~Specific analytes and analyte-specific reporting limits for each analysis are listed in Table 4 of the QAPP.~~

*Revisions to the Analyte List Technical Memorandum* approved by NDEP on October 16, 2008);

- The following metals were not analyzed for: niobium, palladium, platinum, silicon, sulfur, and zirconium (removed based on the *Revisions to the Analyte List Technical Memorandum* approved by NDEP on October 16, 2008);
- As specified in the SAP, Aroclors were only analyzed by USEPA Method 8082 in samples in which the results of the analysis of total PCB congeners were greater than 33 ppb (only one sample met this criterion: GSNC1-BE22);
- USEPA Method 8141A for organophosphorous pesticides was not conducted due to limited detections in historical data;
- USEPA Method 8151A for chlorinated herbicides was not conducted due to limited detections in historical data;
- HPLC Method for organic acids was not conducted due to limited detections in historical data;
- USEPA Method 8015B for nonhalogenated organics was not conducted due to limited detections in historical data;
- USEPA Method 8015 for total petroleum hydrocarbons (TPH) was not conducted due to limited detections in historical data. While TPH was not included in the analytical suite, its components are via other methods. In addition, TPH cannot be included in a risk assessment while its components can; and
- Consistent with the current project analyte list, the following radionuclides were analyzed for: radium-226, radium-228, thorium-228, thorium-230, thorium-232, uranium-233/234, uranium-235/236, and uranium-238.

The soil analyte list consisted of 280307 of the 418 compounds (including water- only parameters) on the project SRC list, as well as physical parameters to support the evaluation of potential impacts to groundwater from migration of chemicals from soil. The analytical and preparatory methods (Table 3-see Table 2) used in accordance with the SAP adhered to the most recent version of the *BRC Quality Assurance Project Plan* (QAPP (; BRC and ERM 2009a; [see Section B4, Table 4 of that document]). As noted in Section 3Section 3.6, the analyte list for

surface flux samples was composed~~comprised~~ of the list specified in the NDEP-approved Standard Operating Procedure (SOP)-16, ~~(~~as provided in the *Field Sampling and Standard Operating Procedures* (FSSOP; ~~[~~BRC, ERM and MWH 2009~~]~~). Surface flux samples were analyzed for VOCs by ~~full~~ USEPA Method TO-15 full scan, plus selective ion mode (SIM) analyses for a subset of the analytes.

## 3.3 INTERMEDIATE SAMPLING AND CLEANUP

### 3.3.1 2009 Removal Action

All initial data were reviewed and a determination made, in consultation with the NDEP, as to whether localized soil removals were warranted. In September 2009, BRC submitted a RAWP (BRC 2009) to the NDEP. This RAWP was approved by the NDEP on September 22, 2009. The overall goal of the RAWP was to present a cleanup strategy for the Site that effectively minimized~~reduces~~, to the extent feasible, the human health risks associated with the identified soil in the impacted areas of the Site.

There were four different remediation areas proposed for the Site: two ditch locations (which contained elevated SVOCs, polynuclear aromatic hydrocarbons (PAHs), and/or dioxins/furans/PCB congeners) and two non-ditch areas (which contained elevated metals and/or dioxins/furans/PCB congeners). Remediation was proposed by excavation and removal of impacted soils to the CAMU. The extent of the excavations is depicted in Figure 10.

The non-ditch remediation areas were developed based on a Thiessen map overlaid across the Site. Thiessen maps are constructed from a series of polygons formed around each sampling~~sample~~ location. Thiessen polygons are created so that every location within a polygon is closer to the sampling~~sample~~ location in that polygon than any other sampling~~sample~~ location. These polygons do not take into account the respective concentrations at each ~~sample~~ location. These polygons were used as the basis for the areal extent of remediation for each of the non-ditch locations with elevated dioxins/furans/PCB congeners or metals levels. There were two polygons associated with elevated chemical levels that were remediated at the Site. These polygons were centered around (1) locations GNC1-BE20/GNC1-JS09/GNC1~~1~~-JS10~~;~~ and (2) GNC1-BE22. In August 2009, four supplemental samples (GNC1-JA04 through JA07) were collected from ~~in~~ the southern half of the Site and analyzed for dioxins/furans/PCB congeners to provide further delineation of the extent of elevated levels detected in this area.

For the ditch locations, the remediation area was centered about the initial sampling locations that triggered remediation (GNC1-JD07 for dioxins/furans/PCB congeners~~,~~ and GNC1-JD09 for PAHs and SVOCs). The extent of excavation at both of these areas w~~) defined~~ as a 50-foot-wide~~ditch~~ segment of the ditch, ~~to a width of 50 feet, which~~ extended such that the limits of excavation reached ~~to~~ half the distance to the adjacent ditch samples to the north and south.

Following remediation, confirmation surface soil samples were collected at each of the original sample locations associated with the remediation area polygons and ditch segments described above (*i.e.*, GNC2-BE20C, GNC2-BE22C, GNC2-JS09C, GNC2-JS10C, GNC2-JD07C, and GNC2-JD09C[17]). All sampling~~sample~~ locations are shown on Figure 11. The analyte list was composed of those chemicals that triggered the remediation at each sampling~~sample~~ location. These included dioxins/furans/PCB congeners, metals, SVOCs, and PAHs.

### 3.3.2 2010 Removal Action

Following the review of data collected from the 2009 remedial~~removal~~ action, four additional remediation areas were identified for the Site (Figure 10). These ~~remediation~~ areas were part of a larger remediation plan for the northern portion of the entire Eastside property. BRC did not submit a formal work plan to the NDEP for conducting remediation at these areas, but discussed the planned excavations with the NDEP in June 2010. The rationale for each additional remediation area is reiterated~~presented~~ below.

- ~~Original sample location GNC1-JD06; Arsenic concentration (9.6 mg/kg) associated with this location was higher than background and the highest found at the Site. Therefore, in 2010, additional remediation and confirmation sampling was conducted at this location. This remediation area was defined using the Thiessen polygon method described above. One confirmation sample was collected from this location (GNC2-JD06).~~

- Supplemental sampling ~~sample~~ location GNC1-JA04; this sample was collected during the first phase of excavation to assess the extent of dioxins/furans/PCB congeners occurrence in the vicinity of the GNC1-BE20/GNC1-JS09/GNC1-JS10 polygon. The detection of dioxins/furans/PCB congeners at TEQ levels above the 50 ppt threshold~~pg/g~~ triggered additional remediation in this area. The remediation area was based on a 50- by 50-foot

[17] The naming convention for confirmation samples uses the same sample identification as the initial (pre-remediation) sample, with an updated numerical prefix. For example, confirmation samples associated with GNC1-JD09 are named GNC2-JD09 (after one round of confirmation sampling) or GNC3-JD09 (after a second scrape and round of confirmation sampling).

square area around this sampling~~sample~~ location. One confirmation sample and a duplicate were collected from this location (GNC2-JA04). In addition, supplemental samples GNC2-JE01 and -JE02 were collected from the~~in the general~~ vicinity in April 2010; these two samples were analyzed for dioxins/furans/PCB congeners to provide further delineation of the extent of elevated levels detected in this area. These two samples did not trigger additional excavation.

- Subsequent to the 2009 remedial~~removal~~ action, issues regarding the counting rules for asbestos were identified. Based on these issues, the initial asbestos results were re-evaluated. This re-evaluation led to the decision to remediate additional surface areas based on asbestos for sampling~~sample~~ locations GNC2-BE20C, GNC2-JS09C, and GNC1-JD10. These remediation areas were defined using the Thiessen polygon method. Three confirmation samples were collected from these locations (GNC3-BE20, GNC3-JS09C, and GNC2-JD10).

As before, the analyte list was composed of those chemicals that triggered the remediation at each sampling~~sample~~ location. These included metals, dioxins/furans/PCB congeners, and/or asbestos.

## 3.4 FINAL CONFIRMATION DATASET

Post-scrape analyses associated with follow-up rounds of remediation focused on the constituents triggering that additional remediation and, therefore, did not include the full suite analyses of the original analytical program. Analytical results from the original SAP dataset were retained for all constituents except those that were re-analyzed after additional scraping. The final confirmation dataset included the following sampling results:

- SAP sampling data, retaining ~~only~~ the results that were not superseded by subsequent sampling~~. [Note: Post-scrape analyses associated with follow-up rounds of remediation focused on the constituents triggering that additional remediation, and did not include the full suite analyses of the original analytical program. Therefore, analytical results from the original SAP dataset were retained for all constituents except those that were re-analyzed after additional scraping]~~;

- Data generated after intermediate sampling and remediation~~cleanup~~ (retaining ~~only~~ the results that were not superseded by subsequent sampling); and

- Additional samples collected for confirmation after completion of remediation activities.

The soil dataset was subjected to a series of statistical analyses ~~in order~~ to determine representative exposure concentrations for the sub-area, as described in Sections 4 and 5 of the NDEP-approved *Statistical Methodology Report* (NewFields 2006). Consistent with the project *Statistical Methodology Report* ~~(NewFields 2006)~~, kriging or geostatistical analysis was not performed on the data because each measurement was assumed to be equally representative for that chemical at any point in each sub-area of the Eastside property. Hence, calculation of the 95 percent upper confidence limit (UCL) by exposure area directly from the data is considered reasonable.

As discussed in Section 4, all data have been validated. Results of all confirmation sampling and analysis are presented in Appendix B, and electronically on the report CD in Appendix B, as is the dataset used in the HHRA for the Site. All confirmation sampling~~sample~~ locations for the Site are shown on Figure 11. Table 3-3 provides a matrix of which analytical suite was analyzed for in each of the samples collected from~~at~~ the Site. Geotechnical and Environmental Services (GES) conducted all field work at the Site. The GES field reports, including boring logs, for each investigation are provided electronically in Appendix ~~Appendix~~ C (included on the report CD in Appendix B).

## 3.5 FINAL CONFIRMATION DATA SUMMARY

Using the compound-specific information presented in Table 2 of the QAPP (BRC and ERM 2009a), the comparison levels for each chemical included in the investigation were compiled for comparison to Site data~~and compared~~. Specific soil comparison levels used for this effort were as follows:

- NDEP BCLs for residential soil (NDEP 2011a~~2010a~~);
- NDEP BCLs for protection of groundwater (LBCL), assuming dilution attenuation factors (DAF) of 1 and 20 (NDEP 2011a~~2010a~~); and
- The maximum background concentration (for metals and radionuclides only), derived from the background soil dataset ~~for the BMI Common Areas~~ presented in Chapter 5.[18]

[18] This value is used for comparison only; as discussed in Section 5.1, background comparisons were performed for the Site dataset using statistical tests.

- ~~*Background Soil Compilation Report – BMI Complex and Common Areas, Clark County, Nevada* (ERM, April 2010); the specific dataset used was the 2003 and 2005 shallow McCullough soils.~~

A DAF of 1~~one~~ is used when little or no dilution or attenuation of soil leachate concentrations is expected, and a DAF of 20 may be used when significant attenuation of the leachate is expected due to Site~~site~~-specific conditions. For the Site, the LBCLs based on a DAF of 1 were used for discussion purposes. Data~~A summary of the data~~ for the Site, including the ~~identification of~~ number of instances in which ~~that~~ chemical concentrations exceed each of the comparison levels, are listed in Table 3-4,[19] and .[20] ~~The constituents with exceedances of the screening criteria are~~ summarized below. It is important to note that these comparisons are used to provide for an initial screening evaluation, ~~to~~ assist in the evaluation of data usability, and determine the~~determination of~~ extent of contamination. They are not used for decision--making purposes~~,~~ or as an indication of the risks associated with the Site.

*Aluminum*

Aluminum was detected in all 53~~55~~ of the ~~Site~~ soil samples in which it was analyzed for (30~~(31~~ surface and 23~~24~~ subsurface samples; Table B-4). All of the detections were lower than the 77,200 mg/kg BCL, but were higher than the 75 mg/kg $LBCL_{DAF1}$. However, none exceeded the 15,300 mg/kg maximum background concentration.

*Arsenic*

Arsenic was detected in 51 ~~53~~ of the 53 ~~Site~~ soil samples in which it was analyzed for (30~~(55 samples, 31~~ surface and 23~~24~~ subsurface samples; Table B-4). All of the detections were higher than the 0.39 mg/kg BCL and the 1 mg/kg $LBCL_{DAF1}$. However, all of the ~~Of these 53~~ detections~~, only the following four~~ were lower than the ~~in excess of the~~ maximum shallow soil background level (27.6~~7.2~~ mg/kg)~~.~~~~):~~

| ~~Sample ID~~ | ~~Depth~~ | ~~Reported Arsenic~~ |
|---|---|---|

[19] Pre-scrape data for the target constituents are not included in Table 3-4. That is, these have been replaced by post-scrape data; however, pre-scrape data for the non-target constituents are included in Table 3-4. Because of this, the total number of analyses does not always coincide with the total number of analyses reported in the tables in Appendix B, which include all data, regardless of status.

~~[20] Pre-scrape data for the target constituents are not included in Table 4, that is, these have been replaced by post-scrape data; however, pre-scrape data for the non-target constituents are included in Table 4. Because of this, the total number of analyses does not always coincide with the total number of analyses reported in the tables in Appendix B, which include all data, regardless of status.~~

| | (ft bgs) | Value (mg/kg) |
|---|---|---|
| GNC1-JD10 | 0 | 7.4 |
| GNC1-JD06 | 10 | 7.7 |
| GNC1-BE20 | 10 | 7.8 |
| GNC1-JS10 | 10 | 8.8 |

In addition, arsenic was reported as a non-detection in two samples (surface soil confirmation samples GNC2-JA04 and a duplicate); the associated analytical reporting limits (5 mg/kg and 5.1 1 mg/kg, respectively) are higher than the comparisonscreening levels and it is not known whether arsenic is present at concentrations above the comparisonscreening levels at this location. However, these analytical reporting limits were sufficiently low to indicate that neither sample contained arsenic at concentrations above background.

*Barium*

Barium was detected in all 5355 of the Site soil samples in which it was analyzed for (3031 surface and 2324 subsurface samples; Table B-4). None of the detections were higher than the 15,300 mg/kg BCL, but all of the barium detections exceeded the 82 mg/kg $LBCL_{DAF1}$. However, none of the detections exceeded the maximum background concentration of 836 mg/kg.

*Boron*

Boron was detected in seven of the 53Site soil samples in which it was analyzed for (3055 samples, 31 surface and 2324 subsurface samples; Table B-4). None of the detections were higher than the 15,600 mg/kg BCL; however, two of the detections were higher than the 23.4 mg/kg $LBCL_{DAF1}$. These two detections (maximum detection 47.1 mg/kg in the surface soil sample from GNC1-BE19) , which were loweralso higher than the maximum shallow soil background level (5711.6 mg/kg). ), are as follows:

| Most<br><br>Sample ID | Depth (ft bgs) | Reported Boron Value (mg/kg) |
|---|---|---|
| GNC1-BE21 | 0 | 38.9 J |
| GNC1-BE19 | 0 | 47.1 J |

The majority of the analytical reporting limits were lower than the boronsufficiently low such that BCL andor $LBCL_{DAF1}$ exceedances would have been observed. The five boron non-detections with reporting limits above the 23.4 mg/kg $LBCL_{DAF1}$ (ranging from 51.3 to 53 mg/kg) are associated with confirmation samples (GNC2-BE20C, GNC2--JS09C, and GNC2--

JS10C) for locations at which the boron BCL and $LBCL_{DAF1}$ were not exceeded in the original sample.

*Cadmium*

Cadmium was detected in 39~~40~~ of the 53~~Site~~ soil samples in which it was analyzed for (30~~(55 samples, 31~~ surface and 23~~24~~ subsurface samples; Table B-4). None of the detections were higher than the 38.9 ~~9~~ mg/kg BCL; however, one of the detections was higher than the 0.4 mg/kg $LBCL_{DAF1}$. This detection, which was also higher than the maximum shallow soil background level (0.26~~16~~ mg/kg), was a surface soil sample collected from GNC1-BE22 (0.44 mg/kg). The analytical reporting limits for non-detections were lower than the~~sufficiently low such that~~ BCL and~~or~~ $LBCL_{DAF1}$. ~~exceedances would have been observed.~~

*Cyanide*

Cyanide was detected in 10~~12~~ of the 51~~Site~~ soil samples in which it was analyzed for[21] (28~~(53 samples, 29~~ surface and 23~~24~~ subsurface samples; Table B-3). None of the detections were higher than the 1,220 mg/kg BCL; however, one of the detections was higher than the 2 mg/kg $LBCL_{DAF1}$. This detection was a surface soil sample collected from GNC1-BF19 (5.8 mg/kg). The analytical reporting limits for non-detections were sufficiently low such that BCL or $LBCL_{DAF1}$ exceedances would have been observed.

*Total Chromium*

Total chromium was detected in all 53~~55~~ of the ~~Site~~ soil samples in which it was analyzed for (30~~(31~~ surface and 23 ~~24~~ subsurface samples; Table B-4). None of the detections were higher than the 100,000 mg/kg BCL, but all ~~of the~~ total chromium detections were higher than the 2 mg/kg $LBCL_{DAF1}$. Of these, three ~~23~~ detections were higher than the 24.2~~16.7~~ mg/kg maximum background detection. These three ~~23~~ total chromium exceedances higher than background are as follows:

- GNC1-BF21 at 0 foot bgs: 24.8 mg/kg;
- GNC1-JD10 at 0 foot bgs: 31.2 mg/kg; and

[21] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. Cyanide analysis was only performed for initial SAP samples (i.e., was not included in the analyses for confirmation samples); thus the tally of cyanide analyses is lower than for some of the other analytical suites, such as metals.

- GNC1-BE22 at 0 foot bgs: 62.8 mg/kg.

| ~~Sample ID~~ | ~~Depth (ft bgs)~~ | ~~Reported Chromium Value (mg/kg)~~ |
|---|---|---|
| ~~GNC1-BF20~~ | ~~0~~ | ~~17~~ |
| ~~GNC1-BG22~~ | ~~0~~ | ~~17.1~~ |
| ~~GNC1-BG21~~ | ~~10~~ | ~~17.1~~ |
| ~~GNC1-BD21~~ | ~~0~~ | ~~17.3~~ |
| ~~GNC1-JD10~~ | ~~11~~ | ~~17.4~~ |
| ~~GNC1-JS11~~ | ~~0~~ | ~~18.1~~ |
| ~~GNC2-JD06~~ | ~~0~~ | ~~18.3~~ |
| ~~GNC1-BE20~~ | ~~10~~ | ~~18.3~~ |
| ~~GNC1-JD11~~ | ~~0~~ | ~~18.6~~ |
| ~~GNC1-BG19~~ | ~~10~~ | ~~18.7~~ |
| ~~GNC1-BF20~~ | ~~10~~ | ~~19.3~~ |
| ~~GNC1-BE19~~ | ~~0~~ | ~~19.4~~ |

| ~~Sample ID~~ | ~~Depth (ft bgs)~~ | ~~Reported Chromium Value (mg/kg)~~ |
|---|---|---|
| ~~GNC1-JS11~~ | ~~0~~ | ~~19.4~~ |
| ~~GNC1-BG19~~ | ~~0~~ | ~~19.9~~ |
| ~~GNC1-BG20~~ | ~~0~~ | ~~20.7~~ |
| ~~GNC2-JA04~~ | ~~0~~ | ~~20.9~~ |
| ~~GNC1-BG21~~ | ~~0~~ | ~~22~~ |
| ~~GNC1-BG22~~ | ~~10~~ | ~~23~~ |
| ~~GNC2-JA04~~ | ~~0~~ | ~~23.1~~ |
| ~~GNC1-BG20~~ | ~~0~~ | ~~23.4~~ |
| ~~GNC1-BF21~~ | ~~0~~ | ~~24.8~~ |
| ~~GNC1-JD10~~ | ~~0~~ | ~~31.2~~ |
| ~~GNC1-BE22~~ | ~~0~~ | ~~62.8~~ |
| | | |

*Iron*

Iron was detected in all 53~~55~~ of the ~~Site~~ soil samples in which it was analyzed for (30~~(31~~ surface and 23 ~~24~~ subsurface samples; Table B-4). None of the detections were higher than the 54,800 mg/kg BCL, but all ~~of the~~ detections were higher than the 7.56 mg/kg $LBCL_{DAF1}$. Of these, three~~19~~ detections were higher than the 22,500~~19,700~~ mg/kg maximum background detection. These three~~19~~ iron exceedances higher than background are as follows:

- GNC2-JA04 at 0 foot bgs: 25,600 mg/kg;
- GNC1-BE22 at 0 foot bgs: 26,900 mg/kg; and
- GNC2-JA04 at 0 foot bgs: 27,300 mg/kg.

| ~~Sample ID~~ | ~~Depth (ft bgs)~~ | ~~Reported Iron Value (mg/kg)~~ |
|---|---|---|
| ~~GNC1-BE19~~ | ~~10~~ | ~~19800~~ |
| ~~GNC1-JS11~~ | ~~10~~ | ~~19800~~ |
| ~~GNC1-BG19~~ | ~~0~~ | ~~19800~~ |
| ~~GNC1-JD10~~ | ~~11~~ | ~~19800~~ |
| ~~GNC1-JD11~~ | ~~0~~ | ~~20000~~ |
| ~~GNC1-JD07~~ | ~~10~~ | ~~20500~~ |
| ~~GNC1-JD10~~ | ~~0~~ | ~~20500~~ |
| ~~GNC1-JD09~~ | ~~10~~ | ~~21200~~ |
| ~~GNC1-BG20~~ | ~~0~~ | ~~21200~~ |
| ~~GNC2-JS09C~~ | ~~0~~ | ~~21200~~ |

| ~~Sample ID~~ | ~~Depth (ft bgs)~~ | ~~Reported Iron Value (mg/kg)~~ |
|---|---|---|
| ~~GNC1-JD11~~ | ~~11~~ | ~~21300~~ |
| ~~GNC1-BF19~~ | ~~11~~ | ~~21400~~ |
| ~~GNC1-BG22~~ | ~~10~~ | ~~21400~~ |
| ~~GNC1-BG19~~ | ~~10~~ | ~~21700~~ |
| ~~GNC1-BF21~~ | ~~0~~ | ~~21800~~ |
| ~~GNC2-JD06~~ | ~~0~~ | ~~21900~~ |
| ~~GNC2-JA04~~ | ~~0~~ | ~~25600~~ |
| ~~GNC1-BE22~~ | ~~0~~ | ~~26900~~ |
| ~~GNC2-JA04~~ | ~~0~~ | ~~27300~~ |
| | | |

*Magnesium*

Magnesium was detected in all 53~~55~~ of the ~~Site~~ soil samples in which it was analyzed for (30~~(31~~ surface and 23~~24~~ subsurface samples; Table B-4). None of the detections were higher than the 100,000 ~~000~~ mg/kg BCL, but all ~~of the~~ detections were higher than the 649 mg/kg $LBCL_{DAF1}$. However, all but one of the magnesium detections were lower than the 17,500 mg/kg maximum background detection. That exceedance (28,500 mg/kg) was associated with a soil sample collected from 11 feet bgs at GNC1-BF19.

*Manganese*

Manganese was detected in all 53~~55~~ of the ~~Site~~ soil samples in which it was analyzed for (30~~(31~~ surface and 23~~24~~ subsurface samples; Table B-4). Of these detections, none were higher than the 1,820 ~~080~~ mg/kg BCL; however, all ~~of the~~ detections were higher than the 3.26 mg/kg $LBCL_{DAF1}$. All of the manganese detections were lower than the maximum background concentration for manganese (2,070~~1,090~~ mg/kg).

*Mercury*

Mercury was detected in 16~~17~~ of the 53~~55 Site~~ soil samples in which it was analyzed for (30~~(31~~ surface and 23 ~~24~~ subsurface samples; Table B-4). None of the detections were higher than the 23~~12~~.5 ~~5~~ mg/kg BCL. However, one detection (0.122 mg/kg) was higher than the 0.105 mg/kg $LBCL_{DAF1}$ (surface soil sample collected at GNC2-BE20C). This detection was also higher than the 0.11 ~~11~~ mg/kg maximum background detection. The exceedance was associated with a duplicate sample; the original sample detection (0.0614 mg/kg) was lower than the $LBCL_{DAF1}$ and was within the background range. The analytical reporting limits for non-detections were lower than the~~sufficiently low such that~~ BCL and~~or~~ $LBCL_{DAF1}$ ~~exceedances would have been observed~~.

*Nickel*

Nickel was detected in all 53~~55~~ of the ~~Site~~ soil samples in which it was analyzed for (30 ~~(31~~ surface and 23 ~~24~~ subsurface samples; Table B-4). None of these detections exceeded ~~exceeded~~ the 1,540 mg/kg BCL, but all were higher than the 7 mg/kg $LBCL_{DAF1}$. However, all of the detections were lower than the maximum background concentration for nickel (30 mg/kg).

*Selenium*

Selenium was detected in one of the 53~~55 Site~~ soil samples in which it was analyzed for (30 ~~(31~~ surface and 23 ~~24~~ subsurface samples; Table B-4). That detection (0.47 mg/kg in a soil sample collected from 11 feet bgs at GNC1-JD11) was lower than the 391 mg/kg BCL, but it was higher than the 0.3 ~~3~~ mg/kg $LBCL_{DAF1}$. However, this detection was lower than the 0.6 mg/kg maximum background detection. The analytical reporting limits for the non-detections (0.4 mg/kg standard reporting limit) were lower than the~~adequately low for detections of~~ BCL ~~exceedances~~; however, they were higher than the $LBCL_{DAF1}$, such that exceedances would not necessarily have been observed.

*Other Inorganics*

As seen in Table 3-4 (Tables section) and Tables B-3 and B-4 in Appendix B, several inorganic constituents in addition to those listed above were routinely detected in soil samples. None of these additional inorganic constituents were detected at concentrations in excess of either the BCL or the $LBCL_{DAF1}$. In all cases, except as noted below, the analytical~~The~~ reporting limits for these additional inorganic constituents were lower than~~generally sufficiently low such that concentrations in excess of~~ the BCL and~~or~~ $LBCL_{DAF1}$~~, if present, would have been reported~~.

Exceptions included:

- Antimony, for which the standard reporting limit was 0.315 mg/kg (0.3 mg/kg $LBCL_{DAF1}$); and
- Thallium, for which the standard reporting limit was 0.75 mg/kg (0.4 mg/kg $LBCL_{DAF1}$).~~);~~

*Organochlorine Pesticides*

Organochlorine pesticides were analyzed for in 51~~53 Site~~ soil samples[22] (28 ~~(29~~ surface and 23 ~~24~~ subsurface samples; Table B-5). The following constituents were detected in at least one sample:

- 2,4-DDE
- beta-BHC
- Endrin

[22] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. Organochlorine pesticide analysis was only performed for initial SAP samples (i.e., was not included in the analyses for confirmation samples); thus the tally of organochlorine pesticide analyses is lower than for some of the other analytical suites, such as metals.

- 4,4-DDD
- 4,4-DDE
- 4,4-DDT
- alpha-~~-~~BHC
- alpha-Chlordane
- Chlordane
- Endosulfan sulfate
- Endrin aldehyde
- gamma-Chlordane
- Methoxychlor

4,4-DDE, 4,4-DDT, and beta-BHC were the most commonly detected (in more than 35 percent of the samples in which they were analyzed for). None of the detections were higher than the BCL, and most of the detections (exceptions are noted, below) were lower than the $LBCL_{DAF1}$. There was ~~The~~ one alpha-BHC detection (0.0022 ~~0022~~ mg/kg) that was higher than the 0.00003 mg/kg $LBCL_{DAF1}$, and ~~. In addition,~~ all 18~~19~~ of the beta-BHC detections were higher than the 0.0001 mg/kg $LBCL_{DAF1}$. The 18 $LBCL_{DAF1}$ ~~19 LBCL~~ beta-BHC exceedances were associated with the ~~following~~ samples listed in Table 3-5.~~:~~

**TABLE 3-5: BETA-BHC DETECTIONS GREATER THAN $LBCL_{DAF1}$**

| Sample ID | Depth (ft bgs) | Reported Value (mg/kg) |
|---|---|---|
| GNC1-JS09 | 0 | 0.0022 |
| GNC1-JS09~~JD06~~ | 0 | 0.0027~~0024~~ |
| GNC1-JD10~~JS09~~ | 0 | 0.0027 |
| GNC1-JS11~~JD10~~ | 0 | 0.0031~~0027~~ |
| GNC1-BD20~~JS11~~ | 0 | 0.0037~~0031~~ |
| GNC1-BG19~~BD20~~ | 0 | 0.004~~0037~~ |
| GNC1-BE20~~BG19~~ | 0 | 0.0043 |
| GNC1-BE19~~BE20~~ | 0 | 0.0043 |
| GNC1-BE22~~BE19~~ | 0 | 0.0047~~0043~~ |
| ~~GNC1-BE22~~ | ~~0~~ | ~~0.0047~~ |

| Sample ID | Depth (ft bgs) | Reported Value (mg/kg) |
|---|---|---|
| GNC1-BF20 | 0 | 0.0048 |
| GNC1-JS11 | 0 | 0.0048 |
| GNC1-BF22 | 0 | 0.0054 |
| GNC1-BD21 | 0 | 0.0095 |
| GNC1-JS10 | 0 | 0.0099 |
| GNC1-BG20 | 0 | 0.011 |
| GNC1-BE20 | 0 | 0.013 |
| GNC1-BG20 | 0 | 0.014 |
| GNC1-BF21 | 0 | 0.019 |
| | | |

The standard analytical reporting limits for most organochlorine pesticides were lower than~~sufficiently low such that concentrations in excess of~~ the comparison levels~~, if present, would be reported~~. The exceptions are alpha- and beta-BHC, for which the reporting limits were routinely higher than the $LBCL_{DAF1}$.

*Volatile Organic Compounds*

VOCs were analyzed for in 51~~53 Site~~ soil samples[23] (28 ~~(29~~ surface and 23~~24~~ subsurface samples; Table B-10). As seen in Table 3-4 and Table B-10, the following 11 VOCs were detected in at least one sample:

- 1,2,4-Trimethylbenzene
- 1,2-Dichlorobenzene
- 1,3,5-Trimethylbenzene
- 1,3-Dichlorobenzene
- 1,4-Dichlorobenzene
- Acetone
- Dichloromethane
- Ethylbenzene
- Nonanal
- n~~N~~-Propylbenzene
- Toluene

1,2,4-Trimethylbenzene and dichloromethane were detected the most frequently, in approximately 33 ~~32 percent~~ and 47 percent of the samples, respectively. None of the detections were above the BCL. With the exception of dichloromethane, the VOC detections were also lower than the $LBCL_{DAF1}$. Dichloromethane was detected in the 24~~following 25~~ soil samples listed in Table 3-6 at concentrations in excess of the 0.001 mg/kg $LBCL_{DAF1}$.~~:~~

**TABLE 3-6: DICHLOROMETHANE DETECTIONS GREATER THAN $LBCL_{DAF1}$**

| Sample ID | Depth (ft bgs) | Reported Value (mg/kg) |
|---|---|---|
| GNC1-BE20 | 0 | 0.0014 |
| GNC1-JS09 | 0 | 0.0027 |
| GNC1-JD07 | 10 | 0.0028 |
| GNC1-JD07 | 0 | 0.0031 |
| GNC1-BD20 | 0 | 0.0032 |
| GNC1-JS09 | 10 | 0.0033 |
| GNC1-BD20 | 10 | 0.0039 |
| GNC1-JS10 | 0 | 0.0041 |
| GNC1-JS10 | 10 | 0.0046 |
| GNC1-BD21 | 0 | 0.0051 |
| GNC1-BD19 | 10 | 0.0083 |
| GNC1-BD19 | 0 | 0.0099 |
| ~~GNC1-BE20~~ | ~~0~~ | ~~0.011~~ |
| GNC1-BE20~~JD06~~ | 0 | 0.011~~012~~ |
| GNC1-JD09 | 10 | 0.014 |
| GNC1-BD21 | 10 | 0.015 |
| GNC1-JD08 | 10 | 0.015 |
| GNC1-JD08 | 0 | 0.016 |
| GNC1-JD09 | 0 | 0.016 |
| GNC1-BG21 | 10 | 0.017 |
| GNC1-JD09 | 0 | 0.017 |
| GNC1-BG22 | 0 | 0.018 |
| GNC1-BG22 | 10 | 0.018 |
| GNC1-BE19 | 0 | 0.019 |
| GNC1-JS09 | 0 | 0.028 |

[23] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. VOC analysis was only performed for initial SAP samples (i.e., was not included in the analyses for confirmation samples), thus the tally of VOC analyses is lower than for some of the other analytical suites, such as metals.

It should be noted that the analytical reporting limits for dichloromethane were often higher than the $LBCL_{DAF1}$; therefore, concentrations in excess of this comparison level, if present, could~~might not~~ have potentially gone un~~been~~ reported. For the other VOCs, the standard reporting limits were lower than the BCL and $LBCL_{DAF1}$~~, and concentrations in excess of these screening levels, if present, would have been reported~~.

*Semi-Volatile Organic Compounds*

SVOCs were analyzed for in 49~~51 Site~~ soil samples[24] (26 ~~(28~~ surface and 23 subsurface samples; Table B-~~-~~9). As seen in Table 3-4 and Table B-9, the following SVOCs were detected in one or more samples:

- Benzoic acid
- bis(2-ethylhexyl)Phthalate
- Butylbenzyl phthalate
- Di-n-butyl phthalate
- Fluoranthene
- Phthalic acid

Fluoranthene was detected the most often, in 12~~11.8~~ percent of the samples. All SVOC detections were lower than the BCL and the $LBCL_{DAF1}$. For SVOC non-detects, the standard reporting limits were lower than the BCL, except for dichloromethyl ether, which routinely had analytical reporting limits higher than the BCL.

~~With the exception of this compound, concentrations in excess of the BCL, if present, would have been reported for SVOCs.~~ For several other SVOC non-detections,~~SVOCs~~ the analytical reporting limits are higher than the $LBCL_{DAF1}$, and it is unknown whether these constituents are present in those samples at concentrations in excess of the $LBCL_{DAF1}$. The constituents with reporting limits routinely higher than the $LBCL_{DAF1}$ are as follows:

- 2,2'-Dichlorobenzil
- 2,4,6-Trichlorophenol
- 2,4-Dichlorophenol
- bis(2-chloroethyl)Ether~~ether~~
- Hexachloroethane
- Isophorone

[24] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. The tally of SVOC analyses is lower than for some of the other analytical suites, such as metals because SVOC analysis was inadvertently not performed at one location (10 feet bgs sample from GNC1-BE21) and two pre-scrape samples (GNC1-JD09 and its duplicate) were superseded by a single confirmation sample.

- 2,4-Dinitrophenol
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene
- 3,3'-Dichlorobenzidine
- Nitrobenzene
- n-Nitrosodi-n-propylamine
- p-Chloroaniline
- Pentachlorophenol

*Dioxins and Furans*

For dioxins/furans, as discussed in Section 1.1, the USEPA TEQ procedure, developed to describe the cumulative toxicity of these compounds, is used. Dioxins and furans were analyzed for in 35~~36 Site~~ surface soil samples[25] (Table B-2). All of the individual dioxins and furans congeners analyzed were reported as detections in at least one sample. None of the samples analyzed had calculated TCDD TEQ concentrations in excess of the NDEP BCL of 50 ppt. $LBCL_{DAF1}$ values have not been established for dioxin/furans~~,~~; thus the potential for impacts to groundwater quality due to their presence could not be assessed by comparisons to the $LBCL_{DAF1}$~~these levels~~.

*Polychlorinated Biphenyls*

PCBs were analyzed for in 35~~36 Site~~ surface soil samples[26] (individual PCB congeners) (Table ~~Table~~ B~~-~~-7). All of the PCB congeners were detected in at least one sample. BCL values have not been established for individual congeners. PCB congeners are included in the calculation of the TCDD TEQ, and are evaluated in this manner, not on an individual congener basis. $LBCL_{DAF1}$ values have not been established for individual PCB congeners.

*Polynuclear Aromatic Hydrocarbons*

PAHs were analyzed for in 51~~52 Site~~ soil samples[27] (28~~ (29~~ surface, 23 subsurface; Table B-6); each PAH constituent was detected in at least one soil sample. The PAH detections ~~were relatively low, and~~ did not exceed either the BCL or the $LBCL_{DAF1}$ where established. The

[25] This tally includes field duplicates and confirmation samples.
[26] This tally includes field duplicates and confirmation samples.
[27] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. The tally of PAH analyses is lower than for some of the other analytical suites, such as metals because PAH analysis was not performed at one location (10 feet bgs samples from GNC1-BE21), and two pre-scrape samples (GNC1-JD09 and its duplicate) were superseded by a single confirmation sample.

standard PAH analytical reporting limits were lower than the BCL and the $LBCL_{DAF1}$,~~;~~ thus concentrations in excess of these comparison levels, if present, would have been reported.

*Aldehydes*

Aldehydes were analyzed for in 51~~53 Site~~ soil samples[28] (28 ~~(29~~ surface and 23~~24~~ subsurface samples; Table B-9). Acetaldehyde was detected in one sample, and formaldehyde was detected in 30 samples ~~(57 percent)~~. None of the detections exceeded the BCL. The analytical reporting limits were lower than the BCL,~~;~~ thus concentrations in excess of the BCL, if present, would have been reported. $LBCL_{DAF1}$ values have not been established for these compounds.

*Radionuclides*

Radionuclides were detected in all 50~~52~~ of the ~~Site~~ soil samples analyzed[29] (28 ~~(29~~ surface and 22 ~~23~~ subsurface soil samples; Table B-8). Exceedances of comparison levels for radionuclides are shown in Table 3-4 for the eight radionuclides currently included in the project analyte list (radium-226, radium-228, thorium-228, thorium-230, thorium-232, uranium-233/234, uranium-235/236, and uranium-238). Of those activities greater than comparison levels, most are lower than the maximum background activity, as shown in Table 3-4. *As seen in that table, only uranium-235/236 was reported at activities*~~Activities~~ higher than comparison levels and background. *Uranium-235/236* ~~are summarized below for each radionuclide:~~

- ~~All of the reported Radium-226~~ activities were higher than the ~~BCL and $LBCL_{DAF1}$ (~~0.11 picoCurie~~0071 picoCuries~~ per gram (pCi/g) BCL in five samples~~and 0.016 pCi/g, respectively)~~. However, only two~~one of those results was higher than the 2.36 pCi/g maximum background activity: a surface soil sample collected from GNC1-BD19 (2.51 pCi/g).~~

- ~~All of the reported Thorium-228 activities were higher than the BCL and $LBCL_{DAF1}$ (0.0078 pCi/g and 0.0023 pCi/g, respectively). However, only one of the results was higher~~

[28] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. Aldehyde analysis was only performed for initial SAP samples (i.e., was not included in the analyses for confirmation samples); thus the tally of aldehyde analyses is lower than for some of the other analytical suites, such as metals.

[29] As noted in Footnote 11, the number of records in the Site dataset for a given analyte may differ from those for other analytes. Radionuclide analysis was only performed for initial SAP samples (i.e., was not included in the analyses for confirmation samples). In addition, radionuclide analysis was not performed at one location (10 feet bgs samples from GNC1-BE21. Thus the tally of radionuclide analyses is lower than for some of the other analytical suites, such as metals.

~~than the 2.28 pCi/g maximum background activity: a sample collected from 10 feet bgs at GNC1-BD20 (2.31 pCi/g).~~

- ~~None of the reported Thorium-232 activities were higher than the BCL (2.8 pCi/g), but all of them were higher than the $LBCL_{DAF1}$ (0.0029 pCi/g). However, only one of the results was higher than the 2.23 pCi/g maximum background activity: a surface soil sample collected at GNC1-JD11 (2.32 pCi/g).~~

- ~~Uranium-235/236 activities were higher than the 0.11 pCi/g BCL. However, only three~~ of the detections were higher than the 0.241~~21~~ pCi/g maximum background activity. Those results are as follows:

- GNC1-BG21 at 10 feet bgs: 0.274 mg/kg; and

- GNC1-JD07 at 10 feet bgs: 0.31 mg/kg.

| ~~Sample ID~~ | ~~Depth (ft bgs)~~ | ~~Reported Value (mg/kg)~~ |
|---|---|---|
| ~~GNC1-BG20 (duplicate)~~ | ~~0~~ | ~~0.229~~ |
| ~~GNC1-BG21~~ | ~~10~~ | ~~0.274~~ |
| ~~GNC1-JD07~~ | ~~10~~ | ~~0.31~~ |

An $LBCL_{DAF1}$ has not been established for this constituent.

As presented in NDEP guidance (NDEP 2009a), as part of the process used to evaluate radionuclide data for the BMI Common Areas, BRC assessed whether radionuclides are in secular equilibrium. As discussed in Section 5.1, secular equilibrium is an indication of background conditions.

The data indicate that radionuclides are in secular equilibrium at the Site. Specifically, the mean radioactivities for the Thorium-232 decay chain (*i.e.*, thorium-232, radium-228, and thorium-228) are comparable (1.4 ~~pCi/g~~, 1.3 ~~pCi/g~~, and 1.4 pCi/g, respectively). Similarly, the mean values for the uranium-238 decay chain (uranium-238, uranium-233/234, thorium-230, and radium-226) are also comparable, ranging from 0.96 ~~pCi/g~~ to 1.2 pCi/g. All of the mean values are lower than their respective maximum background activity levels. A quantitative evaluation of secular equilibrium is presented in Section 5~~6~~.1.

*Summary of Soil Exceedances*

As summarized above and in the associated data tables (Table 3-4 and Appendix B), some~~limited~~ BCL and $LBCL_{DAF1}$ exceedances are currently observed in Site soils. The following constituents were reported at concentrations higher than the BCL and the maximum shallow background concentration (where applicable):

- Uranium-235/236 (2~~Arsenic (4~~ samples)
- ~~Radionuclides (6 samples)~~

The following constituents were reported at concentrations higher than the $LBCL_{DAF1}$ and the maximum shallow background concentration (where applicable):

- Cadmium (1 sample)~~Boron (2 samples)~~
- Total chromium (3 samples)~~Cadmium (1 sample)~~
- Iron (~~Total chromium (2~~3 samples)
- Magnesium (1 sample)~~Iron (19 samples)~~
- ~~Magnesium (1 sample)~~
- Mercury (1 sample)
- Cyanide (1 sample)
- alpha-BHC (1 sample)
- beta-BHC (18~~19~~ samples)
- Dichloromethane (24~~25~~ samples)
- ~~Radionuclides (3 samples)~~

BRC's evaluation of the data revealed that the surface soil sample at one location (GNC1-BE22) exhibited elevated concentrations of several metals. This sample exhibited the maximum detections reported for any Site samples for the following metals: cadmium, chromium, hexavalent chromium, cobalt, copper, lead, molybdenum, and tin. Elevated concentrations of dioxins/furans, organochlorine pesticides, PAHs, and PCBs were also reported in this sample, but only ~~and~~ the dioxins/furans/PCB congeners detections were high enough to trigger remediation. The confirmation sample collected after remediation (GNC2-BE22C) indicated that dioxins/furans/PCB congener~~congeners~~ detections had been significantly reduced. Following procedures defined in the SAP, this confirmation sample was not analyzed for constituents that did not trigger remediation, and post-remediation concentrations of metals, remaining organochlorine pesticides, and PAHs are unknown for this location. It is likely that the low concentrations for these constituents have also been reduced. Sample location GNC1-BE22 was

a biased sample location that coincided with debris pile #53. This debris area was described in ~~the~~ Table 3 of the SAP as being an area of approximately 20-foot radius, consisting of~~:~~ concrete debris, rags, soil stockpiles, carpet, lumber, and circuit boards. Because all of the metal, organochlorine pesticide and PAH detections were lower than their respective BCL (or the maximum background concentration) and because the sample location was subsequently ~~has been over~~ excavated during remediation, it is ~~was~~ not appropriate~~necessary~~ to consider~~treat~~ the associated data as a hot spot or a separate exposure area in the HHRA.

The limited number of BCL and $LBCL_{DAF1}$ exceedances indicates that there is a ~~relatively~~ low likelihood of adverse impacts to human health and the environment due to residual chemical concentrations in Site soils. Consistent with the methodology in the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), an HHRA was conducted to further evaluate this possibility, as discussed in subsequent sections of this report. In addition, using the SESOIL and VLEACH unsaturated zone leaching models, BRC evaluated the potential impacts to groundwater quality due to residual chemical concentrations, as summarized in Section 9.

## 3.6 SURFACE FLUX SAMPLING

Concurrent with the confirmation soil sampling, BRC implemented surface flux sampling across the Site. This sampling conformed to the most recent NDEP-approved version of SOP-16 (BRC, ERM, and MWH 2009). The sampling procedure for the effort included the USEPA surface emission isolation flux chamber (flux chamber) sampling to support an air pathway analysis for the Site.

It should be noted that while radon samples were collected, they are not included in this HHRA for the following reason:~~.~~ BRC recently submitted a technical memorandum to the NDEP (BRC 2010), in which the results of recent radon testing performed in groundwater and indoor air samples were presented. Based on the findings of this memorandum, the NDEP concluded that HHRAs for Eastside property sub-areas do not need to evaluate the pathway of radon migration from groundwater to indoor air for sub-areas with a separation distance of at least 15 feet between any current or future building structure base and the high water table (letter dated November 9, 2010, from Greg Lovato, NDEP, to Mark Paris, BRC). Based on this conclusion and given the depth to groundwater at the Site is at least 25 feet bgs, the intrusion of radon into indoor air is not evaluated in the HHRA ~~for this Site~~. Furthermore, as discussed in Section 5~~6~~.1, other radionuclides are consistent with background levels, which indicate~~indicates~~ that radon should also be consistent with background, naturally -occurring levels in soil.

The flux chamber sample collection rationale was based on the project goal of obtaining a representative dataset of air emissions per sub-area. Flux chamber samples were collected from 15 ~~16~~ locations (Figure 11)~~:~~);~~;~~ 11 random sampling ~~sample~~ locations and four biased locations (and one duplicate)~~. )~~

This density of sample collection is considered adequate for sub-area characterization given~~:~~ the biased nature of the sample locations, the size of the sub-area, and the number of sample locations suggested by the USEPA (1986) in the flux chamber User's Guide for assessing zones of homogeneous site ~~Site~~ properties.

The analyte list for surface~~soil vapor~~ flux samples is composed~~comprised~~ of the list provided in the most recent NDEP-approved version of SOP-16 (BRC, ERM, and MWH 2009). This analyte list is provided in Table 3-7~~5~~, and consists of the US~~full~~ EPA Method TO-15 full scan, plus SIM analyses for a subset of the analytes. The analytical results are summarized in Table B-11 (Appendix B), and the principal investigator Report ~~report~~ of Findings (~~findings,~~ which includes descriptions of sampling procedures)~~,~~ is provided in Appendix D (included on the report CD in Appendix B).[30] It should be noted that, in addition to VOC data for the Site, the flux chamber report also contains data for the remainder of the Galleria North sub-area outside the Site boundaries. Data collected from outside the Site boundaries are not included in this HHRA. A data summary for the flux chamber sample results is provided in Table 3-8~~6~~.

As seen in Tables 3-8~~6~~ and B-11, 35 organic constituents were detected in at least one surface flux sample. The most commonly detected constituents were benzene, carbon tetrachloride, chloroform, and tetrachloroethene, which were detected in more than 85 percent of the samples using the SIM method. Nearly all of the detections were qualified with "J" flags, indicating the reported concentrations were estimated. ~~All of the detections were lower than 1 µg/m$^2$,min$^{-1}$.~~ The highest concentrations were of acetone (0.247 ~~247~~ µg/m$^2$,min$^{-1}$ at GNC1-BE20 and 0.206 µg/m$^2$,min$^{-1}$ at GNC1-BE21) and dichloromethane (0.239 ~~239~~ µg/m$^2$,min$^{-1}$ at GNC1-BE21). Both ~~of~~ these constituents are common laboratory contaminants.

As discussed in Section 4, all data have been validated. The HHRA surface flux dataset for the Site is included ~~as Appendix D to the HHRA (found~~ on the report CD ~~provided~~ in Appendix B~~)~~. Surface flux sample locations are shown on Figure 11.

[30] Note that this report was prepared prior to data validation~~;~~, therefore, data qualifiers may differ from~~than those for~~ those in the remainder of this report.

## 3.7 LEACHATE DATA

As specified in the SAP, one sample collected within the Site during the initial sampling event was submitted for synthetic precipitation leaching procedure (SPLP) analysis.[31] This sample was collected from location GNC1-BE21 at 10 feet bgs. This soil sample was analyzed for aldehydes, general chemistry and ~~/~~ions, metals, organochlorine pesticides, PAHs, radionuclides, and SVOCs. As noted in the SAP, these constituents are considered those of greatest concern for potential migration and impacts to groundwater. Data associated with this SPLP sample are summarized in Appendix B, Table B-12. For reference, Table B-12 includes constituent-specific comparison levels (viz., NDEP's residential water BCLs and USEPA Maximum Contaminant Levels). As summarized in Table B-12, there were few detections in the leachate sample from GNC1-BE21. All of the detections in this leachate sample were inorganic constituents (*i.e.*, general chemistry and ions, metals and radionuclides); organic compounds were not detected. Of these detections, only perchlorate (0.148 milligrams per liter [mg/L]) and arsenic (0.0034 mg/L) detections were higher than their respective comparison levels. Potential impacts to groundwater are further evaluated in Section ~~Section~~ 9.

[31] SPLP analysis was prepped per USEPA Method 1312 - West solution pH 4.95 with 60/40 weight sulfuric/nitric acid.

# 4.0 DATA EVALUATION

This section~~Section~~ describes the procedures used to evaluate the acceptability of data for use in the risk assessment. Overall quality of sample results is a function of proper sample management. Management of samples began at the time of collection and continued throughout the analytical~~analysis~~ process. SOPs were followed to ensure that samples were collected and managed properly and consistently and to optimize the likelihood that the resultant data are valid and representative.

The primary objective of the data review and usability evaluation was to identify appropriate data for use in the HHRA. The analytical data were reviewed for applicability and usability following procedures in USEPA's ~~the~~ *Guidance for Data Usability in Risk Assessment (Part A)* (~~USEPA~~ 1992a) and *Risk Assessment Guidance for Superfund: Volume I* ~~USEPA~~ (1989), and the NDEP's *Supplemental Guidance for Assessing Data Usability for Environmental Investigations at ~~Guidance for~~ the BMI Complex and Common Areas* (~~NDEP~~ 2008a). A quality assurance/quality control (QA/QC) review of the analytical results was conducted during the sampling events. According to the USEPA Data Usability Guidance, there are six principal evaluation criteria by which data are judged for usability in risk assessment. The six criteria are:

- Reports~~reports~~ to risk assessor (availability of information associated with Site data);
- Documentation;
- Data ~~documentation;~~
- ~~data~~ sources;
- Analytical ~~analytical~~ methods and detection limits;
- Data ~~data~~ review; and
- Data~~data~~ quality indicators (DQIs), including precision, accuracy, representativeness, comparability, and completeness (PARCC).

A summary of these six criteria for determining data usability is provided below. In addition to the six principal evaluation criteria, the NDEP's Data Usability Guidance includes a step for data usability analysis, which is discussed after these six USEPA evaluation criteria. Data usability evaluation tables are provided electronically in Appendix E (included on the report CD in Appendix B).

## 4.1 CRITERION I – REPORTS TO RISK ASSESSOR (AVAILABILITY OF INFORMATION ASSOCIATED WITH SITE DATA)

The usability analysis of the site characterization data requires the availability of sufficient data for review. The required information is available from documentation associated with the Site data and data collection efforts. Data have been validated as described in the following DVSRs, which are provided electronically in Appendix F:

- *Data Validation Summary Report, Galleria North Sub-Area Soil Investigations, January-March 2009; July-August 2009 (Dataset 60)* (BRC and ERM 2010b), ~~2010a), which was~~ approved by the NDEP on June 14, 2010;
- *Data Validation Summary Report, Sunset North Commercial and Galleria North Sub-Areas 2nd Round Confirmation Soil Investigations – September 2009, December 2009, January 2010 and May 2010 (Dataset 60a)* (BRC and ERM 2010c), ~~2010b), which was~~ approved by the NDEP on September 10, 2010~~.~~; and
- *Data Validation Summary Report, 2010 Eastside North Confirmation Soil Investigations – April through September 2010 – Part I (Dataset 72a)* (BRC and ERM 2010d),~~2010c), which was re-submitted on November 15, 2010;~~ approved by the NDEP on December 21, 2010~~is pending~~.

The information sources and the availability of such information for the data usability process are as follows:

- A Site description provided in this report and the NDEP-approved SAPs identifies the location and features of the Site, the characteristics of the vicinity, and contaminant transport mechanisms.
- A Site~~site~~ map with sampling~~sample~~ locations is provided on Figure 11.
- Sampling design and procedures were provided in the NDEP-approved SAPs.
- Analytical methods and sample quantitation limits (SQLs) are provided in the dataset file included on the report CD in Appendix B.
- A complete dataset is provided in the dataset file included on the report CD in Appendix B.

- A narrative of qualified data is provided with each analytical data package;~~,~~ the laboratory provided a narrative of QA/QC procedures and results. These narratives are included as part of the DVSRs (BRC and ERM 2010b, ~~2010a,b,~~c, d).

- QC results are provided by the laboratory, including blanks, replicates, and spikes. The laboratory QC results are included as part of the DVSRs (BRC and ERM 2010b, ~~2010a,b,~~c, d).

- Data flags used by the laboratory were defined adequately.

- Electronic files containing the raw data made available by the laboratory are included as part of the DVSRs (BRC and ERM 2010b, ~~2010a,b,~~c, d).

## 4.2 CRITERION II – DOCUMENTATION REVIEW

The objective of the documentation review is to confirm that the analytical results provided are associated with a specific sampling ~~sample~~ location and collection procedure, using available documentation. For the purposes of this data usability analysis, the chain-of-custody forms prepared in the field were reviewed and compared to the analytical data results provided by the laboratory to ensure completeness of the dataset as discussed in the DVSRs (BRC and ERM 2010b, ~~2010a,b,~~c, d). Based on the documentation review, all samples analyzed by the laboratory were correlated to the correct geographic location at the Site, as shown on Figure 11. The samples were collected in accordance with the SAP and RAWP (BRC 2009), and the SOPs developed for the BMI Common Areas as provided in the FSSOP (BRC, ERM, and MWH 2009). Field procedures included documentation of sample times, dates, and locations;~~,~~ other sample-~~-~~specific information such as sample depth was ~~were~~ also recorded. Information from field forms generated during sample collection activities was imported into the project database.

~~Measurement of asbestos was conducted consistent with NDEP's *Technical Guidance for the Calculation of Asbestos-Related Risk in Soils* (2009b).~~ The analytical data were reported in a format that provides adequate information for evaluation, including appropriate QC~~quality control~~ measures and acceptance criteria. Each laboratory report describes the analytical method used, provides results on a sample-~~-~~by-~~-~~sample basis along with sample specific SQLs, and provides the results of appropriate QC~~quality control~~ samples such as laboratory control spike samples, sample surrogates and internal standards, and matrix spike samples. All laboratory reports, except for asbestos, were prepared as provided by the documentation required by USEPA's Contract Laboratory Program (USEPA 2003a, 2004b, c) which includes chain-~~-~~of-

custody records, calibration data, QC results for blanks, duplicates, and spike samples from the field and laboratory, and all supporting raw data generated during sample analysis were also included. Reported analytical~~sample analysis~~ results were imported into the project database.

Measurement of asbestos was conducted consistent with the NDEP's *Technical Guidance for the Calculation of Asbestos-Related Risk in Soils* (2009b). The recommended method for providing asbestos data that are useful for risk assessment purposes was performed by EMSL Analytical, Inc., in Westmont, New Jersey. Although this~~This~~ laboratory is not currently certified in Nevada, it does have ~~the~~ State of ~~Nevada, but has~~ California and U.S.~~national~~ accreditation for asbestos analysis. Because many of the QC procedures associated with other analyses do not apply to asbestos analysis (*e.g.*, laboratory blanks, duplicates and spikes), data validation of the asbestos laboratory reports involved a somewhat lesser level of effort than for other analyses (consistent with the NDEP's *Technical Guidance for the Calculation of Asbestos-Related Risk in Soils*).~~[32]~~

## 4.3 CRITERION III – DATA SOURCES

The review of data sources is performed to determine whether the analytical techniques used in the site characterization process (*i.e.*, SAP sampling) are appropriate for risk assessment purposes. The data collection activities specified in the SAP were developed to characterize a broad spectrum of chemicals potentially present on the Site, including asbestos, aldehydes, general chemistry and ~~/~~ions, VOCs, SVOCs, metals, dioxins/furans, PAHs, organochlorine pesticides, radionuclides, and PCBs (SRCs~~site related chemicals~~ and analyses performed under SAP implementation n are listed in Table 3-2, and Table 3-7~~5~~ for surface flux samples).[33] Because of the soil removals that have occurred on the Site, data collected prior to SAP implementation had significant ~~data~~ gaps and inconsistencies in analytical methodology, and as discussed in Section 2, those historical data are not evaluated further in the data usability process, or the HHRA. Only post-remediation data collected under the SAP (and subsequent RAWPs) are being used in the HHRA, and these were subjected to the formal data usability evaluation described in this section. Figure 11 demonstrates that samples collected in accordance with the SAP are situated across the entire Site; analyses associated with these samples are summarized in Tables 3-~~Tables~~ 2 (soil) and 3-7~~5~~ (surface flux).

~~[32] Although radon samples were collected and analyzed for the Site, radon has been evaluated has been evaluated through a separate process and is not considered further in the data usability process (see Section …).~~

[33] Although radon samples were collected and analyzed for the Site, radon has been evaluated through a separate process and is not considered further in the data usability process (see Section 3.6).

The State of Nevada is in the process of certifying the laboratories used to generate the analytical data. As such, standards of practice in these laboratories follow the quality program developed by the Nevada Revised Statutes ~~(NRS)~~ and are within the guidelines of the analytical methodologies established by the USEPA. Based on the review of the available information, the data sources for chemical and physical parameter measurements are adequate for use in a risk assessment.

## 4.4 CRITERION IV – ANALYTICAL METHODS AND DETECTION LIMITS

In addition to the appropriateness of the analytical techniques evaluated as part of Criterion III, it is necessary to evaluate if~~whether~~ the detection limits are low enough to allow adequate characterization of risks. At a minimum, this data usability criterion can be met through the determination that routine USEPA and U.S. Department of Energy (DOE) reference analytical methods were used in analyzing samples collected from the Site. The USEPA and DOE methods that were used in conducting the laboratory analysis of soil and surface flux samples are identified in the dataset file included on the report CD in Appendix B. Each of the identified methods is considered the most appropriate method for the respective constituent class and each was approved by the NDEP as part of the SAP and RAWPs (BRC 2008, 2009). As recommended by NDEP's guidance on *Detection Limits and Data Reporting* (NDEP 2008b), the laboratory reported SQL was used in evaluating detection limits.

Laboratory practical quantitation limits (PQLs) were based on those outlined in the reference method, the SAP (BRC 2008), and the project QAPP ~~(BRC and ERM 2009a)~~. In accordance with respective laboratory SOPs, the analytical processes included performing instrument calibration, laboratory method blanks, and other verification standards used to ensure QC~~quality control~~ during the analyses of collected samples.

The range of SQLs achieved in field samples was compared to NDEP BCLs (NDEP 2011a~~2010a~~). As seen in the summary of the Site dataset provided in Tables 3-4 (soil) and 3-8~~6~~ (surface flux), of the standard analytes, only three constituents had SQLs that exceeded their respective residential soil BCLs. Twenty SPLP constituents exceeded their respective residential water BCLs. The SQLs exceedances of NDEP BCLs are discussed below.

- The arsenic SQL in two of 55 sample analyses was higher than the BCL; this constituent was detected in all of the other samples tested. These two results were qualified due to equipment blank contamination and the reporting limits were raised to the PQL.

- Organics with SQLs higher than the BCL were n-nitrosodi-n-propylamine in 39 of 51 samples, and dichloromethyl ether in all 51 samples analyzed. Neither of these compounds was detected in any samples. The n-nitrosodi-n-propylamine SQL was only slightly higher than the BCL. The dichloromethyl ether SQL is greater than 200 times the BCL and a reduction in the SQL is not likely to be easily achieved by the laboratory. Therefore, the analytical SQLs are considered adequate for risk assessment purposes.

- The following analytes have SPLP SQLs higher than their ~~the~~ residential water BCL: ~~were noted for~~ toxaphene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno-(1,2,3-cd)pyrene, 1,2-diphenylhydrazine, 2,2'-dichlorobenzil, 2,4,6-trichlorophenol, 2,4-dinitrotoluene~~dinitrotoluene~~, 3,3-dichlorobenzidine, bis(2-chloroethyl) ether, bis(2-chloroisopropyl) ether, bis(2-ethylhexyl) phthalate, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, nitrobenzene, n-nitrosodi-n-propylamine, and pentachlorophenol. Of these, only benzo(a)anthracene, ~~anthracene,~~ benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno-(1,2,3-cd)pyrene, bis(2-ethylhexyl) phthalate were detected in soils. Because the non-detect SPLP data were also not detected in soils, they are not anticipated to be of concern with respect to potential impacts to groundwater. While n-nitrosodi-n-propylamine SQLs also exceeded the soil BCL for the majority of its samples, as noted above, it was only slightly exceeded. For the detected constituents, the soil concentrations were all below the $LBCL_{DAF1}$.

As discussed in the *2008 Supplemental Shallow Soil Background Report* (BRC and ERM 2009b), there are differences in SQLs among datasets that~~which~~ may affect data comparability for datasets comprised primarily of non-detect~~detected~~ values. For these datasets, left-censored data can result in difficulties in differentiating whether datasets are actually different or merely an artifact of detection limits.

## 4.5 CRITERION V – DATA REVIEW

The data review portion of the data usability process focuses primarily on the quality of the analytical data received from the laboratory. Soil and surface flux sample data were subject to data validation. DVSRs were prepared as separate deliverables (BRC and ERM 2010b, ~~2010a,b,~~c, d; Appendix F). The analytical data were validated according to the internal procedures using the principles of USEPA National Functional Guidelines (USEPA 1999, 2004d, 2005a, 2008) and were designed to ensure completeness and adequacy of the dataset. Additionally, the DVSRs were issued utilizing the NDEP's two *Supplemental Guidance on Data Validation* documents (NDEP 2009c, d). Any analytical errors and/or limitations in the data have

been addressed and an explanation for data qualification provided in the respective data tables. The results of ERM's data review for these issues are presented in the DVSRs and are summarized below.

Only one ~~of the~~ data point~~points~~ was rejected (an ammonia result for GNBF19-11). The rejection was due to a very low matrix spike/matrix spike duplicate (MS/MSD) recovery~~,~~ and does not reflect a larger concern for this compound, sample, or method. Data qualifications are discussed in the subsections that follow.

### 4.5.1 Holding Time Exceedances / Sample Condition Qualifications

Holding time refers to the period of time between sample collection and the preparation and/or analysis of the sample. The accuracy of analytical results may depend upon analysis within specified holding times and sample temperature. In general, a longer holding time is assumed to result in a less accurate measurement due to the potential for loss or degradation of the analyte over time. Sample temperature is of greatest concern for VOCs that may volatilize from the sample at higher temperatures. As described in the DVSRs (BRC and ERM 2010b, ~~2010a,b,~~c, d),~~)~~ sample results were reviewed for compliance with the method-prescribed preparation and analysis holding times.

USEPA guidance for validation allows professional judgment to be used in evaluating qualification due to holding time exceedances. Sample results that were generated after the required holding time but less than two times after the holding time were qualified as estimated (J- or UJ-flagged). If the samples were prepared after two times the holding time was exceeded, non-detect results were~~are~~ qualified as rejected (R). Qualifications to five samples were made on the basis of exceeded holding times (see Table 2-2 of DVSRs 60 and 60a [BRC and ERM 2010b, c~~2010a,b~~]; Appendix F), as follows:

- Hexavalent chromium results for three soil samples in two laboratory data packages~~batches~~ (TestAmerica data packages~~batches~~ F9A290238 [GNC1-BD19-0 and GNC1-BD19-10, 3~~three~~ days beyond the method-prescribed 4-day period], F9B120206 [SPLP sample GNC1-BE21-10, 4.5 hours past the holding time], were qualified due to holding time exceedances. The results were qualified as estimated with a potential low bias (UJ).

- Dioxin/furan results associated with soil sample GNC1-JD09-0 and its duplicate were associated with analyses performed one day outside the method-prescribed holding time. The

results were qualified as estimated with a potential low bias ("J-")~~-")~~ for detections or "UJ" for non-detections.

As noted in the DVSRs (BRC and ERM 2010b, c, d~~2010a,b,c~~), all samples were received at the laboratory within the required temperatures range of 4° ±~~°±~~ 2° Celsius. No sample results were qualified based on sample temperatures or other sample preservation issues.

### 4.5.2 Blank Contamination

Blanks are artificial samples designed to evaluate the nature and extent of contamination of environmental samples that may be introduced by field or laboratory procedures. Field and laboratory blanks, consisting of contaminant-free water, were prepared and analyzed as part of standard QA/QC procedures to monitor for potential contamination of field equipment, laboratory process reagents, and sample containers. As presented in the DVSRs (BRC and ERM 2010~~2010a,~~b,c,d) 318~~) 427~~ results were qualified as undetected (U) or estimated (J+) due to laboratory or field blank contamination, as discussed below. Detections of constituents qualified as non-detections due to comparable detections in laboratory or field blanks are known as "censored" data, and are presented in Tables 2-5 and 2-6 of DVSR 60, Tables 2-4 and 2-5 of DVSR 60a, and Tables 2-3 and 2-4 of DVSR 72a (Appendix F). In these cases, non-detections are represented in the database as "< [*the PQL*]" in the case of inorganics detected below the PQL, or as "<[*result value*]" for all others.[34]

These censored data are summarized in Appendix E, Table E-14 (included on the report CD in Appendix B) by compound class. As seen in that table, analytes were initially reported as detections in samples, but were later qualified as non-detections based on the presence of comparable concentrations of that analyte in blank samples. As seen in Appendix E, compounds most often censored for soil results included the following:

- Acetone (43 samples)
- Dichloromethane (18 samples)
- ~~Styrene (16 samples)~~
- ~~Cyanide (34~~ samples)
- Mercury (23 samples)
- 1,2,4-Trimethylbenzene (33~~35~~ samples)
- Cyanide (34~~Unknown aldol condensate (SVOC TIC) (48~~ samples)

[34] Although NDEP has issued recent guidance regarding qualifying data due to blank contamination (NDEP 2011b); BRC has addressed this issue in the *Technical Memorandum – BRC Comments on NDEP Blank Contamination Guidance* (BRC 2011a) and, consistent with this Technical Memorandum, no changes were made to the Site dataset.

In addition, benzene was frequently censored for surface flux samples (14 of 16 TO-15 full scan samples).

Table 4-1 presents the metals most likely to be affected by this issue:

**TABLE 4-1: METALS MOST FREQUENTLY CENSORED DURING BLANK SAMPLE EVALUATION**

| Metal | Number of Detect | Number of Samples | Number of Censored Results | Max Non-Detect (mg/kg) | NDEP Residential BCL (mg/kg) |
|---|---|---|---|---|---|
| Antimony | 0 | 53 | 53 | 2.7 | 31 |
| Boron | 7 | 53 | 46 | 53 | 15,633 |
| Selenium | 1 | 53 | 52 | 2.7 | 391 |
| Thallium | 0 | 53 | 53 | 0.75 | 5.5 |

This table demonstrates that while the number of censored results is high compared to the number of detections, the censored values are still much lower than residential soil BCLs.

### 4.5.3 Sample/Duplicate Differences Outside Permissible Range or Greater than Permissible Values

During the data validation process, sample/duplicate results are evaluated to determine whether differences in those results suggest potential issues with data quality. Specifically, the analyst evaluates~~reviews~~ the following:

- MS/MSD relative percent difference (RPDs), to determine if~~whether~~ the RPDs are outside acceptance limits;
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) RPDs, to determine if~~whether~~ the RPDs are outside acceptance limits;
- Sample/field duplicate results to determine if~~whether~~ differences are greater than the permissible value; and
- Sample/laboratory duplicate results to determine if~~whether~~ differences are greater than the permissible value.

#### *4.5.3.1 Qualifications Due~~due~~ to MS/MSD Recoveries Outside Acceptance Criteria*

As discussed in the DVSRs (BRC and ERM 2010b, ~~2010a,b,~~c, d), inorganic constituent results for 345 sample results were qualified as estimated (either UJ for non-detections or J for detections; "+" or "–"~~"~~ added to denote potential high or low bias, respectively) based on

MS/MSD recoveries; there was one rejection for data associated with MS/MSD recoveries. The qualifications applied on the basis of MS/MSD recoveries were as follows:

- One ammonia result GNBF19-11 was qualified and rejected due to a recovery much lower than the acceptance criterion;

~~•~~ ~~.~~

- The Total Kjeldahl Nitrogen results for the following nine soil samples were qualified as estimated due to a recovery greater than the acceptance criteria: GNC1-JD07-0, GNC1-JD07-10, GNC1-JS09-0, GNC1-JS09-0-FD, GNC1-JS09-10, and GNC1-JS10-0 in data package F9A310166, and GNC1-JS11-0, GNC1-JS11-0-FD, and GNC1-JS11-10 in data package F9A300184); and

| ~~Sample ID~~ | ~~Lab ID~~ |
|---|---|
| ~~GNC1-JD07-0~~ | ~~F9A310166004~~ |
| ~~GNC1-JD07-10~~ | ~~F9A310166005~~ |
| ~~GNC1-JS09-0~~ | ~~F9A310166006~~ |
| ~~GNC1-JS09-0-FD~~ | ~~F9A310166007~~ |
| ~~GNC1-JS09-10~~ | ~~F9A310166008~~ |

| ~~Sample ID~~ | ~~Lab ID~~ |
|---|---|
| ~~GNC1-JS10-0~~ | ~~F9A310166011~~ |
| ~~GNC1-JS11-0~~ | ~~F9A300184006~~ |
| ~~GNC1-JS11-0-FD~~ | ~~F9A300184007~~ |
| ~~GNC1-JS11-10~~ | ~~F9A300184008~~ |
| | |

- Metals results for soil samples in various laboratory data packages were qualified due to recoveries outside the acceptance criteria, as summarized in Table 4-2~~the table~~ below.~~:~~

**TABLE 4-2: METALS SAMPLES QUALIFIED DUE TO RECOVERIES OUTSIDE ACCEPTANCE CRITERIA**

| Laboratory Data Package | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Copper | Lead | Lithium | Manganese | Mercury | Molybdenum | Potassium | Selenium | Silver | Strontium | Tin | Titanium | Tungsten | Uranium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F9A290238 | - | | + | | | | | | | | | | + | | + | | | | - | | | |
| F9A300184 | - | | + | | | | | + | | | | | | | + | | | | - | | | - |
| F9A310166 | - | | | | | | | | | | + | | | | | | | | - | | | |
| F9B060191 | - | | - | | | | | | | | | | | | + | | | | | | - | |
| F9B070176 | - | | - & + | | | + | + | | | | - | | + | | + | | | | - | | + | - & + |
| F9B100109 | - | | - | + | | | | | + | | | | | | + | | | | - | + | | - & + |
| F9B140120 | - | | | | + | - | | - | | | | | + | | + | | | | - | | - | - |
| F9B180129 | - | | | | + | - | | - | | | | | + | | | | | | - | | - | - |

## TABLE 4-2: METALS SAMPLES QUALIFIED DUE TO RECOVERIES OUTSIDE ACCEPTANCE CRITERIA

| Laboratory Data Package | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Copper | Lead | Lithium | Manganese | Mercury | Molybdenum | Potassium | Selenium | Silver | Strontium | Tin | Titanium | Tungsten | Uranium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F9H140144 | - | + | - & + | | + | | + | + | | | - | | + | | | - | | + | - | + | + | + |
| F0A090446 | - | + | + | | + | | + | + | + | | | + | + | + | + | + | + | + | | + | + | + |
| F0H030409 | - | | + | | | | | | | + | | | + | | | | | | - | | | |

+ = Recovery greater than the acceptance limits
- = Recovery less than the acceptance limits
Blank entry signifies that the recovery was within the acceptance limits

-Appendix E, Table E-11 (included on the report CD in Appendix B) lists the samples and associated analytes exhibiting MS/MSD percent recoveries below the laboratory control limits. In cases in which~~where~~ the recoveries were higher than the acceptance criteria, the results have the potential of being similarly biased high, and using these data in the HHRA could result in risks being calculated that are higher than would be associated with actual Site conditions. Of more concern for the HHRA is underestimation of risk, which could be associated with the use of data that are biased low.

As indicated in that table (Table E-11), reported detections and non-detects for soil data were flagged as estimated ("J-" or "UJ," respectively) due to low MS/MSD recoveries (*i.e.*, from 30 to 74 percent for metals)[35]. Detections associated with "very low" MS/MSD recoveries (*i.e.*, less than 30 percent for metals), are generally rejected as unusable. Because only one of the MS/MSD recoveries was that low, only one sample result was rejected on this basis.

The data flagged as estimated based on low MS/MSD recoveries were subjected to further review in terms of data usability for the Site, as discussed in Section 4.6.2.3.

*4.5.3.2 Qualifications due to LCS/LCSD Recoveries Outside Acceptance Criteria*

Organic and inorganic constituent results for four samples were qualified as estimated (either UJ for non-detections or J for detections; "+" or "–" added to denote potential high or low bias,

[35] If additional validation criteria (aside from the MS/MSD recoveries) did not suggest a low bias for a given result, the sample result was flagged with "J" (no bias inferred).

respectively) based on LCS/LCSD recoveries. The qualifications applied on the basis of LCS/LCSD recoveries are summarized in Table 4-3.~~were as follows:~~

**TABLE 4-3: RESULTS QUALIFIED DUE TO LCS/LCSD RECOVERIES OUTSIDE ACCEPTANCE CRITERIA**

| Sample ID | Lab ID | Analyte | Result | Unit | Recovery | Limits |
|---|---|---|---|---|---|---|
| GNC1-BD19-0 | F9A290238010 | Cyanide, Total | < 0.087 UJ | mg/kg | 83 | 85-115 |
| GNC1-BD19-10 | F9A290238011 | Cyanide, Total | <0.53 UJ | mg/kg | 83 | 85-115 |
| GNC1-JS11-0 | F9A300184006 | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 12 J | pg/g | 78 | 79-140 |
| GNC1-JS11-0-FD | F9A300184007 | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 49 J | pg/g | 78 | 79-140 |

As noted above, recoveries below the lower laboratory limits are of the most concern in terms of data usability. Appendix E, Table E-11 (included on the report CD in Appendix B) lists the samples and associated analytes exhibiting LCS/LCSD percent recoveries below the lower laboratory control limit. No results were rejected as unusable based on very low LCS/LCSD recovery. The data flagged as estimated based on low LCS/LCSD recoveries were subjected to further review in terms of data usability for the Site, as discussed in Section 4.6.2.3.

*4.5.3.3 Qualifications due to Sample/Field Duplicate Differences Outside Acceptance Criteria*

The following eight soil field duplicates were collected during the sampling activities

- GNC1-BE20-0-FD
- GNC1-BG20-0-FD
- GNC1-JD09-0-FD
- GNC1-JS09-0-FD
- GNC1-JS11-0-FD
- GNC2-BE20C-0-DUP
- GNC2-JS10C-0-DUP
- GNC2-JA04-0-DUP

In addition, the following surface flux field duplicate was also collected during the sampling activities: GNC1-JS11-R.[36]

Field duplicate differences in excess of acceptance limits were noted in eight field duplicate pairs of soil samples. The differences are presented in Appendix E, Table E-12 (included on the report CD in Appendix B). All associated data were flagged as estimated (J/UJ). No data were rejected on the basis of sample/field duplicate differences.

[36] The Galleria North-School Site includes a sub-set of the entire Galleria North sub-area. Field duplicates noted in this section do not reflect the total number of field duplicates collected during the Galleria North sub-area sampling events.

#### *4.5.3.4 Qualifications due to Sample/Laboratory Duplicate Differences Outside Acceptance Criteria*

Of the samples representing post-remediation conditions (*i.e.*, excluding~~not including~~ those data points associated with samples from soil intervals subsequently removed from the Site), ~~the following~~ 26 samples had sample/laboratory duplicate differences greater than the ~~1 pCi/g~~ permissible values (i.e., 1 pCi/g for radionuclides and RPD > 20 percent criteria for cation exchange capacity). These samples are listed in Table 4-4.~~:~~

**TABLE 4-4: RESULTS QUALIFIED DUE TO SAMPLE/LABORATORY DUPLICATE DIFFERENCES OUTSIDE ACCEPTANCE CRITERIA**

| Field Sample ID | Lab Sample ID | Analyte | Result | Unit | RPD or Difference |
|---|---|---|---|---|---|
| GNC1-BD19-0 | F9A290238010 | Cation Exchange Capacity | 16.7 | meq/100g | RPD=22 |
| GNC1-BD19-10 | F9A290238011 | Cation Exchange Capacity | 20.7 | meq/100g | RPD=22 |
| GNC1-BE19-0 | F9B060191008 | Cation Exchange Capacity | 22.6 | meq/100g | RPD=44 |
| GNC1-BE19-10 | F9B060191009 | Cation Exchange Capacity | 20.2 | meq/100g | RPD=44 |
| GNC1-BE22-0 | F9B060191016 | Cation Exchange Capacity | 12.8 | meq/100g | RPD=44 |
| GNC1-BE22-10 | F9B060191017 | Cation Exchange Capacity | 13.5 | meq/100g | RPD=44 |
| GNC1-BF19-0 | F9B060191010 | Cation Exchange Capacity | 16.4 | meq/100g | RPD=44 |
| GNC1-BF19-11 | F9B060191011 | Cation Exchange Capacity | 15.4 | meq/100g | RPD=44 |
| GNC1-BF21-0 | F9B060191014 | Cation Exchange Capacity | 18.8 | meq/100g | RPD=44 |
| GNC1-BF21-10 | F9B060191015 | Cation Exchange Capacity | 12.9 | meq/100g | RPD=44 |
| GNC1-BG19-0 | F9B060191012 | Cation Exchange Capacity | 17.5 | meq/100g | RPD=44 |
| GNC1-BG19-10 | F9B060191013 | Cation Exchange Capacity | 13.2 | meq/100g | RPD=44 |
| GNC1-BG20-0 | F9B060191001 | Cation Exchange Capacity | 10 | meq/100g | RPD=44 |
| GNC1-BG20-0-FD | F9B060191002 | Cation Exchange Capacity | 16.5 | meq/100g | RPD=44 |
| GNC1-BG20-10 | F9B060191003 | Cation Exchange Capacity | 6.3 | meq/100g | RPD=44 |
| GNC1-BG21-0 | F9B060191004 | Cation Exchange Capacity | 14.2 | meq/100g | RPD=44 |
| GNC1-BG21-10 | F9B060191005 | Cation Exchange Capacity | 15.4 | meq/100g | RPD=44 |
| GNC1-BG22-0 | F9B060191006 | Cation Exchange Capacity | 16.5 | meq/100g | RPD=44 |
| GNC1-BG22-10 | F9B060191007 | Cation Exchange Capacity | 11.9 | meq/100g | RPD=44 |
| GNC1-JD10-0 | 224260001 | Radium-228 | 1.14 | pCi/g | Difference=1.41 |
| GNC1-JD10-11 | 224260002 | Radium-228 | 1.38 | pCi/g | Difference=1.41 |
| GNC1-JD11-0 | 224260003 | Radium-228 | 0.958 | pCi/g | Difference=1.41 |
| GNC1-JD11-11 | 224260004 | Radium-228 | 1.11 | pCi/g | Difference=1.41 |
| GNC1-JS11-0 | 223713010 | Radium-228 | 1.3 | pCi/g | Difference=1.166 |
| GNC1-JS11-0-FD | 223713011 | Radium-228 | 2.18 | pCi/g | Difference=1.166 |
| GNC1-JS11-10 | 223713012 | Radium-228 | 1.52 | pCi/g | Difference=1.166 |

The above data flagged as estimated (J) based on sample/laboratory duplicate differences were subjected to further review in terms of data usability for the Site, as discussed in Section 4.6.2.3.

### 4.5.4 Internal Standards Outside Acceptance Criteria

Internal standards are prepared for certain organic gas chromatograph/mass spectrometry (GC/MS) and inductively coupled plasma/mass spectrometry~~ICP/MS~~ analyses by adding compounds similar to target compounds of interest to sample aliquots. Internal standards are used in the quantitation of target compounds in the sample or sample extract. The evaluation of internal standards involved comparing the instrument response and retention time from the target compounds in the sample with the response and retention time of specific internal standards added to the sample extract prior to analysis.

As presented in the DVSRs (BRC and ERM 2010b, ~~2010a,b,~~c, d), no sample results were rejected based on internal standards. The following results were qualified due to internal standard exceedances:

- SVOC results for one soil sample (GNC1-BE20-10);
- PCB results for one~~two~~ soil sample~~samples~~ (GNC1-BF22-0~~ and GNC1-JD06-0~~);
- VOC results for 10 surface flux samples (GNC1-BE22, GNC1-BF19, GNC1-BF20, GNC1-BF21, GNC1-BG19, GNC1-BG20, GNC1-BG21, GNC1-BG22, GNC1-JS09, and GNC1-JS10); and
- VOC results for 10 soil samples, as listed in Table 4-5.~~follows:~~

**TABLE 4-5: VOC SOIL SAMPLE RESULTS QUALIFIED DUE TO INTERNAL STANDARDS OUTSIDE ACCEPTANCE CRITERIA**

| Laboratory Data Package # | Sample ID | |
|---|---|---|
| F9B060191 | GNC1-BE19-0 | GNC1-BE22-0 |
| | GNC1-BG19-0 | GNC1-BG20-0 |
| | GNC1-BG20-0-FD | |
| F9B070176 | GNC1-BE20-0 | GNC1-BE20-0-FD |
| | GNC1-BF22-0 | |
| F9A300184 | GNC1-JS11-0 | GNC1-JS11-0-FD |

- Dioxins/furans results for three soil samples, as listed in Table 4-6.~~follows~~

**TABLE 4-6: DIOXIN/FURAN SOIL SAMPLE RESULTS QUALIFIED DUE TO INTERNAL STANDARDS OUTSIDE ACCEPTANCE CRITERIA**

| Laboratory Data Package # | Sample ID |
|---|---|

| | |
|---|---|
| F9B070176 | GNC1-BF22-0 GNC1-BE21-0 |
| F9B100109~~FB9100109~~ | GNC1-JD10-0 |

### 4.5.5 Surrogate Percent Recoveries Outside Laboratory Control Limit

As discussed in the DVSRs (BRC and ERM 2010b, ~~2010a,b,~~c, d), surrogate spikes were added to each of the samples submitted for organic analysis to monitor potential interferences from the matrix. Results associated with unacceptable surrogate recoveries were qualified as estimated (J+ or UJ). Generally, when surrogate recoveries are less than 10 percent, associated non-detect results are qualified as rejected (R) because false negatives are a possibility. No sample results were rejected due to surrogate recoveries. The ~~following~~ soil samples listed in Table 4-7 were qualified due to surrogate recovery exceedances.~~:~~

**TABLE 4-7: RESULTS QUALIFIED DUE TO SURROGATE RECOVERIES OUTSIDE LABORATORY CONTROL LIMIT**

| Sample ID | Lab ID | Analysis | Recovery | Acceptable Range |
|---|---|---|---|---|
| GNC1-BE19-0 | F9B060191008 | Organochlorine pesticides | 160 | 61-150 |
| GNC1-BE20-0 | F9B070176006 | Organochlorine pesticides | 60 | 72-130 |
| GNC1-BE20-0-FD | F9B070176007 | VOCs | 152 | 46-150 |
| GNC1-BG19-0 | F9B060191012 | VOCs | 170 | 46-150 |
| GNC1-JD10-0 | F9B100109008 | Organochlorine pesticides | 171 | 61-150 |
| GNC1-JS10-0 | F9A310166011 | Organochlorine pesticides | 220 | 61-150 |

In addition, two surface flux samples (GNC1-BG19 and GNC1-BG22) were qualified due to surrogate recovery exceedances, both higher than the acceptable range.

Appendix E (included on the report CD in Appendix B) lists the samples and associated analytes exhibiting surrogate percent recoveries below the laboratory control limits. As seen in that appendix, with the exception of the organochlorine pesticide results for GNC1-BE20-0, the recoveries outside the acceptance criteria were higher than the upper laboratory control limit. The GNC1-BE20-0 organochlorine pesticide results were subjected to further review in terms of data usability for the Site, as discussed in Section 4.6.2.3.

### 4.5.6 Calibrations Outside Laboratory Control Limits

Requirements for instrument calibration ensure that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of analytical run. Continuing calibrations checks document satisfactory maintenance and adjustment of the instrument on a day-to-day basis. As presented in the DVSRs (BRC and ERM 2010b, ~~2010a,b,~~c, d), certain data were qualified due to

initial or continuing calibration issues. Of specific concern~~,~~ are analytes with a final qualifier indicating a low bias due to calibration. In the following tables, the percentage of analyte recovered is based on the percent difference of the actual amount and recovered amount reported from the continuing calibration. As the percentage decreases, the potential for false negatives increases.

Table 4-8~~The following table~~ summarizes the SVOC results that were qualified due to evaluation of calibration control limits. ~~those analytes for SVOCs:~~

**TABLE 4-8: SUMMARY OF SVOC RESULTS QUALIFIED DUE TO CALIBRATIONS OUTSIDE LABORATORY CONTROL LIMIT**

| Analyte | # of Samples Qualified | Percent of Qualified Non-Detect | Percentage of Analyte Recovered as Indicated by Outlier |
|---|---|---|---|
| ~~Analyte~~ | ~~# of Samples Qualified~~ | ~~Percent of Qualified Non-detect~~ | ~~Percentage of Analyte Recovered as Indicated by Outlier~~ |
| 1,4-Dioxane | 5 | 100% | 57-72% |
| 3,3'-Dichlorobenzidine | 5 | 100% | 69-74% |
| 3-Nitroaniline | 10 | 100% | 61-74% |
| 4-Nitroaniline | 22 | 100% | 64-70% |
| Acetophenone | 5 | 100% | 69-71% |
| Benzoic Acid | 15 | 100% | 67-74% |
| bis[Chlorophenyl]sulfone | 11 | 100% | 74% |
| bis[p-Chlorophenyl]disulfide | 2 | 100% | 72% |
| Carbazole | 10 | 100% | 56-75% |
| Diphenyl sulfone | 11 | 100% | 74% |
| Hexachlorocyclopentadiene | 2 | 100% | 60% |
| Octachlorostyrene | 3 | 100% | 69% |
| Phthalic Acid | 11 | 100% | 45-65% |

Table 4-9 summarizes the organochlorine pesticide results that were qualified due to calibrations.

**TABLE 4-9: SUMMARY OF ORGANOCHLORINE PESTICIDE RESULTS QUALIFIED DUE TO CALIBRATIONS OUTSIDE LABORATORY CONTROL LIMIT**

| Analyte | # of Samples Qualified | Percent of Qualified Non-Detect | Percentage of Analyte Recovered as Indicated by Outlier |
|---|---|---|---|

~~The following table summarizes those analytes for organochlorine pesticides:~~

| ~~Analyte~~ | ~~# of Samples Qualified~~ | ~~Percent of Qualified Non-detect~~ | ~~Percentage of Analyte Recovered as Indicated by Outlier~~ |
|---|---|---|---|
| 4,4'-DDT | 3 | 66% | 81-83% |
| Heptachlor | 8 | 100% | 82-83% |
| Methoxychlor | 4 | 100% | 83-84% |

Table 4-10 summarizes the VOC results that were qualified in soil samples due to calibrations.

## TABLE 4-10: SUMMARY OF VOC SOIL RESULTS QUALIFIED DUE TO CALIBRATIONS OUTSIDE LABORATORY CONTROL LIMIT

| Analyte | # of Samples Qualified | Percent of Qualified Non-Detect | Percentage of Analyte Recovered as Indicated by Outlier |
|---|---|---|---|

~~The following table summarizes those analytes for VOCs:~~

| ~~Analyte~~ | ~~# of Samples Qualified~~ | ~~Percent of Qualified Non-detect~~ | ~~Percentage of Analyte Recovered as Indicated by Outlier~~ |
|---|---|---|---|
| Freon 12 | 16 | 100% | 71% |
| Methyl iodide | 5 | 100% | 71% |
| MTBE | 14 | 100% | 73% |

In addition, low instrument response was noted for ethanol, acetonitrile, and methyl ethyl ketone as indicated by the relative response factor. ~~(RRF).~~

Table 4-11~~The following table~~ summarizes the VOC results that were qualified in~~those analytes for~~ surface flux samples due to calibrations. ~~VOCs:~~

## TABLE 4-11: SUMMARY OF VOC SURFACE FLUX SAMPLE RESULTS QUALIFIED DUE TO CALIBRATIONS OUTSIDE LABORATORY CONTROL LIMIT

| Analyte | # of Samples Qualified | Percent of Qualified Non-Detect | Percentage of Analyte Recovered as Indicated by Outlier |
|---|---|---|---|
| ~~Analyte~~ | ~~# of Samples Qualified~~ | ~~Percent of Qualified Non-detect~~ | ~~Percentage of Analyte Recovered as Indicated by Outlier~~ |
| 1,2,4-Trichlorobenzene | 7 | 100% | 33-70% |
| 1,2,4-Trimethylbenzene | 3 | 0% | 67% |
| 2-Methyl-1-propanol | 11 | 91% | 55-66% |
| 2,2-Dichloropropane | 1 | 100% | 57% |
| Acetone | 9 | 44% | 48-67% |
| Bromoform | 1 | 100% | 61% |
| Bromomethane | 1 | 100% | 39% |
| Carbon disulfide | 4 | 50% | 48-58% |
| Chloroethane | 1 | 100% | 69% |
| cis-1,3-Dichloropropene | 1 | 100% | 66% |
| Cymene | 5 | 100% | 65-69% |
| Ethanol | 3 | 100% | 50% |
| Methyl ethyl ketone | 1 | 0% | 69% |
| Methyl iodide | 1 | 100% | 43% |
| Naphthalene | 4 | 100% | 60% |
| n-Butylbenzene | 8 | 100% | 61-69% |
| Tert-Butylbenzene | 8 | 100% | 62-69% |
| Trans-1,3-Dichloropropene | 1 | 100% | 50% |
| Trichloroethene | 4 | 100% | 65-68% |
| Vinyl acetate | 1 | 100% | 70% |

### 4.5.7 Tentatively Identified Compounds

For the GC/MS methods, a list and estimated concentrations for tentatively identified compounds (TICs) was ~~were~~ provided by the laboratory if detected. Most~~The majority~~ of the reported TICs were identified as "unknown" or "unknown aldol condensate." Others were as follows:

.beta.-Sitosterol
1-Bromo-11-iodoundecane
1-Bromo-4-bromomethyldecane
1-Decanol, 2-hexyl-
1H-Indene, 5-butyl-6-hexyloctahydro-
2,5-Furandione, 3-dodecyl-
28-Nor-17.alpha.(H)-hopane
2-Dodecen-1-yl(-)succinic anhydride
2-Naphthalenol, 1-((4-methyl-2-nitrophen
5-Bromo-4-oxo-4,5,6,7-tetrahydrobenzofur
6-Isopropenyl-4,8a-dimethyl-4a,5,6,7,8,8
9-Octadecenamide, (z)-
9-Octadecenoic acid, (e)-
alpha-Methylstyrene
Benzamide, N-propyl-
Cholestan-3-one, (5.alpha.)-
Cholestane
Cyclotetradecane, 1,7,11-trimethyl-4-(1-
D-Homoandrostane, (5.alpha.,13.alpha.)-
Eicosane
Ecocide, 9-cyclohexyl-
Erucylamide
Ethyl acetate
Heneicosane, 11-cyclopentyl-
Heneicosane, 11-pentyl-
Heptacosane, 1-chloro-
Heptadecane
Heptadecane, 9-octyl
Hexacosane
Hexadecanamide
Hexadecane, 2,6,10,14-tetramethyl-
Hexadecanoic acid
Imidazole, 2-fluoro-1-triacetylribofuran
Myristin, 2,3-diaceto-1-
N1-Tetrahydrofuran-2-ylmethyl-2-(4-chlor
n-Hexadecane
Nonadecane
Nonadecane, 1-chloro-
Octacosane
Octadecanamide
Octadecane, 1-chloro-
Octadecanoic acid
PCB 138
PCB 156
PCB 167
PCB 175
PCB 187
Silane, trichlorooctadecyl-
Stearic acid hydrazide
Tetradecanamide
Tricosane
Vitamin E

Only six of the detected TICs~~ identified chemicals,~~ alpha-methylstyrene, ethyl acetate, and the PCBs~~,~~ have associated toxicity criteria. Others do not ~~associated with it~~. Reported TICs such as siloxanes and amides are indicative of column breakdown and saturated fatty acids. With the exception of the PCBs, vitamin E, and beta-sitosterol, the above named compounds are indicative of column breakdown and are not likely to be Site-~~site~~ related. The PCBs are included in the PCB congener analysis USEPA method 1668. It is unknown~~unclear~~ what the source of vitamin E could be; however, it is unlikely to result in adverse health effects to those exposed. Beta-sitosterol is a plant sterol and could be present due to ~~some~~ organic matter collected along with the soil sample. ~~Toxicity criteria have not been established for any of these TICs.~~

### 4.5.8 Data Review Summary

For 801 ~~out~~ of the 15,487~~968~~ analytical results in the final HHRA dataset, quality criteria were not met and various data qualifiers were added to indicate limitations and/or bias in the data. The definitions for the data qualifiers, or data validation flags, used during validation are those defined in SOP-40 (BRC, ERM, and MWH 2008) and the project QAPP (BRC and ERM 2009a). Of the 801 qualified sample results, only one was rejected. Sample results are rejected based on findings of serious deficiencies in the ability to properly collect or analyze the sample and meet QC criteria. Only rejected data are considered unusable for decision-making purposes and rejected analytical results are not used in the HHRA.

As noted above, only one sample result (an ammonia result for GNBF19-11) was rejected in the Site dataset and excluded from the HHRA for the reasons previously noted. Other data points were excluded from the risk assessment not due to data quality issues, but for one of the following reasons: the sample was re-analyzed by the laboratory~~;~~ or the sample location was removed during a removal action.

## 4.6 CRITERION VI – DATA QUALITY INDICATORS

DQIs are used to verify that sampling and analytical systems used in support of project activities are in control and the quality of the data generated for this project is appropriate for making decisions affecting future activities. The DQIs address the field and analytical data quality aspects as they affect uncertainties in the data collected for site characterization and risk assessment. The DQIs include ~~precision, accuracy, representativeness, comparability, and completeness (~~PARCC~~)~~. The project QAPP provides the definitions and specific criteria for assessing DQIs using field and laboratory QC samples and is the basis for determining the overall quality of the dataset. Data validation activities included the evaluation of PARCC parameters, and all data not meeting the established PARCC criteria were qualified during the validation process using the guidelines presented in the National Functional Guidelines for Laboratory Data Review for~~,~~ Organics, ~~and~~ Inorganics, and Dioxin/Furans (USEPA 1999, 2004d, 2005a, 2008).

### 4.6.1 Evaluation of Data Precision

Precision is a measure of the degree of agreement between replicate measurements of the same source or sample. Precision is expressed by RPD between replicate measurements. Replicate measurements can be made on the same sample or on two samples from the same source. Precision is generally assessed using a subset of the measurements made. The precision of the

data was evaluated using several laboratory QA/QC procedures. Based on BRC's~~ERM's~~ review of the results of these procedures, the general level of precision for the Site data and the background data (BRC and ERM 2009b) does not appear to limit the usability of a particular analyte, sample, method, or dataset as a whole.

### 4.6.2 Evaluation of Data Accuracy

Accuracy measures the level of bias that an analytical method or measurement exhibits. To measure accuracy, a standard or reference material containing a known concentration is analyzed or measured and the result is compared to the known value. Several QC parameters are used to evaluate the accuracy of reported analytical results, including:

- Holding times and sample temperatures;
- Calibration limits;
- LCS percent recovery;
- MS/MSD percent recovery;
- Spike sample recovery (inorganics);
- Surrogate spike recovery (organics); and
- Blank sample results.

Detailed discussions of ~~and tables with~~ specific exceedances~~, with respect~~ to precision and accuracy (with tables)~~,~~ are provided in the DVSRs (BRC and ERM 2010b, ~~2010a,b,~~c, d) and data qualified as a result of this evaluation are presented with qualifiers in the data usability tables in Appendix E (included on the report CD in Appendix B). As presented in Section 4.5, only one sample result (an ammonia result for GNBF19-11) was rejected in the Site dataset and excluded from the HHRA. The remaining results were considered sufficiently accurate for risk assessment purposes, as discussed below.

#### *4.6.2.1 Holding Time Exceedances/Sample Condition*

There is a potential for analyte loss if the holding time for a sample is exceeded. As discussed in Section 4.5.1, ~~for the Site,~~ holding times were exceeded in three soil samples for hexavalent chromium analysis (less than 1 ~~one~~ percent of the samples analyzed for that constituent), and in

one sample and its duplicate for dioxin/furan analysis (less than 1~~one~~ percent of the samples analyzed). All three ~~of the~~ samples were qualified as estimated. Based on the limited holding time issues, there is not likely to be a significant potential for a low bias to the hexavalent chromium or dioxin/furan datasets for Site soils.

As presented in the DVSRs (BRC and ERM 2010b, ~~2010a,b,~~c, d), all Site samples with temperature requirements were received at the laboratory within the required range of 4° ±~~°±~~ 2° Celsius. No sample results were qualified based on sample temperatures or due to lack of proper preservation.

*4.6.2.2 Calibration Violations Indicating a~~A~~ Low Bias*

The instrument calibration checks that ~~which~~ resulted in a low bias are summarized in the tables presented in Section 4.5.6. Five~~There were five~~ TO-15 surface flux analytes (~~,~~ 1,2,4-trichlorobenzene, acetone, bromomethane, carbon disulfide, and methyl iodide~~) which~~ had recoveries below 50 percent in some samples. 1,2,4-Trichlorobenzene, acetone, and carbon disulfide were qualified in all samples due to calibration violations. However, only 1,2,4-trichlorobenzene was non-detect~~detected~~ in all samples. 1,2,4-Trichlorobenzene is evaluated further in the Uncertainty Analysis (Section 7) of the report. For the other non-detect analytes with SQLs, the maximum SQLs were compared to the residential soil BCL. It is unlikely, ~~that~~ even with a potential for a false negative, that the bias could affect the result to such a degree that the analyte is present at the Site in excess of the BCL.

*4.6.2.3 MS/MSD or LCS/LCSD Recoveries below~~Below~~ Acceptance Criteria*

During the data usability review, results associated with MS/MSD and/or LCS/LCSD recoveries that were only slightly lower than the lower acceptance limit (*i.e.*, 50 to 75 percent recoveries for inorganics ~~and the higher of greater than 30 percent or one-half the statistically-derived lower limit for organics~~) were accepted as usable without further evaluation. Samples with lower percent recoveries (*i.e.*, recoveries lower than 50 percent for inorganics and one-half the lower limit or 30 percent, whichever is greater, for organics) were reviewed more closely to assess if~~whether~~ it was appropriate to use them in the HHRA. Inorganic results with MS/MSD recoveries less than 50 percent [37] were as follows:

[37] Only samples associated with MS/MSD results in which~~where~~ both recoveries were below 50 percent~~%~~ are listed.

- An ammonia result for one soil sample (GNC1-BF19-11) in TestAmerica data package F9B060191 (a non-detection, which was later rejected on this basis);
- Antimony results for two soil samples in TestAmerica data package F9A290238 (both non-detections); and
- Antimony and tungsten results for two ~~three~~ soil samples in TestAmerica data package F9H030409 (all non-detections).

Given the small~~limited~~ number of samples involved, these data points are not likely to have a significant effect on risk assessment. Furthermore, antimony was not detected in any Site soil samples and it is unlikely that it was present in the four~~these five~~ samples listed above. Similarly, tungsten was ~~not routinely~~ detected in three of 55 Site samples. ~~(three detections in 55 samples).~~

No organic results were associated with recoveries below the lower laboratory limit.

As noted in Section 4.5.3, LCS/LCSD recoveries lower than the lower laboratory control limit were observed for cyanide for two soil samples (GNC1-BD19-0 and GNC1-BD19-10~~F9A290238~~), both non-detections and for two detections of 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin (TestAmerica data package F9A300184). Because the cyanide and dioxin recoveries (83~~%~~ and 78 percent~~%~~, respectively) were only slightly lower than the lower laboratory control limit (85~~%~~ and 79 percent~~%~~, respectively), no concerns were identified regarding their usability.

*4.6.2.4 Surrogate Percent Recoveries below~~Below~~ Laboratory Control Limit*

As noted in Section 4.5.5, surrogate recoveries lower than the lower laboratory control limit were observed for organochlorine pesticides in one laboratory batch (TestAmerica data package F9B070176). Because the recoveries in this analytical batch (60 percent~~%~~) were not substantially~~only slightly~~ lower than the lower laboratory control limit (72 percent~~%~~), no concerns were identified regarding their usability.

*4.6.2.5 Blank Contamination*

As noted in Section 4.5.2, certain detections were flagged during the data review as being non-detections or estimated with a high bias due to laboratory or field blank contamination. If the associated constituent qualified as being a non-detection was~~were~~, in fact, present in the samples related to the affected blank sample, revising its status to non-detect could result in risk

underestimation. In the dataset for the Site, 318~~a total of 339~~ results were censored due to blank contamination. Affected analytes are listed in Table 4-12.~~as follows:~~

**TABLE 4-12: SUMMARY OF ANALYTES CENSORED DURING BLANK SAMPLE EVALUATION**

| Analyte | # of Censored Results | Analyte | # of Censored Results | Analyte | # of Censored Results |
|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane (Flux) | 1 | bis(2-Ethylhexyl) phthalate | 2 | o-Xylene (Flux) | 2 |
| 1,1,2-Trichloroethane (Flux) | 1 | Boron | 5 | Radium-226 | 1 |
| 1,2,3,4,6,7,8-Heptachloro-dibenzo-p-dioxin | 2 | Cadmium | 4 | Selenium | 8 |
| 1,2,4-Trimethylbenzene | 33 | Cyanide, Total | 34 | Selenium (SPLP) | 1 |
| 1,2-Dichlorobenzene (Flux) | 2 | Dichloromethane | 18 | Styrene | 16 |
| 1,3-Dichlorobenzene (Flux) | 2 | 1,2-Dibromoethane (Flux) | 2 | Tetrachloroethene (Flux) | 1 |
| 1,4-Dichlorobenzene (Flux) | 2 | Formaldehyde | 4 | Thorium-230 | 3 |
| Acetaldehyde | 1 | Isopropylbenzene (Flux) | 1 | Tin | 8 |
| Acetone | 43 | m & p-Xylene (Flux) | 1 | Toluene (Flux) | 3 |
| Acetone (Flux) | 3 | Mercury | 23 | Total Kjeldahl Nitrogen (TKN) (SPLP) | 1 |
| Acetonitrile (Flux) | 1 | Mercury (SPLP) | 1 | Total Organic Carbon | 9 |
| Ammonia (as N) | 2 | Methyl ethyl ketone (Flux) | 1 | Total Organic Carbon (SPLP) | 1 |
| Antimony | 3 | Molybdenum | 8 | Trichloroethene (Flux) | 7 |
| Antimony (SPLP) | 1 | Octachlorodibenzodioxin | 5 | Tungsten | 3 |
| Arsenic | 2 | Orthophosphate | 7 | Uranium-233/234 | 11 |
| Benzene (Flux) | 14 | Orthophosphate (SPLP) | 1 | Uranium-235/236 | 1 |
| | | | | Uranium-238 | 12 |

| ~~Analyte~~ | ~~# of Censored Results~~ | ~~Analyte~~ | ~~# of Censored Results~~ |
|---|---|---|---|
| ~~Orthophosphate as P~~ | ~~8~~ | ~~1,2,4-Trimethylbenzene~~ | ~~35~~ |
| ~~Ammonia [as N]~~ | ~~2~~ | ~~1,2-Dichlorobenzene~~ | ~~1~~ |
| ~~Total Organic Carbon~~ | ~~8~~ | ~~1,3,5-Trimethylbenzene~~ | ~~1~~ |
| ~~Radium-226~~ | ~~1~~ | ~~Acetone~~ | ~~43~~ |
| ~~Thorium-230~~ | ~~3~~ | ~~Methylene chloride~~ | ~~18~~ |
| ~~Uranium-233/234~~ | ~~11~~ | ~~Ethylbenzene~~ | ~~1~~ |
| ~~Uranium-235/236~~ | ~~1~~ | ~~Styrene~~ | ~~18~~ |
| ~~Uranium-238~~ | ~~12~~ | ~~9-Octadecenamide, (z)-~~ | ~~6~~ |
| ~~Arsenic~~ | ~~2~~ | ~~bis(2-Ethylhexyl) phthalate~~ | ~~2~~ |
| ~~Antimony~~ | ~~3~~ | ~~Unknown~~ | ~~8~~ |
| ~~Boron~~ | ~~5~~ | ~~Unknown aldol condensate~~ | ~~48~~ |
| ~~Cadmium~~ | ~~5~~ | ~~1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin~~ | ~~2~~ |
| ~~Molybdenum~~ | ~~8~~ | ~~Octachlorodibenzodioxin~~ | ~~3~~ |
| ~~Selenium~~ | ~~8~~ | ~~Acetaldehyde~~ | ~~1~~ |

| | | | |
|---|---|---|---|
| Thallium | 1 | Formaldehyde | 5 |
| Tin | 9 | Cyanide, Total | 34 |
| Tungsten | 3 | | |
| Mercury | 23 | | |

The constituents for which this potential concern has the most bearing in risk assessment are those in soil samples for which the detections are close to or exceed either (1) background conditions, or (2) relevant human health comparison levels (i.e.g., the, NDEP BCLs). As determined during that evaluation, qualification of detections as non-detections based on blank contamination is are not likely to have an appreciable effect on the risk estimates, as discussed below.

Censored results that are less than the maximum background concentration and the residential soil BCL would have a negligible impact on risk assessment findings. If a portion of the result reflects an actual site concentration, then the uncertainty related to the censored result is low. However, data censored at values at or above background, where applicable, or the residential soil BCLs, may pose a potential underestimation of human health risks. Therefore, censored results at values in excess of the residential soil BCL (or the maximum background concentration, if higher) were evaluated further. With the exception of arsenic and threecertain radionuclides, none of the soil data censored due to blank contamination waswere in excess of the BCLs. The fouronly analytes with censored results greater than the BCLs are listed in Table 4-13 as follows:

**TABLE 4-13: ANALYTES CENSORED DURING BLANK SAMPLE EVALUATION WITH RESULTS GREATER THAN BCLs**

| Analyte | Range of Censored Results | BCL | Maximum Background Concentration |
|---|---|---|---|
| Arsenic (2 censored results) | 3.8 to 4 mg/kg | 0.39 mg/kg | 7.2 mg/kg |
| Radium-226 (1 censored result) | 0.773 pCi/g | 0.0071 pCi/g | 2.36 pCi/g |
| Uranium-235/236 (1 censored result) | 0.247 pCi/g | 0.11 pCi/g | 0.21 pCi/g |
| Uranium-238 (12 censored results) | 0.533 to 0.989 pCi/g | 0.46 pCi/g | 2.37 pCi/g |

With the exception of the sole uranium-235/236 result, all of the above-listed censored data were lower than the maximum background concentration. The uranium-235/236 results were determined to be in secular equilibrium and within the range of background. Therefore, these censored data do not represent a significant potential for risk underestimation.

Surface flux data are not comparable with BCLs. Benzene was associated with 14 censored data points (of 16 surface flux samples); the remaining censored analytes were associated with five or fewer surface flux samples. Benzene was detected at 14 of 16 surface flux locations, but was qualified as non-detect~~detections~~ in 14 of 16 for the full scan analysis and 0 of 16 in the SIM analysis. Widespread blank contamination was noted for the full scan surface~~soil~~ flux analysis of benzene. Benzene has been detected in groundwater across the BMI Complex. Since benzene was also detected in the SIM analysis (and not censored), risk estimates were calculated for benzene based on the SIM analysis results. Therefore, there is likely no effect on the final risk estimates for the Site~~site~~. Benzene is discussed further in the Uncertainty Analysis (Section 7) of this ~~the~~ report.

*4.6.2.6 Data Usability Summary*

As discussed above, because the~~any~~ qualifications with the potential for low bias were small~~limited~~ in number, the data usability evaluation determined it was unlikely that they could lead to significant risk underestimation. Furthermore, the small~~limited~~ amount of rejected data points (one ammonia result) does not represent a significant data gap in terms of risk assessment.

### 4.6.3 Evaluation of Data Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of the population at a sampling point or an environmental condition (USEPA 2002a). There is no standard method or formula for evaluating representativeness, which is a qualitative term. Representativeness is achieved through selection of sampling locations that are appropriate relative to the objective of the specific sampling task, and by collection of an adequate number of samples from the relevant types of locations. The sampling locations at the Site were based on both systematic sampling with random point placement within each grid cell, as well as focused samples collected from specific areas to further investigate potential areas of concern.

The samples were analyzed for a broad spectrum of chemical classes across the Site. Samples were delivered to the laboratory in coolers with ice to minimize the loss of analytes. In a few instances, such as samples being analyzed slightly beyond the holding time or delayed preservation of SPLP samples, the representativeness of the associated data is in question; however, there were limited instances of this, as discussed in Section 4.5.1. As previously noted, no sample results were qualified based on sample temperatures or preservation.

Sample specific results are discussed in the DVSRs. A discussion of representativeness for the background dataset is provided in each of the background investigation reports~~*Background Shallow Soil Summary Report, BMI Complex and Common Area Vicinity* (BRC and TIMET 2007)~~.

### 4.6.4 Evaluation of Data Completeness

Completeness is commonly expressed as a percentage of measurements that are valid and usable relative to the total number of measurements made. Analytical completeness is a measure of the number of overall accepted analytical results, including estimated values, compared to the total number of analytical results requested on samples submitted for analysis after review of the analytical data. Some of the data were eliminated due to data usability concerns. The percent completeness for the Site is 99.99 percent and includes the surface flux chamber data. The percent completeness for the soil-~~-~~only dataset is 99.99 percent. The percent completeness for~~in~~ the background dataset used in the HHRA is 99.4~~98.5~~ percent~~ (BRC and TIMET 2007)~~.

### 4.6.5 Evaluation of Data Comparability

Comparability is a qualitative characteristic expressing the confidence with which one dataset can be compared with another. The desire for comparability is the basis for specifying the analytical methods; these methods are generally consistent with those used in previous investigations of the Site. The comparability goal is achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units. The ranges of detected sample results from the current investigation are generally comparable to recent results at the Eastside, as well as to the Site~~site~~ background datasets (~~see~~ Section 5).

One exception may be uranium-235/236, which has reported activities that are somewhat elevated compared to background and other reported isotopes of uranium. This~~One~~ difference may be because the Site dataset's~~between the site dataset and background is that the site~~ radionuclide analyses were performed at a different laboratory than the background dataset. The laboratory that performed the Site radionuclide analysis has indicated that the activities for uranium-235/236 hover around the noise level of the instrument and secular equilibrium is still achieved. Therefore, activities at the noise level of the instrument may vary between the instruments used at either laboratory.

There are differences in SQLs among datasets that~~which~~ may affect data comparability for datasets comprised primarily of non-detect~~detected~~ values. Examples of the differences in SQLs

at the Site~~site~~ and in shallow background for several analytes with low detection frequency are provided~~shown~~ in Table 4-14~~the following table~~.

**TABLE 4-14: LOW DETECTION ANALYTES EXHIBITING SQL DIFFERENCES BETWEEN BACKGROUND AND SITE SAMPLES**

| Analyte | Background Min SQL | Background Max SQL | Site Min SQL | Site Max SQL[38] |
|---|---|---|---|---|
| Antimony | 0.0394 | 0.3298 | 0.225 | 2.7 |
| Boron | 3.2 | 5.4 | 16.5 | 53 |
| Mercury | 0.0072 | 0.0072 | 0.005 | 0.0373 |
| Selenium | 0.1579 | 0.1579 | 0.4 | 2.7 |
| Thallium | 0.5428 | 1.3 | 0.105 | 1 |

All results in units of mg/kg.

Cumulative probability plots and side-by-side boxplots for the background and Site datasets are included in Appendix ~~Appendix~~ G. For these datasets, left-censored data can result in difficulties in differentiating whether datasets are actually different or merely an artifact of detection limits. Note that for constituents with SQLs that meet project limit requirements, comparisons between Site and background may be less important as these left-censored data are likely to indicate conditions that pose an "acceptable" risk and further evaluation is not necessary.

## 4.7 DATA ANALYSIS

Data validation and usability evaluations tend to look at the data on a result--by--result basis. The data analysis step is intended to take a step back and look at the dataset as a whole. The intent of this is to identify any anomalies or unusual data trends that may indicate ~~any~~ potential laboratory issues. This is performed by reviewing summary statistics, cumulative probability plots and side-by-side boxplots, or other visual aids. The soil dataset used for the HHRA is summarized in tabular format in Table 3-4. While it is not feasible to present all the detected analytes in a graphical format, cumulative probability plots and side-by-side boxplots are provided in Appendix ~~Appendix~~ G for the analytes included in the background comparisons (that is, metals and radionuclides). No anomalies in the dataset were identified.

As discussed in Section 4.5, the data validation process resulted in numerous sample results being qualified as estimated, with only the above-listed results being rejected. Sample results qualified as estimated are likely to be quantitatively biased to some degree; estimated analytical

[38] The SQLs reported here may differ from the detection limits reported elsewhere (*e.g.*, background comparisons). Detection limits may be raised due to blank contamination.

results are used in the HHRA. Data qualified as anomalous, as defined in the DVSRs, refers to data that were qualified ("U") due to blank contamination, and are used in the HHRA. These data usability decisions follow the guidelines provided in the *Guidance for Data Usability in Risk Assessment (Part A)* (USEPA 1992a).

For the HHRA, all soil data associated with post-remediation conditions that were not rejected during data validation, replaced by re-analysis results, or removed during a soil removal action were included. Some data~~Data~~ were ~~often~~ qualified as estimated due to recoveries being outside the acceptance criteria. In cases where the recoveries were higher than the acceptance criteria, the results have the potential of being similarly biased high, and using these data in the risk assessment could result in risks being calculated that are higher than would be associated with actual Site conditions. Of more concern for the HHRA is underestimation of risk, which could be associated with the use of data that are biased low. Results associated with the following QA/QC issues could lead to results that are biased low, and were subjected to further scrutiny during the data usability evaluation:

- Results associated with holding time exceedances;
- Detections qualified during the data review as being non-detections due to laboratory or field blank contamination;
- Results associated with calibration violations indicating a low bias;
- Results associated with MS/MSD or LCS/LCSD recoveries below acceptance criteria; and/or
- Results associated with surrogate percent recoveries below laboratory control limits.

Such data, which are listed above in Section 4.5, were evaluated during the data usability process to determine whether it was appropriate to use them in the risk assessment. The data usability evaluation determined that the estimated results listed in Section 4.5 were appropriate for use in the risk assessment and that the rejected data did not constitute significant data gaps and/or were~~was~~ not otherwise likely to lead to an underestimation of risk, as discussed in Section 4.6.2.

# 5.0 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The broad suite of analytes sampled for was the initial list of potential COPCs at the Site. However, to ensure that a risk assessment focuses on those substances that contribute the greatest to the overall risk (USEPA 1989)~~,~~; the following procedures were used to eliminate analytes as COPCs for quantitative evaluation in the risk assessment:[39]

- Identification~~identification~~ of chemicals with detected levels similar to background concentrations (where applicable) (Section 5.1)~~;~~,
- Site and background lithology considerations (Section 5.2);
- Chemicals~~chemicals~~ that are considered essential nutrients (Section 5.3); and~~2),~~
- ~~Chemicals chemicals with maximum concentrations below risk-based comparison levels (*i.e.*, below one-tenth of the residential soil BCLs) (Section 5.3),~~
- ~~Site and background lithology considerations (Section 5.4), and~~
- ~~identification of organic chemicals that are infrequently detected at the Site (Section 5.5~~).

Following USEPA guidance (1989), compounds reliably associated with Site activities based on historical information were not eliminated from the risk assessment, even if the results of the procedures given in this section~~Section~~ indicate that such elimination is possible. The procedures for evaluating COPCs relative to background conditions and further selection of COPCs based on the other procedures are presented below.

## 5.1 EVALUATION OF CONCENTRATIONS/ACTIVITES RELATIVE TO BACKGROUND CONDITIONS

Some chemicals at the Site, particularly metals and radionuclides, are known to be naturally - occurring constituents of soils and groundwater. A risk assessment should consider the contribution of background concentrations to overall Site risks, as differentiated from those concentrations associated with historical Site operations or regional anthropogenic conditions.

[39] Note that these procedures for selection of COPCs deviate somewhat from those presented in the BRC Closure Plan, but are consistent with discussions between BRC and NDEP and their consultants in a December 9, 2010, meeting. BRC will use these procedures for all subsequent risk assessments. BRC will also revise the Closure Plan accordingly to make it consistent with these procedures.

Therefore, it is necessary to establish Site~~site~~-specific background conditions to support the risk assessment.

As discussed in BRC's draft *Evaluations Conducted for Multiple Lines of Evidence for the Selection of Metal COPCs* (BRC 2011b), background data recommended for the Site is the entire Qal background dataset. The lithology for the Site and surrounding area is shown on Figure 12~~indicated in the *Background Shallow Soil Summary Report, BMI Complex and Common Area Vicinity* (BRC and TIMET 2007) the Site is in an area of McCullough lithology (see Figure 12, $Qh_1$ label)~~. Therefore, comparison of Site-related soil concentrations to background levels was conducted using the entire Qal~~shallow soils~~ background dataset ~~(McCullough lithology only)~~ presented in the *Background Soil Compilation Report* (BRC and ERM 2010a).~~TIMET (2007).~~[40] The background dataset used is included in the dataset file on the enclosed report CD in Appendix B~~ (the background dataset for the deep McCullough soils is also provided)~~.

Background comparisons were performed using the Quantile test, Slippage test, the *t*-test, and the Wilcoxon Rank Sum (WRS) test with Gehan modification. The computer statistical software program, Guided Interactive Statistical Decision Tools (GiSdT®; Neptune and Company 2009), was used to perform all background comparison statistics. A weight-of-evidence approach is utilized to interpret the results of these analyses. If the detection frequency in both Site and background datasets is ~~are~~ greater than 40 percent, then the following rationale is used for evaluation: (1) where one or two results fail one or more of the statistical tests, the remaining testing and statistical information (boxplots, summary statistics) are reviewed to support decision-making regarding whether or not the chemical should be considered consistent with background (as described by the rationale in the table below); and (2) where three or more statistical tests fail, the constituent is considered inconsistent with background. If the detection frequency is less than 40 percent in either the background or Site datasets, then the constituent is evaluated based on boxplots and summary statistics.

~~[40] However, it is noted that the Site, especially sub-surface soil, may also be more representative of deeper McCullough soils than that characterized by the shallow soil background dataset. These soils may be more representative of background soil characterized by the *2008 Deep Soil Background Report – BMI Common Areas (Eastside), Clark County, Nevada* (BRC and ERM 2009c). Therefore, although not evaluated in this report, comparisons could also be conducted using the deep McCullough background dataset. It is noted that preliminary background comparisons to this deeper background dataset indicate results similar to those for the shallow soil dataset used in this evaluation.~~

For samples with primary and field duplicate results, the Site sample and field duplicate[41] are treated as independent samples and both are included in all subsequent data analyses, regardless of whether one or both are non-detect. This is considered appropriate because field duplicate samples represent a discrete and unique measurement of soil chemical conditions proximal to the primary sample (unlike split samples). The field duplicates were compared to the primary sample during the course of data validation. The variances were not out of the line with the variance in results across the Site. Therefore, as distinct soil chemical measurements, they are treated as unique samples in the analyses.

The entire Qal background dataset was compared to the Site HHRA dataset as a whole. The results of the background comparison evaluation are presented in Table 5-1 (Tables section), and summarized in Table 5-2 below.

**TABLE 5-2: SUMMARY OF STATISTICAL BACKGROUND COMPARISON EVALUATION**

| Chemical | Statistical Tests Greater than Background? | Geochemical Evaluation Greater than Background?[1] | Greater than Background? | Basis |
|---|---|---|---|---|
| Aluminum | **YES** | NO | NO | Geochemical evaluation |
| Antimony | NO | N/A | NO | Multiple tests; ND in Site |
| Arsenic | NO | NO | NO | Multiple tests; geochemical evaluation |
| Barium | **YES** | NO | NO | Geochemical evaluation |
| **Beryllium** | **YES** | N/A | **YES** | Multiple tests |
| **Boron** | **YES** | N/A | **YES** | Multiple tests |
| **Cadmium** | **YES** | N/A | **YES** | Multiple tests |
| Calcium | **YES** | NO | NO | Geochemical evaluation |
| **Chromium** | **YES** | N/A | **YES** | Multiple tests |
| Chromium (VI) | NO | N/A | NO | Multiple tests |
| Cobalt | **YES** | NO | NO | Geochemical evaluation |
| **Copper** | **YES** | N/A | **YES** | Multiple tests |

[41] Field duplicates are shown in Appendix B and indicated with the "FD" qualifier under the column entitled "Sample Type.""~~.~~

## TABLE 5-2: SUMMARY OF STATISTICAL BACKGROUND COMPARISON EVALUATION

| Chemical | Statistical Tests Greater than Background? | Geochemical Evaluation Greater than Background?[1] | Greater than Background? | Basis |
|---|---|---|---|---|
| Iron | **YES** | NO | NO | Geochemical evaluation |
| **Lead** | **YES** | N/A | **YES** | Multiple tests |
| Lithium | NO | N/A | NO | Multiple tests |
| Magnesium | **YES** | NO | NO | Geochemical evaluation |
| Manganese | **YES** | NO | NO | Geochemical evaluation |
| **Mercury** | **YES** | N/A | **YES** | Multiple tests |
| **Molybdenum** | **YES** | N/A | **YES** | Multiple tests |
| **Nickel** | **YES** | N/A | **YES** | Multiple tests |
| **Potassium** | **YES** | N/A | **YES** | WRS test |
| **Selenium** | **YES** | N/A | **YES** | Multiple tests |
| Silver | NO | N/A | NO | Multiple tests |
| Sodium | NO | N/A | NO | Multiple tests |
| Strontium | **YES** | NO | NO | Geochemical evaluation |
| Thallium | NO | N/A | NO | Multiple tests; ND in Site |
| **Tin** | **YES** | N/A | **YES** | Multiple tests |
| **Titanium** | **YES** | N/A | **YES** | Multiple tests |
| **Tungsten** | **YES** | N/A | **YES** | Multiple tests |
| Uranium | NO | N/A | NO | Multiple tests |
| Vanadium | **YES** | NO | NO | Geochemical evaluation |
| **Zinc** | **YES** | N/A | **YES** | Multiple tests |
| Radium-226 | NO | N/A | NO | Multiple tests |
| Radium-228 | NO | N/A | NO | Multiple tests |
| Thorium-228 | NO | N/A | NO | Multiple tests |
| Thorium-230 | NO | N/A | NO | Multiple tests |
| Thorium-232 | NO | N/A | NO | Multiple tests |

## TABLE 5-2: SUMMARY OF STATISTICAL BACKGROUND COMPARISON EVALUATION

| Chemical | Statistical Tests Greater than Background? | Geochemical Evaluation Greater than Background?[1] | Greater than Background? | Basis |
|---|---|---|---|---|
| Uranium-233/234 | NO | N/A | NO | Multiple tests |
| Uranium-235/236 | NO | N/A | NO | Other radionuclides (and uranium) not greater than background; all results near noise level of instrument |
| Uranium-238 | NO | N/A | NO | Multiple tests |

[1]Geochemical evaluation presented in Section 5.2.
N/A = Not evaluated.

Cumulative probability plots and side-by-side boxplots[42] were also prepared and are included in Appendix G. These plots give a visual indication of the similarities and differences between the Site and background datasets. The results of this comparison indicate that a number of metals are statistically significant (greater than) with respect to background levels. Due to the large number of sample data in both the Site and background datasets, even small differences between the two are identified as statistically significant. For example, although there were small differences in median concentrations, cobalt, copper, and nickel were found to be statistically greater than background, as shown in Table 5-3.

## TABLE 5-3: EXAMPLE DIFFERENCES IN SITE AND BACKGROUND MEDIAN CONCENTRATIONS FOR CHEMICALS STATISTICALLY GREATER THAN BACKGROUND

~~The 2003 and 2005 McCullough background dataset as a whole was compared to HHRA dataset as a whole. The results of the background comparison evaluation are presented in Table 7, and summarized below.~~

| ~~Chemical~~ | ~~Greater than Background?~~ | ~~Basis~~ |
|---|---|---|
| ~~**Aluminum**~~ | ~~**YES**~~ | ~~Multiple tests~~ |
| ~~Antimony~~ | ~~NO~~ | ~~Non-detect at Site; boxplots~~ |
| ~~**Arsenic**~~ | ~~**YES**~~ | ~~Multiple tests~~ |

[42] Site and background boxplots were segregated by depth (and all data). This is different than how the data were segregated in the development of exposure point concentrations as presented in Section 6.1.

| ~~Chemical~~ | ~~Greater than Background?~~ | ~~Basis~~ |
|---|---|---|
| ~~Barium~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Beryllium~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Boron~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Cadmium~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Calcium~~ | ~~YES~~ | ~~WRS test~~ |
| ~~Chromium~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Chromium (VI)~~ | ~~YES~~ | ~~Non-detect in background~~ |
| ~~Cobalt~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Copper~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Iron~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Lead~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Lithium~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Magnesium~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Manganese~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Mercury~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Molybdenum~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Nickel~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Potassium~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Selenium~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Silver~~ | ~~YES~~ | ~~Slippage test~~ |
| ~~Sodium~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Strontium~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Thallium~~ | ~~NO~~ | ~~Non-detect at Site~~ |
| ~~Tin~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Titanium~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Tungsten~~ | ~~NO~~ | ~~Multiple tests~~ |
| ~~Uranium~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Vanadium~~ | ~~YES~~ | ~~Multiple tests~~ |

| ~~Chemical~~ | ~~Greater than Background?~~ | ~~Basis~~ |
|---|---|---|
| ~~Zinc~~ | ~~YES~~ | ~~Multiple tests~~ |
| ~~Radium-226~~ | ~~NO~~ | ~~Multiple tests~~ |
| ~~Radium-228~~ | ~~NO~~ | ~~Multiple tests~~ |
| ~~Thorium-228~~ | ~~NO~~ | ~~Multiple tests~~ |
| ~~Thorium-230~~ | ~~NO~~ | ~~Multiple tests~~ |
| ~~Thorium-232~~ | ~~NO~~ | ~~Multiple tests~~ |
| ~~Uranium-233/234~~ | ~~NO~~ | ~~Multiple tests~~ |
| ~~Uranium-235/236~~ | ~~NO~~ | ~~Multiple tests~~ |
| ~~Uranium-238~~ | ~~NO~~ | ~~Multiple tests~~ |

~~Cumulative probability plots and side-by-side boxplots[43] were also prepared and are included in Appendix G. These plots give a visual indication of the similarities/differences between the Site and background datasets. The results of this comparison indicate that a large number of metals are statistically significant (greater than) background levels. Due to the large number of sample data in both the Site and background datasets, even small differences between the two are identified as statistically significant. For example, although there were small differences in median concentrations, cobalt, copper, and nickel were found to be statistically greater than background:~~

| **Metal** | **Difference**[1] (median concentrations) |
|---|---|
| Cobalt | 0.80 mg/kg |
| Copper | 2.3 mg/kg |
| Nickel | 1.0 mg/kg |

1 These differences in median concentrations were small relative to both background median concentrations and residential soil BCLs.

It should be noted that~~As~~ statistically significant differences may not represent scientifically and ~~/~~technically relevant differences. Therefore, the metals identified above as greater than background using statistical tests are evaluated further in Section 5.2.

~~[43] Site and background boxplots were segregated by depth (and all data). This is different than how the data were segregated in the development of exposure point concentrations as presented in Section 6.1.~~

**Secular Equilibrium for Radionuclides.** For radionuclides, secular equilibrium exists when the quantity of a radioactive isotope remains constant because its production rate (due to the decay of a parent isotope) is equal to its decay rate. In theory, if secular equilibrium exists, the parent isotope activity should be equivalent to the activity of all daughter radionuclides. Pure secular equilibrium is not expected in environmental samples because of the effect of natural chemical and physical processes. However, approximate secular equilibrium is expected under background conditions (NDEP 2009e). Both the thorium-232 and uranium-238 chains were determined to be in approximate secular equilibrium following equivalence testing outlined in the NDEP's *Guidance for Evaluating Secular Equilibrium at the BMI Complex and Common Areas February* (NDEP 2009e~~2009a~~). The results of the equivalence testing for secular equilibrium are provided in Table 5-4.~~as follows:~~

**TABLE 5-4: SECULAR EQUIVALENCE TESTING RESULTS**

| Chain | Equivalence Test | | Secular Equilibrium? | Mean Proportion | | | |
|---|---|---|---|---|---|---|---|
| | Delta | *p*-value | | Ra-226 | Th-230 | U-233/234 | U-238 |
| U-238 | 0.1 | 0.002500~~14~~ | Yes | 0.28692~~859~~ | 0.25472~~556~~ | 0.22792~~303~~ | 0.2305~~2282~~ |
| | | | | Ra-228 | Th-228 | Th-232 | |
| ~~Th-232~~Th-232 | 0.1 | <0.0001 | Yes | 0.3172 | 0.34983~~513~~ | 0.33333~~317~~ | |

Therefore, since no radionuclides failed any background tests and all are in secular equilibrium, all radionuclides are considered to be similar to background. Radionuclides are therefore not evaluated further in the HHRA.

## 5.2 GEOCHEMICAL EVALUATION

Because of the number of metals that are indicated by the statistical tests in Section 5.1 to have statistically significant differences when compared to the background dataset, a geochemical evaluation was also conducted for the Site. Appendix H provides the methodology and results of the geochemical evaluation of the concentrations of selected metals in background and Site soil samples.[44] The geochemical evaluation was performed to provide independent lines of evidence to compliment the standard statistical site-to-background comparisons performed in Section 5.1. Statistical site-to-background comparisons for trace elements in soil commonly have high false-positive and false-negative error rates. They also consider only the absolute concentrations of

[44] The geochemical evaluation was not performed for all metals.

individual elements, disregarding the interdependence of element concentrations and the geochemical mechanisms controlling element behavior. A full discussion on the geochemical evaluation methodology and results is presented in Appendix H. Based on the results of the geochemical evaluation, the following metals, which were initially considered greater than background using the standard site-to-background comparisons performed in Section 5.1, are considered to be naturally occurring:

- Calcium
- Magnesium
- Aluminum
- Arsenic
- Strontium
- Iron
- Vanadium
- Cobalt
- Barium

## 5.3 ESSENTIAL NUTRIENTS

An essential nutrient is a chemical required for normal body functioning that either cannot be synthesized by the body at all, or cannot be synthesized in amounts adequate for good health, and thus must be obtained from a dietary source. USEPA (1989) states that "Chemicals that are (1) essential human nutrients, (2) present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and (3) toxic only at very high doses (i.e., much higher than those that could be associated with contact at the Site~~site~~) need not be considered further in the quantitative risk assessment. Examples of such chemicals are calcium, iron, magnesium, potassium, and sodium." As discussed with and approved by the NDEP[45] and consistent with guidance and standard practices, no further quantitative evaluations are required for these essential nutrients.

## 5.4 COMPARISON TO RESIDENTIAL SOILS BCLS

~~5.3 BCLs~~

BCLs for residential soils are chemical-specific, risk-based concentrations in soils that are protective of a residential land use scenario (NDEP 2011a~~2010a~~). As discussed with and approved by the NDEP (see footnote 35~~23~~), if the maximum detected concentration for a constituent is less than one-tenth of the residential soil BCL, then no further quantitative

[45] Meeting with NDEP on December 9, 2010.

evaluation is required for that constituent. For those constituents with 100 percent non-detect~~detected~~ values, if the maximum non-detect concentration[46] for a constituent is less than one-tenth of the residential soil BCL, no further evaluation will be conducted. If the maximum non-detect concentration is greater than one-tenth of the residential soil BCL, no further quantitative evaluation will be conducted; however, a discussion is provided in the Uncertainty Analysis (Section 7) ~~of the report~~ for these constituents.

Consistent with the Closure Plan, if the TCDD TEQ concentrations do not exceed the NDEP residential BCL of 50 ppt for any sample within the Site,[47] dioxins/furans are not retained as COPCs. Therefore, because this criterion is met for the Site, dioxins/furans are not considered COPCs, and are not evaluated further in the HHRA. Lead was also not evaluated further in the HHRA since all concentrations were below its target goal of 400 mg/kg for residential land use.

The results of comparisons to one-tenth of the residential soil BCL are presented in Table 5-5 (Tables section)~~8~~, and summarized in Table 5-6 below.

**TABLE 5-6: RESULTS OF COMPARISON TO RESIDENTIAL SOILS BCLs**

| Chemical~~Chemical~~ | ~~Maximum Concentration Greater than BCL?~~ | ~~Notes~~ |
|---|---|---|
| ~~Aluminum~~ | Maximum Concentration | ~~Notes~~ |
| ~~Perchlorate~~Arsenic | **YES** | |
| ~~Cobalt~~ | ~~YES~~ | |
| ~~Lithium~~ | ~~YES~~ | |
| ~~Manganese~~ | ~~YES~~ | |
| ~~Vanadium~~ | ~~YES~~ | |
| ~~Perchlorate~~ | ~~YES~~ | |
| All other metals/inorganics | NO | |
| **Butylbenzyl phthalate** | **YES** | |
| **Benzo(a)pyrene~~anthracene~~** | **YES** | |
| ~~Benzo(a)pyrene~~ | ~~YES~~ | |
| **Benzo(b)fluoranthene** | **YES** | |

[46] The non-detect value is equal to the SQL.
[47] See Section 2.5 for a discussion on future land use for the Galleria North-School Site sub-area.

**TABLE 5-6: RESULTS OF COMPARISON TO RESIDENTIAL SOILS BCLs**

| Chemical~~Chemical~~ | ~~Maximum Concentration Greater than BCL?~~ | ~~Notes~~ |
|---|---|---|
| ~~Benzo(k)fluoranthene~~ | ~~YES~~ | |
| ~~Chrysene~~ | ~~YES~~ | |
| Dibenzo(a,h)anthracene | YES | |
| ~~Indeno(1,2,3-cd)pyrene~~ | ~~YES~~ | |
| All other organic compounds | NO | |

Note: Only metals and radionuclides greater than background (Sections 5.1 and 5.2 were included in the comparison to one-tenth of the residential soil BCL.~~Note:~~
~~SQL = sample quantitation limit~~

Four~~Eight~~ organic compounds and one~~seven~~ inorganic compound~~/metals~~ were found to exceed their respective one-tenth of the residential soil BCL.

## ~~5.4 SITE AND BACKGROUND LITHOLOGY CONSIDERATIONS~~

~~Based on the current understanding of the Eastside property, depths of overlying alluvial lithologies decrease as one approaches the Las Vegas Wash from the south – *i.e.*, overlying alluvial lithologies taper or "pinch off" as one approaches the Las Vegas Wash from the south. The Site is located approximately 0.7 miles south of the Las Vegas Wash; whereas, the Qal McCullough background dataset was derived from soil samples collected 2 to 5 miles south and 800 ft above (topographically) of the Site. Accordingly, it is BRC's opinion that the shallow Qal McCullough lithology may not be entirely or adequately representative as background soils for the Site.~~

~~Clay content measured at the Galleria North sub-area ranges from 0.9 to 7.1 percent. These data suggest that relatively high clay content exists at the Site in subsurface soils, and possibly in surface soils. Moreover, based on the maximum percentage, the clay content in soils at the Site is intermediate to Qal McCullough[48] and TMCf lithologies (see below).~~

| ~~Lithology~~ | ~~Clay Content (%)~~ | | |
|---|---|---|---|
| | ~~N~~ | ~~Minimum~~ | ~~Maximum~~ |

[48] ~~Given the lack of clay content data for shallow Qal McCullough, clay content for Deep Qal is used as surrogate data. It is noted that clay content for the Southern RIBs sub-area, for which the shallow Qal McCullough is considered more representative, ranges from 0.7 to 2.2 percent.~~

| | | | |
|---|---|---|---|
| Deep Qal[1] | 4 | 2.5 | 4.2 |
| TMCf | 3 | 10 | 18 |
| Galleria North Sub-Area | 6 | 0.90 | 7.1 |

1. No clay content data exist for shallow Qal McCullough. Deep Qal is used as a surrogate.
N = number of samples

Given the clay content, it is anticipated that metals that preferentially sorb to clays (*e.g.*, arsenic) would have naturally occurring concentrations greater in background lithologies with greater clay content as compared to background lithologies with lower clay content. this pattern is observed for shallow Qal McCullough and TMCf lithologies. for comparison, maximum concentrations for metals that exceeded the one-tenth residential soil BCL are provided for the TMCf lithology:

| **Metal** | **Site** (Maximum) [mg/kg] | **Shallow Qal McCullough** (Maximum) [mg/kg] | **TMCf** (Maximum) [mg/kg] | **Exceeds Qal McCullough and TMCf?** |
|---|---|---|---|---|
| Aluminum | 14,700 | 15,300 | 19,700 | NO |
| Arsenic | 8.8 | 7.8 | 24.8 | NO |
| Cobalt | 12.8 | 16.3 | 12.9 | NO |
| Lithium | 20.9 | 26.5 | 189 | NO |
| Manganese | 808 | 863 | 836 | NO |
| **Vanadium** | 82.7 | 59.1 | 73.3 | **YES** |

The maximum concentration for arsenic at the Site is slightly greater than the maximum for the shallow Qal McCullough and is well below the concentration of 24.8 mg/kg for the TMCf. Only vanadium had maximum concentrations at the Site that exceeded concentrations in soils for both shallow Qal McCullough and TMCf lithologies.

## 5.5 FREQUENCY OF DETECTION

Another criterion that may warrant chemical reduction is the frequency of detection. In general, chemicals exhibiting a low frequency of detection do not contribute significantly to the risk estimates. USEPA (1989) suggests that chemicals with a frequency of detection less than or equal to five percent, with the exception of metals, known human carcinogens, and persistent, bioaccumulative, and toxic (PBT) chemicals as defined by the USEPA PBT program, may be considered for elimination. Prior to eliminating a chemical based on the frequency of detection criteria, (1) any elevated concentrations are addressed, and (2) data distributions within the Site

~~are considered. However, this particular procedure for reducing the number of COPCs was not used for this Site.~~

## 5.5 SUMMARY OF SELECTION OF COPCS

The procedures for COPC selection were discussed above. Results of the selection of COPCs, including the rationale for excluding chemicals as COPCs, are presented in Table 5-7.[49] ~~9.~~

These procedures apply to soil results. Indoor air exposures are evaluated on a sample-~~-~~by-sample basis, per NDEP requirements, using the surface flux data measurements. Because of this, elimination~~selection~~ of COPCs from the surface flux data is not done.~~conducted.~~ Instead, every chemical detected in an individual surface flux location is included in the evaluation for that location. Therefore, the minimum and maximum surface flux risk estimates are summed with the soil risk estimates to provide a range of cumulative risks.

[49] Consistent with the BRC Closure Plan and prior submittals approved by the NDEP, COPCs identified in Table 5-7 are also carried through to the soil-leaching-to-groundwater evaluation. There is not a separate selection of COPCs for the soil leaching-to-groundwater pathway.

# 6.0 HUMAN HEALTH RISK ASSESSMENT

This section~~Section~~ presents the HHRA of all COPCs identified in Section 5 for all receptors of concern via all complete pathways. The methods used in the risk assessment follow standard USEPA guidance. Specifically, the methods used in the risk assessment followed basic procedures outlined in the USEPA's *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual* (USEPA 1989). Other guidance documents consulted include:

- *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual. Supplemental Guidance: Standard Default Exposure Factors* (~~.~~ USEPA~~.~~ 1991b).
- *Guidelines for Exposure Assessment* (~~.~~ USEPA~~.~~ 1992b).
- *Soil Screening Guidance: Technical Background Document* (~~.~~ USEPA 1996).
- *Exposure Factors Handbook, Volumes I-III* (~~.~~ USEPA 1997).
- *Soil Screening Guidance for Radionuclides* (~~.~~ USEPA~~.~~ 2000b).
- *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (~~.~~ USEPA 2002b).
- *Technical Support Document for a Protocol to Assess Asbestos-Related Risk. Final Draft* (~~.~~ USEPA~~.~~ 2003b).
- *Child-Specific Exposure Factors Handbook* (~~.~~ USEPA 2006).
- *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part ~~Part~~ E, Supplemental Guidance for Dermal Risk Assessment)* (~~)~~. USEPA 2004e).
- *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part ~~Part~~ F, Supplemental Guidance for Inhalation Risk Assessment)* (~~)~~. USEPA 2009).

Various NDEP guidance documents are also relied on for the HHRA. These include:

- *Supplemental Guidance for Assessing Data Usability for Environmental Investigations at the BMI Complex and Common Areas in Henderson, Nevada* (~~.~~ NDEP 2008a).

- *Guidance for Evaluating Secular Equilibrium at the BMI Complex and Common Areas* (~~,~~ NDEP 2009a).
- *Technical Guidance for the Calculation of Asbestos-Related Risk in Soils for the Basic Management Incorporated (BMI) Complex and Common Areas* (~~,~~ NDEP 2009b, 2010)~~b~~.
- *Supplemental Guidance on Data Validation* (~~,~~ NDEP 2009c, d).
- *Guidance for Evaluating Radionuclide Data for the BMI Plant Sites and Common Areas Projects* (~~,~~ NDEP 2009e).

The risk assessment is a deterministic risk assessment,~~;~~ meaning that~~,~~ single values based on conservative assumptions are used for all modeling, exposure parameters, and toxicity criteria. These conservative estimates compound each other so that the calculated risks likely exceed the true risks at the Site.

The method used in the risk assessment consists of several steps. The first step is the calculation of exposure point concentrations representative of the particular area, for each mediu~~media~~ of concern. This step includes fate and transport modeling to predict concentrations that may be present when direct measurements are not available. The second step is the exposure assessment for the various receptors present in the particular areas. The next step is to define the toxicity values for each COPC. The final step is risk characterization where theoretical upper-bound cancer risks and non-cancer HIs are calculated.

## 6.1 DETERMINATION OF EXPOSURE POINT CONCENTRATIONS

A representative exposure concentration is a COPC-specific and media-specific concentration value. In risk assessment, these exposure concentrations are values incorporated into the exposure assessment equations from which potential baseline human exposures are calculated. As described below, the methods, rationale, and assumptions employed in deriving these concentration values follow USEPA guidance and reflect Site~~site~~-specific conditions.

Chemical, physical, and biological processes may affect the fate and transport of chemicals in water, soil, and air. Chemical processes include solubilization, hydrolysis, oxidation-reduction, and photolysis. Physical processes include advection and hydrodynamic dispersion, volatilization, dispersion, and sorption/desorption to soil, sediment, and other solid surfaces. Biological processes include biodegradation, bioaccumulation, and bioconcentration. All of these processes are dependent upon the physical and chemical properties of the chemicals, the physical

and chemical properties of the soil and water, and other environmental factors such as temperature, humidity, and the conditions of water recharge and movement. The net effect of these environmental factors is a time-dependent reduction of chemical concentrations in water, soil, and air. The determination of exposure point concentrations for media other than soil take into account chemical-specific physical parameters and inter-media transfers as discussed below. All modeling input parameters, calculations and results are presented in Appendix I~~H~~ (included on the report CD in Appendix B).

### 6.1.1 Soil

Due to the uncertainty associated with determining the true average concentration at a site, where direct measurements of the site average are infeasible and unavailable, the USEPA recommends using the lower of the maximum detected concentration or the 95 percent ~~upper confidence limit (~~UCL~~)~~ as the concentration of a chemical to which an individual could be exposed over time (USEPA 1992b). For the 95 percent UCL concentration approach, the 95 percent UCL was computed ~~in order~~ to represent the area-wide exposure point concentrations. The 95 percent UCL is a statistic that quantifies the uncertainty associated with the sample mean. If randomly drawn subsets of Site~~site~~ data are collected and the UCL is computed for each subset, the UCL equals or exceeds the true mean roughly 95 percent of the time. The purpose for using the 95 percent UCL is to derive a conservative, upper-bound estimate of the mean concentration, which takes into account the different concentrations to which a person may be exposed ~~to~~ at the Site. That is, an individual will be exposed to a range of concentrations that exist at an exposure area, from non-detect to the maximum concentration, over an entire exposure period.

The 95 percent UCL statistical calculations were performed using the ~~computer statistical software program~~ GiSdT® (Neptune and Company 2009). ~~See~~ Section 5.1 outlines the treatment of~~for how~~ sample locations with field duplicates ~~were treated~~ prior to the 95 percent UCL statistical calculations described in this section. For these calculations, chemical non-detect results are assigned a value of one-half the SQL. The formulas for calculating the 95 percent UCL COPC concentration (as the representative exposure concentration) are presented in USEPA (1992c, 2002c) and GiSdT® (Neptune and Company 2009). Three UCL methods are employed in the GiSdT® software. They include the Student's t UCL, the bootstrap percentile UCL, and the bootstrap BCa UCL. The maximum UCL of these three methods was used as the exposure point concentration, unless the maximum UCL of the three methods was greater than the maximum detected concentration. In these cases, the maximum detected concentration was selected as the exposure point concentration.

The representativeness of the 95 percent UCLs for the exposure area, that is, a Site~~site~~-wide mean concentration is valid for all receptors at the Site, is further supported by the intensity plot figures included in Appendix J.~~I.~~ Figures for each of the COPCs are included in Appendix J~~I~~ (in addition to figures developed for all metals). A figure is also presented for TCDD TEQ. Although not COPCs for the Site, TCDD TEQ is a primary chemical of interest for the project. Based on the results of the background comparison tests, a review of the probability plots, boxplots, and distribution and intensity plot figures, data across the Site are assumed to be uncorrelated, that is, there is no discernable spatial correlation.[50] Although there may be spatial correlation of data across the Site, it has not been observed. Thus,~~evaluated directly. Instead~~ the assumption is made for statistical testing purposes that the data are not spatially correlated.[51] This results in lower p-values and hence a greater number of statistical differences than would be the case if spatial correlation were ~~is~~ accounted for. Ignoring~~Because ignoring~~ correlation therefore causes conservatism, and ~~in this sense,~~ the need to further evaluate spatial correlation is not warranted. Therefore consistent with the project *Statistical Methodology Report* (~~BRC and~~ NewFields 2006), each measurement is assumed to be equally representative for that chemical at any point in the Site and calculation of the 95 percent UCL is appropriate.

The data were also reviewed for the presence of hot spots, and as discussed in Section 3.5 one location was evaluated. Because all constituents were lower than their respective BCL (or maximum background concentration) and the sampling ~~sample~~ location has been over-excavated, it was not necessary to treat the associated data at this location as a hot spot or a separate exposure area in the HHRA. No other potential hot spots were identified at the Site.

Representative exposure concentrations for soil are based on the potential exposure depth for each of the receptors. For all receptors, two different exposure depths are considered, based on the sample depth rules schematic presented in Section 3: all data (surface and subsurface) and data classified as surface soil only. These different soil exposure classifications are considered to represent all possible exposure potential for all receptors, based on the future grade and use of Site soils. Ninety-five~~95~~ percent UCLs are calculated for both exposure depth scenarios. To ~~In order to~~ be conservative, the higher of the two values was used in the risk estimates for each

[50] Although the Statistical Methodology Report states that confirmation measurements of each chemical in a given soil layer will be used to compute variograms, as noted in the text above, this was not conducted for the Site, which is a deviation from the *BRC Closure Plan* methodology.

[51] Some variability of the data is expected, if there was perfect homogeneity then only one sample would be needed to represent the Site. This natural variability is demonstrated by the background datasets for the project. As shown on the probability and boxplots in Appendix G, the data generally follow a normal distribution, and their variability are similar to the background data.

COPC. The 95 percent UCL for each COPC is presented in Table 6-1 (Tables section).~~10.~~ For indirect exposures, this concentration was used in fate and transport modeling.

The exposure point concentrations for asbestos (USEPA 2003b, NDEP 2009b) were based on the pooled analytical sensitivity of the dataset.[52] The asbestos data and analytical sensitivities are presented in Table 6-2.~~11.~~ Therefore, asbestos exposure point concentrations are determined differently than those for the other COPCs. The pooled analytical sensitivity is calculated as follows:

$$Pooled\ Analytical\ Sensitivity = 1/\left[\sum_i (1/analytical\ sensitivity\ \ for\ trial\ i)\right]$$

Two estimates of the asbestos concentration were evaluated, best estimate and upper bound, as defined in the draft methodology (USEPA 2003b). The best estimate concentration is similar to a central tendency estimate, while the upper bound concentration is comparable to a reasonable maximum exposure estimate. The pooled analytical sensitivity is multiplied by the number of chrysotile or amphibole structures to estimate concentration:

$$\text{Estimated Bulk Concentration } (10^6 \text{ s/gPM10}) = \text{Long fiber count} \times \text{Pooled analytical sensitivity}$$

For the best estimate, the number of fibers measured across all samples is incorporated into the calculation above. The upper bound of the asbestos concentration was also evaluated. It is calculated as the 95 percent UCL of the Poisson distribution mean, where the Poisson mean was estimated as the total number of structures detected across all samples. In Microsoft Excel~~EXCEL~~, the following equation may be employed to calculate this value:

95 percent~~%~~ UCL of Poisson Distribution Mean = CHIINV(1-upper confidence percentile, 2 × (Long fiber count + 1))/2

This value is then multiplied by the pooled analytical sensitivity to estimate the upper bound concentration. The intent of the risk assessment methodology is~~was~~ to predict the risk associated with airborne asbestos. In order to quantify the airborne asbestos concentration, the estimated dust levels or particulate emission factors (PEFs) were used:

[52] Unlike other analytes, although called field duplicate samples, these samples for asbestos are more accurately characterized as field split samples. That is, these samples were obtained from a split of the sample collected in the field. This split was conducted by the field sample crew prior to sending the samples to the laboratory. Therefore, only the higher of the split sample results are included in the pooled analytical sensitivity or risk calculations for asbestos.

$$\text{Estimated Airborne Concentration } (s/cm^3) = \text{Estimated bulk concentration } (10^6\ s/gPM10) \times \text{Estimated dust level } (ug/cm^3)$$

Further explanation of the asbestos risk calculations and estimates are provided in the NDEP's *Technical Guidance for the Calculation of Asbestos-Related Risk in Soils* (2009b) and *Workbook for the Calculation of Asbestos-Related Risk in Soils* (2010~~, 2010b~~).

### 6.1.2 Indoor Air

*USEPA's 2002 Vapor Intrusion Guidance*

BRC has reviewed USEPA's 2002 Vapor Intrusion Guidance (2002d), and this approach was used for the Site. The guidance recommends that a tiered approach be followed to address vapor intrusion. BRC has followed a tiered approach for each of the Eastside sub-areas, including the Site.

First, in each of the sub-area SAPs, including that for the Site, each of the chemicals (VOCs and volatile SVOCs) to be evaluated further in each sub-area (that is, a Tier 1 assessment) was identified.

Second, the existing groundwater data for wells that are located within (or adjacent to) that sub-area was compared with the USEPA 2002 Tier 2 comparison values (provided in lookup tables in the guidance document). Thus, this Tier 2 assessment was done in the NDEP-approved SAPs for each of the sub-areas.

Third, a Site-specific HHRA for vapor intrusion using surface flux data on a sample-by-sample basis was conducted, per NDEP recommendations (that is, a Tier 3 assessment; see below).

As noted in USEPA's 2002 guidance for a Tier 3 site-specific assessment: "If buildings are not available or not appropriate for sampling, for example in cases where future potential impacts need to be evaluated, … other more direct measures of potential impacts, such as emission flux chambers or soil gas surveys, may need to be conducted in areas underlain by subsurface contamination." Thus surface flux measurements are allowed under USEPA's guidance. BRC is aware of USEPA's recent *Review of the Draft 2002 Subsurface Vapor Intrusion Guidance*. Issues and recommendations identified in this documents as well as the USEPA Office of Inspector General's *Evaluation Report—Lack of Final Guidance on Vapor Intrusion Impedes Efforts to Address Indoor Air Risks* (December 14, 2009), focus primarily on Tier 1 and Tier 2

assessments, and ultimately will not affect how indoor air exposures have been evaluated for the Site.

Fourth, the various factors pertaining to vapor intrusion, including depth to groundwater (now and in the future), the nature of the soil column from ground surface to groundwater, and, water quality (i.e., the constituents likely to be present in groundwater and that might pose any vapor intrusion concerns) were evaluated.

A more detailed Site-specific evaluation of vapor intrusion potential at a comparison study area within the Eastside property was also performed. Although depth to groundwater at the Site (25 to 30 feet bgs) is shallower than at the comparison study area (55 to 60 feet bgs), VOC concentrations in groundwater are much lower at the Site than in the comparison study area (for example, chloroform concentration in groundwater of 66 to 97 µg/L at the Site versus 250 to 900 µg/L at the comparison study area). Therefore, the comparison study area presents a greater potential for vapor intrusion than the Site. The detailed evaluation of vapor intrusion risk assessments for chloroform performed at the comparison study area location showed that risks were acceptable (residential indoor cancer risks ranged from $1 \times 10^{-8}$ to $4 \times 10^{-7}$, and non-cancer HIs were well below 1.0).

*Site-Specific Tier 3 Assessment*

Concentrations of volatile constituents (VOCs and certain SVOCs) in soil and groundwater that may infiltrate buildings to be constructed at the Site through cracks in the foundations are estimated using USEPA surface emission isolation flux chamber (flux chamber) measurements collected at the Site in accordance with USEPA (~~guidance (USEPA~~ 1986) ~~guidance~~ and the Flux Chamber SOP-16 (BRC, ERM, and MWH 2008). The flux chamber is used to measure the emission rates from surfaces emitting gas species. Use of the flux chamber reduces the need for modeling surface flux rates, which ~~potentially~~ reduces the uncertainty in the air representative exposure concentrations and the risk characterization. Because the flux chamber measurements were conducted outdoors on open soil, an "infiltration factor" is applied to the outdoor surface flux data to generate data supporting the inhalation of indoor air exposure pathway. The infiltration factor is based on the factors found in the American Society for Testing and Materials (ASTM) *Standard Guide for Risk Based Corrective Action* (2000). The indoor air concentrations are determined from the surface flux measurements using the following mixing equation:

$$C_a = \frac{J \times \eta}{L \times ER}$$

where:

$C_a$ = indoor air concentration (milligram per cubic meter [$mg/m^3$])
J = measured surface flux of chemical ($mg/m^2$-min)
η = foundation crack fraction (unitless)
L = enclosed space volume/infiltration area ratio (meter [m])
ER = enclosed space air exchange rate (1/min)

Default parameter values from ASTM (2000) for residential buildings were used. These default parameters are presented in the electronic indoor air calculation files in Appendix I~~H~~ (included on the report CD in Appendix B). As noted in Section 5.5~~2~~, indoor air exposures are evaluated on a sample by sample basis, per NDEP requirements, using the surface flux data measurements. Every chemical detected in an individual surface flux location is included in the evaluation for that location.

Indoor air concentrations based on the surface flux data measurements are shown in the electronic indoor air calculation files in Appendix I~~H~~ (included on the report CD in Appendix B) and are summarized in Table 6-3.~~Table 12.~~ In all cases the maximum of the two flux chamber measurements (TO-15 full scan and TO-15 SIM) is used.

### 6.1.3 Outdoor Air

Long–term exposure to COPCs bound to dust particles is evaluated using the USEPA's PEF approach (USEPA 2002b). The PEF relates concentrations of a chemical in soil to the concentration of dust particles in the air. The Q/C (Site-Specific Dispersion Factor ~~[USEPA 2002b]~~) values in this equation are for Las Vegas, Nevada (Appendix D of USEPA 2002b). The equation used is:

$$PEF = Q/C_{wind} \times \frac{3{,}600 \text{ sec/hr}}{0.036 \times (1 - V) \times (U_m / U_t)^3 \times F(x)}$$

where:

PEF = Particulate emission factor ($m^3/kg$)
$Q/C_{wind}$ = Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source ($g/m^2$ -s per $kg/m^3$)
V = Fraction of vegetative cover (unitless)
$U_m$ = Mean annual windspeed (m/s)

$U_t$ = Equivalent threshold value of windspeed at 7m (m/s)
F(x) = Function dependent on $U_m/U_t$ derived using USEPA (1985) (unitless)

and

$$Q/C_{wind} = A \times \exp \frac{(\ln A_{site} - B)^2}{C}$$

where

$A_{site}$ = Source Area (acre)
A, B, C = Air Dispersion Constants for LV (unitless)

The dust model and parameters utilized to generate the PEF are presented in Table 6-4~~13~~.

The USEPA guidance for dust generated by construction activities (USEPA 2002b) was used for assessing short-term construction worker exposures:

$$PEF = \frac{1}{\left(\left(\frac{1}{PEF_{sc}}\right) + \left(\frac{1}{PEF_{sc_road}}\right)\right)}$$

where:

$PEF_{sc}$ = Subchronic particulate emission factor for construction activities ($m^3/kg$)
$PEF_{sc_road}$ = Subchronic particulate emission factor for unpaved road traffic ($m^3/kg$)

Input soil concentrations for the model are the exposure point concentrations as described above. The construction dust model and all relevant equations and parameters utilized to generate the construction worker PEF from this guidance are provided in Table 6-5.~~14.~~ Site-specific surface soil moisture data were collected in January, February, and August. The average of the surface soil data is 4.31 percent. This is considered an adequate representation of the~~an~~ annual average~~,~~; therefore, this value is used for the percent moisture in dry road surface parameter instead of the NDEP model default value.

In addition, for receptors with indoor exposures (*i.e.*, residents, indoor commercial workers), a dilution factor is applied to obtain an indoor air concentration of dust particles, based on USEPA (2000b).

The flux chamber measurements as described in Section 6.1.2 above are used for exposures to VOCs and volatile SVOCs in outdoor air if the chemical was present in the TO-15 analyte list. If the VOC or volatile SVOC was measured in soil but not on the TO-15 analyte list, then the exposure point concentration was estimated using USEPA's volatilization factor. Outdoor surface flux data are divided by the dispersion factor for volatiles ($Q/C_{vol}$ for Las Vegas; from USEPA 2002b) for use in the outdoor air exposure pathway. The same dispersion factor is used for all scenarios. The dispersion factor for the construction worker is not adjusted to account for soil intrusion activities. Outdoor air concentrations based on soil data for all receptors are shown in Table 6-6.~~15.~~ Outdoor air concentrations based on the surface flux data measurements are shown in the electronic indoor air calculation files in Appendix I~~Appendix H~~ (included on the report CD in Appendix B) and are summarized in Table 6-3~~12~~.

### 6.1.4 Homegrown Produce

Consistent with the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010) and USEPA guidance, the consumption of homegrown produce is an applicable exposure pathway for residential receptors. Representative exposure concentrations in plants were obtained using the soil 95 percent UCL for each COPC, multiplied by plant uptake factors. As per the Closure Plan, plant uptake factors were obtained from USEPA (2005b) and Baes *et al.* (1984). Plant uptake factors for inorganics were obtained from empirical data, where available. Plant uptake factors for organics are calculated based on the following equations (from USEPA 2005b):

Aboveground plant uptake factor:

$$log\ Br_{above} = 1.588 - 0.578\ log\ K_{ow}$$

Belowground plant uptake factor:

$$Br_{below} = \frac{RCF}{Kd_s} \times VG$$

where:

| | | |
|---|---|---|
| $Br_{above}$ | = | aboveground plant uptake factor (mg/kg plant DW/mg/kg soil) |
| $Br_{below}$ | = | belowground plant uptake factor (mg/kg plant DW/mg/kg soil) |
| $K_{ow}$ | = | octanol/water partitioning coefficient (unitless) |
| RCF | = | root concentration factor (mg/g plant DW/mg/mL soil water) |

$Kd_s$ = Soil-water partition coefficient (mL water/g soil)

VG = empirical correction factor for belowground produce (unitless)(0.01 for COPCs with a log Kow greater than 4 and 1.0 for COPCs with a log Kow less than 4)

Plant uptake factors are presented in Table 6-7.~~16.~~ See Section 7.2.3~~2~~ regarding plant uptake of perchlorate.

## 6.2 EXPOSURE ASSESSMENT

In a risk assessment, the possible exposures of populations are examined to determine if the chemicals at a site could pose a threat to the health of identified receptors. The risks associated with exposure to chemicals depend not only on the concentration of the chemicals in the media, but also on the duration and frequency of exposure to those media. For example, the risks associated with exposure to chemicals for 1 ~~one~~ hour a day are less than those associated with exposure to the same chemicals at the same concentrations for 2~~two~~ hours a day. Potential health impacts from chemicals in a medium can occur via one or more exposure pathways. The exposure assessment step of a risk assessment combines information regarding impacted media at a site with assumptions about the people who could come into contact with these media. The result is an estimation of a person's potential rate of contact with impacted media from the Site. The intake rates are evaluated in the risk characterization step to estimate the risks they could pose.

In this section, assumptions regarding people's activities, such as the frequency with which a person could come into contact with impacted media, are discussed. Finally, the daily doses at the points of potential human contact were estimated using these assumptions, the models described in Section 6.1, and the chemical concentrations reported for soil and surface flux ~~chamber~~ samples collected from the Site.

### 6.2.1 Exposure Parameters

In this section, the assumptions regarding the extent of exposure are presented for each of the exposure pathways for each medium of concern at the Site. Tables 6-8~~17~~ and 6-9~~18~~ present each of the exposure parameters used in the risk assessment for each receptor and each pathway. Many of the assumptions regarding the extent of exposure are ~~were~~ default factors developed by USEPA's Superfund program. Default values were modified to reflect Site~~site~~-specific conditions, where possible. The exposure parameters used in the risk assessment were those

defined in Tables 9-2 through 9-5 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010).

### 6.2.2 Quantification of Exposure

In this section, the concentrations of COPCs at the points of potential human exposure are combined with assumptions about the behavior of the populations potentially at risk ~~in order~~ to estimate the dose of COPCs that may be taken in by the exposed individuals. Later, in the risk characterization step of the assessment, the doses are combined with toxicity parameters for COPCs to estimate whether the calculated intake levels pose a threat to human health.

The method used to estimate the average daily dose (ADD) for non-carcinogens COPCs via each of the complete exposure pathways is based on USEPA (1989, 1992b) guidance. For carcinogens, lifetime ADD (LADD) estimates are based on chronic lifetime exposure, extrapolated over the estimated average lifetime (assumed to be 70 years). This establishes consistency with cancer slope factors (CSFs), which are based on chronic lifetime exposures. For non-carcinogens, ADD estimates are averaged over the estimated exposure period. ADDs and LADDs were calculated for each exposure scenario using the following generic equation:

$$Dose = \frac{C \times IR \times ED \times EF}{BW \times AT \times 365\ d/yr}$$

where:

| | | |
|---|---|---|
| Dose | = | ADD for non-carcinogens and LADD for carcinogens (in mg/kg-day) |
| C | = | chemical concentration in the contact medium (*e.g.*, mg/kg soil) |
| IR | = | intake rate (*e.g.*, mg/day soil ingestion and dermal contact [requires a conversion factor of $10^{-6}$ kg/mg]; |
| ED | = | exposure duration (years of exposure) |
| EF | = | exposure frequency (number of days per year) |
| BW | = | average body weight over the exposure period (kilograms) |
| BIO | = | relative bioavailability (unitless) |
| AF | = | absorption fraction (percent) |
| AT | = | averaging time; same as the ED for non-carcinogens and 70 years (average lifetime) for carcinogens |

Risk estimates for inhalation exposures follow USEPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)* (USEPA 2009). That is, the concentration of a chemical in air is

used as the exposure metric (*e.g.*, mg/m$^3$), rather than inhalation intake of a chemical in air based on inhalation rate and body weight (*e.g.*, mg/kg-day). The generic equation for calculating inhalation exposures is:

$$EC = \frac{C_{air} \times ET \times ED \times EF}{AT}$$

where:

EC = exposure concentration (in mg/m$^3$)
$C_{air}$ = chemical concentration in air (in mg/m$^3$)
ET = exposure time (hours per day)
ED = exposure duration (years of exposure)
EF = exposure frequency (number of days per year)
AT = averaging time; same as the ED for non-carcinogens and 613,200 hours (*i.e.*, 70 years; average lifetime) for carcinogens

Pathway-specific equations for calculating ADDs and LADDs are provided in Table 9-6 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010).

For conservatism, the ~~The~~ relative oral bioavailability (BIO) of all COPCs was assumed to be 100 percent. Chemical-specific dermal absorption values from USEPA guidance (USEPA 2004e [Part E RAGS]) were used in the risk assessment. ~~For other inorganics not included in USEPA (2004e), default dermal absorption values from California EPA (1994) and California South Coast Air Quality Management District (SCAQMD 1988) guidance were used.~~ USEPA does not recommend absorption factors for VOCs based on the rationale that VOCs from the soil are volatilized ~~from the soil~~ on skin and exposure is accounted for via inhalation routes. In addition, RAGS Part E (USEPA 2004e) states "For inorganics, the speciation of the compound is critical to the dermal absorption and there are too little data to extrapolate a reasonable default value." Therefore, dermal absorption factors are also not used for inorganics. The NDEP and its consultants have concurred with this decision.

Exposure levels of potentially-carcinogenic and non-carcinogenic chemicals are calculated separately because different exposure assumptions apply (*i.e.*, ADD for non-carcinogens and LADD for carcinogens). Exposure levels are estimated for each relevant exposure pathway (*i.e.*, soil, air, and water), and for each exposure route (*i.e.*, oral, inhalation, and dermal). Daily doses for the same route of exposure are summed. The total dose of each chemical is the sum of doses

across all applicable exposure routes. As noted previously, radionuclides are consistent with background concentrations and are not addressed in this HHRA.

### 6.2.3 Asbestos

Although final USEPA guidance is unavailable at this time, USEPA recommends that site-specific risk assessments be performed for asbestos (USEPA 2004f). Risks associated with asbestos in soil are evaluated using the NDEP's *Technical Guidance for the Calculation of Asbestos-Related Risk in Soils* (2009b~~, 2010b~~) and *Workbook for the Calculation of Asbestos-Related Risk in Soils* (2010), and the draft methodology proposed by USEPA (2003b). This methodology is an update of the method described in *Methodology for Conducting Risk Assessments at Asbestos Superfund Sites-Part 1: Protocol* and *Part 2: Technical Background Document* (Berman and Crump 1999a, b). Because the risk assessment methodology for asbestos is unlike that for other COPCs, asbestos risks are evaluated separately from other chemical risks.

The intent of the risk assessment methodology is to predict the amount of airborne asbestos, which causes an unacceptable risk to a human receptor. Asbestos concentrations are measured in soil, and are then used to predict airborne asbestos concentrations using a dust emissions model. Asbestos data are collected from ~~in~~ the top 2~~two~~ inches of soil. While asbestos might exist below the top 2~~two~~ inches of soil due to soil turnover, the concentrations in the surface soil are likely to be greater than concentrations beneath the surface, and the exposure pathway is to near-surface soils. Therefore, the "shallow"~~'shallow'~~ surface soils asbestos concentration estimate is used to represent the potential exposure to asbestos.

To interpret measurements of asbestos in soils, it is necessary to establish the relationship between the asbestos concentrations observed in soils and concentrations that will occur in air when such soil is disturbed by natural or anthropogenic forces. This is because asbestos is a hazard when inhaled (see, for example, Berman and Crump 2001; USEPA 2003b). Indeed~~In fact~~, the Modified Elutriator Method (Berman and Kolk 2000), which was the method employed to perform the analyses presented in this report, was designed specifically to facilitate prediction of airborne asbestos exposures based on bulk measurements (see, for example, Berman and Chatfield 1990).

Briefly, the Modified Elutriator Method incorporates a procedure for isolating and concentrating asbestos structures as part of the respirable dust fraction of a sample, and analytical measurements are reported as the number of asbestos structures per mass of respirable dust in the sample. This turns out to be precisely the dimensions required to combine such measurements

with published dust emission and dispersion models to convert them to asbestos emission and dispersion models. These models can be combined with measurements from the Modified Elutriator Method to predict airborne exposures and assess the attendant risks.

## 6.3 TOXICITY ASSESSMENT

This section describes the toxicity of the COPCs at the Site. Numerical toxicity values were developed for use in the calculation of the hazard quotients (HQs; for non-carcinogens) and risks (for carcinogens).

### 6.3.1 Toxicity Values

Toxicity values, when available, are published by the USEPA in the on-line Integrated Risk Information System [IRIS]; USEPA 2011~~2010~~). CSFs (in units of milligrams per kilogram per day [mg/kg-d]$^{-1}$) are chemical-specific and experimentally derived potency values that are used to calculate the risk of cancer resulting from exposure to potentially carcinogenic chemicals. Inhalation unit risks (IURs) represent the upper-bound excess lifetime cancer risk from continuous exposure to a chemical at a concentration of 1 microgram per cubic meter (µg/m$^3$). A higher value implies a more potent carcinogenic potential. Reference dosages (RfDs) are experimentally derived "no-effect" levels used to quantify the extent of toxic effects other than cancer due to exposure to chemicals (in units of mg/kg-d). Similarly, a reference concentration (RfC) is the derived "no-effect" concentration for a lifetime of continuous inhalation exposure (in units of milligrams per cubic meter [mg/m$^3$]). With RfDs or RfCs, a lower value implies a more potent toxicant. These criteria are generally developed by USEPA risk assessment work groups and listed in the USEPA risk assessment guidance documents and databases. Available toxicity values for all Site COPCs used in the risk assessment were obtained using the following hierarchy for selecting toxicity criteria (based on USEPA 2003c):

1. IRIS;
2. USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs);
3. National Center for Environmental Assessment (or other current USEPA sources);
4. Health Effects Assessment Summary Tables (HEAST);

5. USEPA Criteria Documents (*e.g.*, drinking water criteria documents, drinking water Health Advisory summaries, ambient water quality criteria documents, and air quality criteria documents);

6. ATSDR toxicological profiles;

7. USEPA's Environmental Criteria and Assessment Office; and

8. Peer-reviewed scientific literature.

In addition, toxicity criteria and toxicological surrogates recommended by the NDEP are used in the risk assessment. Toxicity criteria are consistent with those used in the development of the NDEP's BCLs (NDEP 2011a~~2010a~~), unless newer values are available from USEPA. Toxicity criteria have not been developed by BRC for elements or compounds that do not have criteria published in the above sources.

Although USEPA has developed toxicity criteria for the oral and inhalation routes of exposure, it has not developed toxicity criteria for the dermal route of exposure. USEPA has proposed a method for extrapolating oral toxicity criteria to the dermal route in the recently released *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* (USEPA 2004e). USEPA states that the adjustment of the oral toxicity factor for dermal exposures is necessary only when the oral-gastrointestinal absorption efficiency of the chemical of interest is less than 50 percent (due to the variability inherent in absorption studies). For COPCs to which dermal exposure might occur at the Site, the oral-gastrointestinal absorption efficiencies are greater than 50 percent, except for total chromium, hexavalent chromium, mercury, nickel, and vanadium. Therefore, the USEPA indicated adjustment of the oral toxicity criteria to generate dermal criteria was performed for these COPCs.

### 6.3.2 Non-Carcinogenic Health Effects

For non-carcinogenic health effects, USEPA assumes that a dose threshold exists, below which adverse effects are not expected to occur. A chronic RfD or RfC of a chemical is an estimate of a lifetime daily dose to humans that is likely to be without appreciable deleterious non-carcinogenic health effects. To derive an RfD or RfC, a series of professional judgments is made to assess the quality and relevance of the human or animal data and to identify the critical study and the most critical toxic effect. Data typically used in developing the RfD or RfC are the highest no-observable-adverse-effect-levels (NOAELs) for the critical studies and effects of the

non-carcinogen. For each factor representing a specific area of uncertainty inherent in the extrapolation from the available data, an uncertainty factor is applied. Uncertainty factors generally consist of multiples of 10, although values less than 10 are sometimes used.

Four major types of uncertainty factors are typically applied to NOAELs in the derivation of RfDs or RfCs. Uncertainty factors of 10 are used to (1) account for the variability between humans, (2) extrapolate from animals to humans, (3) account for a NOAEL based on a subchronic study instead of a chronic study, and (4) extrapolate from a lowest-observed-adverse-effect-level (LOAEL) to a NOAEL, if necessary. In addition, a modifying factor can be used to account for adequacy of the database. Typically, the modifying factor is set equal to one.

To obtain the RfD or RfC, all uncertainty factors associated with the NOAEL are multiplied together, and the NOAEL is divided by the total uncertainty factor. Therefore, each uncertainty factor adds a degree of conservatism (usually one order of magnitude) to the RfD or RfC. An understanding of the uncertainties associated with RfDs or RfCs is important in evaluating the significance of the HIs calculated in the risk characterization portion of the risk assessment. When available sub-chronic RfDs or RfCs were used to evaluate construction worker exposures. The COPCs in this assessment with USEPA-established oral/dermal and inhalation RfDs or RfCs are presented in Tables 6-10~~19~~ and 6-11~~20~~, for surface flux and soil COPCs, respectively.

### 6.3.3 Carcinogenic Health Effects

USEPA develops CSFs and IURs from chronic animal studies or, where possible, epidemiological data. Because animal studies use much higher doses over shorter periods of time than the exposures generally expected for humans, the data from these studies are adjusted, typically using a linearized multi-stage (LMS) mathematical model. To ensure protectiveness, CSFs/IURs are typically derived from the ~~upper~~ 95th percentile UCL~~confidence limit~~ of the slope, and thus the actual risks are unlikely to be higher than those predicted using the CSF/IUR, and may be considerably lower. The COPCs in this assessment with USEPA-established oral/dermal and inhalation CSFs/IURs are presented in Tables 6-10~~19~~ and 6-12~~21~~, for surface flux and soil COPCs, respectively.

### 6.3.4 Asbestos

Asbestos toxicity criteria were obtained from Table 8-1 of Berman and Crump's (2001) document and Tables 8--2 and 8--3 in the USEPA (2003b) guidance. The toxicity criteria vary based on fiber type, endpoint (lung cancer, mesothelioma, or combined) and percent of fibers

longer than 10 micrometers (µm)~~10µm~~ and less than 0.4 µm in width. For this risk assessment the toxicity criteria were based on a combined endpoint of lung cancer and mesothelioma averaged over the smokers and non-smokers of the population, with the assumption that 50~~fifty~~ percent of fibers are greater than 10 µm in length. The resulting unit risk factors (structures/cubic centimeter) are presented in Appendix I~~H~~ (included on the report CD in Appendix B). A complete discussion on issues associated with risk estimates for asbestos is presented in the NDEP's *Technical Guidance for the Calculation of Asbestos-Related Risk in Soils* (2009b).

## 6.4 RISK CHARACTERIZATION

In the last step of a risk assessment, the estimated rate at which a receptor intakes a chemical is compared with information about the toxicity of that COPC to estimate the potential risks posed by exposure to the COPC. This step is known as risk characterization. The methods used for assessing cancer risks and non-cancer adverse health effects are discussed below.

### 6.4.1 Methods for Assessing Cancer Risks

In the risk characterization, carcinogenic risk is estimated separately as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to chemicals and asbestos. Carcinogenic risks for chemicals were evaluated by multiplying the estimated average exposure rate (*i.e.*, LADD calculated in the exposure assessment) by the chemical's CSF or IUR. The CSF converts estimated daily doses averaged over a lifetime to incremental risk of an individual developing cancer. Because cancer risks are averaged over a person's lifetime, longer-term exposure to a carcinogen results in higher risks than shorter-term exposure to the same carcinogen, if all other exposure assumptions are constant. Theoretical risks associated with low levels of exposure in humans are assumed to be directly related to an observed cancer incidence in animals associated with high levels of exposure while the IUR converts estimated exposure concentrations averaged over a lifetime to incremental risk of an individual developing cancer. According to USEPA (1989), this approach is appropriate for theoretical upper-bound ILCRs of less than $1 \times 10^{-2}$. The following equations were used to calculate COPC-specific risks and total risks:

$$Risk = EC \times IUR \quad or \quad LADD \times CSF$$

where:

LADD = lifetime average daily dose (mg/kg-d)
EC = exposure concentration ($mg/m^3$)

IUR = inhalation unit risk $(mg/m^3)^{-1}$
CSF = cancer slope factor $(mg/kg\text{-}d)^{-1}$

and

$$Total\ Carcinogenic\ Risk = \Sigma\ Individual\ Risk$$

It is assumed that cancer risks for different chemicals and from multiple exposure routes are additive, which introduces~~may introduce~~ a protective bias in the result of the cancer risk assessment. Carcinogenic risk estimates were compared to the USEPA acceptable, incremental risk range of 1 in 10,000 ($10^{-4}$) and 1 in 1 million ($10^{-6}$) and the NDEP's acceptable, incremental level of $10^{-6}$. If the estimated incremental risk falls within or below this risk range, the chemical is considered unlikely to pose an unacceptable carcinogenic risk to individuals under the given exposure conditions. A risk level of $1 \times 10^{-5}$ (1 E-5) represents an incremental ~~a~~ probability of one in 100,000 that an individual could develop cancer from exposure to the potential carcinogen under a defined set of exposure assumptions.

### 6.4.2 Methods for Assessing Non-Cancer Health Effects

Non-cancer adverse health effects are estimated by comparing the estimated average exposure rate (*i.e.*, ADDs estimated in the exposure assessment) with an exposure level at which no adverse health effects are expected to occur for a long period of exposure (*e.g.*, the RfDs or RfCs). ADDs (or exposure concentrations [ECs]) and RfDs (or RfCs) are compared by dividing the ADD by the RfD (or EC by the RfC) to obtain the ADD:RfD (EC:RfC) ratio, as follows:

$$HQ = \frac{EC}{RfC}\ or\ \frac{ADD}{RfD}$$

where:

HQ = hazard quotient
ADD = average daily dose (mg/kg-d)
EC = exposure concentration $(mg/m^3)$
RfD = reference dose (mg/kg-d)
RfC = reference concentration $(mg/m^3)$

The ADD-to-RfD (EC-to-RfC) ratio is known as an ~~a~~ HQ. If a person's average exposure is less than the RfD or RfC (*i.e.*, if the HQ is less than 1), the chemical is considered unlikely to pose a significant non-carcinogenic health hazard to individuals under the given exposure conditions.

Unlike carcinogenic risk estimates, an ~~a~~ HQ is not expressed as a probability. Therefore, while both cancer and non-cancer risk characterizations indicate a relative potential for adverse effects to occur from exposure to a chemical, a non-cancer adverse health effect estimate is not directly comparable with a cancer risk estimate.

If more than one pathway is evaluated, the HQs for each pathway are summed to determine whether exposure to a combination of pathways poses a health concern. This sum of the HQs is known as an HI.

$$Hazard\ Index = \Sigma\, Hazard\ Quotients$$

Any HI less than 1.0 indicates the exposure is unlikely to be associated with a potential health concern. If the HI is greater than 1.0, then the HQs are summed by the specific target organs affected by a particular chemical or chemicals. This is also summed across pathways and chemicals. Target organs are identified primarily by the source of the toxicity criteria (*e.g.*, IRIS). Since a chemical may affect more than one organ, in addition to the source of the toxicity criteria Oak Ridge National Laboratory's (ORNL) Risk Assessment Information System's toxicity profiles were also searched for target organ information (ORNL 2011~~2010~~).

### 6.4.3 Methods for Assessing Asbestos Risks

For assessing asbestos risks, Table 8-2 (Based on Optimum Risk Coefficients) of USEPA (2003b) was used. Table 8-2 presents best estimate risks optimized based upon separation of fiber type, size and endpoint (mesothelioma/lung cancer), thereby reducing apparent variation between the studies utilized. The values in Table 8-2 are used because they are the authors' "best" estimates of potency based upon all the available data (whereas the "conservative values" presented in Table 8-3 present only the most conservative, and best "behaved" data). As described in USEPA (2003b), because the asbestos risks to male and female smokers/non-smokers are different, population averaged risks are evaluated based on Eqn. 8-1 of USEPA (2003b):

$$URF = 0.5 \times ((0.786 \times (NSM + NSF)) + ((0.214 \times (SM + SF)) \times CF$$

where:

URF = Population Averaged Unit Risk Factor (risk per fibers/cubic centimeter [c~~[s/cm$^3$]$^{-1}$~~;~~*g.*, mg/kg, milligrams per cubic meter [mg/~~m$^3$])

NSM = risk for male non-smokers

NSF = risk for male non-smokers
SM = risk for male smokers
SF = risk for female smokers
CF = factor to convert risk from risk per 100,000 to risk per 1,000,000

This equation considers male smokers, male non-smokes, female smokers, and female non-smokers. In addition, because both chrysotile and amphibole have been detected at the BMI Common Areas, both amphibole and chrysotile fibers are evaluated in the risk assessments, regardless of if~~as to whether~~ either was detected within an exposure area (as calculated using the 95 percent UCL of the mean of the assumed underlying Poisson distribution).

The basic equation for assessing inhalation cancer risk for asbestos is analogous to that recommended by USEPA for other inhalation carcinogens. As shown in Equation 11 of *Risk Assessment Guidance for Superfund, Part F* (USEPA, 2009) inhalation cancer risk is the product of an IUR factor and an exposure concentration. The exposure concentration is a function of the asbestos air concentration, the length of time an individual is exposed, and the averaging time for which carcinogenic effects are evaluated for the unit risk factor. This calculation of asbestos related risk (ARR) is also consistent with application of Berman and Crump (2003) to risk calculations described in Berman (2003a,~~; 2003~~b; 2005). The risk equation used in performing an asbestos inhalation risk assessment is:

$$ARR = \frac{C_{air} \times URF \times ET \times EF \times ED}{AT}$$

where:

$C_{air}$ = air concentration of asbestos (f/cm$^3$) (fibers per centimeter cubed)
ET = exposure time (hours/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
AT = averaging time (hours)
URF = unit risk factor (risk per f/cm$^3$)

Asbestos risk estimates are compared to the USEPA acceptable, incremental risk range for carcinogens of 1 in 10,000 ($10^{-4}$) and 1 in 1 million ($10^{-6}$) and the NDEP's acceptable, incremental level of $10^{-6}$, although the risk estimates represent the probability of death from mesothelioma~~mesthelioma~~ or lung cancer rather than the probability of contracting cancer. If the estimated asbestos risk falls within or below this risk range, asbestos is considered unlikely to

pose an unacceptable risk to individuals under the given exposure conditions. A risk level of $1 \times 10^{-5}$ (1 E-5) represents a probability of one in 100,000 that an individual could die from contracting mesothelioma or lung cancer from exposure to asbestos under a defined set of exposure assumptions.

### 6.4.4 Risk Assessment Results

The calculation of theoretical upper-bound ILCRs and non-cancer health effects are presented by receptor in Tables 6-13~~22~~ through 6-16~~25~~ and are discussed in Section 8.0. These tables present the theoretical upper-bound ILCRs and non-cancer health effects calculations for residential, construction worker, commercial (indoor) worker, and maintenance (outdoor) worker receptors. The risk of death from lung cancer or mesothelioma as a consequence of exposure to asbestos on a Site~~site~~-wide basis is presented in Table 6-17.~~26.~~ All calculation spreadsheets are provided in Appendix I~~H~~ (included on the report CD in Appendix B).

# 7.0 UNCERTAINTY ANALYSIS

Risk estimates are values that have uncertainties associated with them. These uncertainties, which arise at every step of a risk assessment, are evaluated to provide an indication of the uncertainty associated with a risk estimate. Risk assessments are not intended to estimate the true risk to a receptor associated with exposure to chemicals in the environment. In fact, estimating the true risk is impossible because of the variability in the exposed or potentially exposed populations. There are always gaps in knowledge because a true exposure for every individual human being cannot be measured. Therefore, risk assessment is a means of estimating the probability that an adverse health effect (*e.g.*, cancer, impaired reproduction) will occur in a receptor ~~in order~~ to assist in decision-~~-~~making regarding the protection of human health. The use of conservative values for a majority of the assumptions in risk assessments helps guard against the underestimation of risks.

Risk estimates are calculated by combining Site data, assumptions about individual receptor's exposures to impacted media, and toxicity data. The uncertainties in this HHRA can be grouped into four main categories that correspond to these steps:

- Uncertainties in environmental sampling and analysis;
- Uncertainties in fate and transport modeling (discussed in Section 9);
- Uncertainties in assumptions concerning exposure scenarios; and
- Uncertainties in toxicity data and dose-response extrapolations.

General uncertainties associated with the HHRA for the Site are summarized in Table 7-1.~~27.~~ In this table~~Table 27~~, "Low," "Moderate," and "High" are qualitative indicators as to whether the source of uncertainty will likely have a small, medium, or large effect on the risk calculations, respectively. In general, the scenarios and parameters evaluated and used in this HHRA are considered conservative based on how the Site will be developed. This is a large source of potential conservative bias in this HHRA. Additional discussion on the uncertainties associated with the HHRA is provided below.

## 7.1 ENVIRONMENTAL SAMPLING

The HHRA for the Site was based on the sampling results obtained from investigations conducted in 2008 and 2009. Errors in sampling results can arise from the field sampling, laboratory analyses, and data analyses.

The environmental sampling at the Site is one source of uncertainty in the evaluation. However, the number of sampling locations and events is large, widespread and spatially distributed, with consistent analytical results (*i.e.*, no hot spots), and sampling was performed using approved procedures; therefore, the sampling and analytical~~analysis~~ data are ~~is~~ sufficient to characterize the impacts and the associated potential risks.

Because of the surface soil removal undertaken for certain chemicals, the new surface layer of the Site could have different chemical concentrations than those ~~that were~~ measured prior to soil removal. Because only the trigger constituents were re-analyzed for in the post-scrape samples, the original measured surface soil data at the Site for all other chemicals was retained for further evaluation. However, it is reasonable to assume that the concentrations are now lower for some chemicals (*e.g.*, metals, if due to contamination), because of the removal of some soil.

The laboratory data are another potential source of uncertainty. Maximum SQLs for 1,2-diphenylhydrazine, bis(2-chloroethyl) ether, hexachlorobenzene, and n-nitrosodiphenylamine exceeded one-tenth their respective residential soil BCL. These chemicals were not evaluated quantitatively in the HHRA as they were not detected in any Site samples. This may result in an underestimation of risk.

The types of analyses were chosen based on historical knowledge of the Site and BMI Common Areas. The data validation and data usability evaluations provided documentation that the HHRA database is adequate to support HHRA conclusions (~~see~~ Section 4 and Appendix E). Based on the data validation and data usability, the risk estimates are likely to be overestimated rather than underestimated.

Uncertainties are also introduced into the risk assessment by assumptions that are made regarding the grading plan. As described in Section 3.1, the grading plan affects the interpretation of the data in terms of assigning samples to the surface or the subsurface. This was done to avoid the situation in which current surface samples might not be included in the evaluation of exposures to future surface soils. The data were subdivided by depth intervals as described in Section 3.1, and the maximum of the UCLs for the two subsets of data was used as

the exposure point concentration. There is some uncertainty in the choice of subsetting on the concentrations of interest, and there is a potential small overestimation of risk by choosing the maximum of the two UCLs as the exposure point concentration. The effects are likely to be small given the data, since there is not much variation in the different UCLs.

## 7.2 ESTIMATES OF EXPOSURE

The selection of exposure pathways is a process, often based on best professional judgment, which attempts to identify the most probable potentially harmful exposure scenarios. In a risk assessment, it is possible that risks are not calculated for all of the exposure pathways that may occur, possibly causing some underestimation of risk.

### 7.2.1 Aggregation of Exposure Areas

For the residential scenario that is evaluated, default exposure areas are 1/8$^{th}$ ~~-~~acre in size. However, sampling has not been performed at the frequency of guaranteeing at least one sample per every 1/8$^{th}$-acre exposure area. Instead, sampling has been performed at the scale of approximately once every 3~~three~~ acres. This is considered sufficient if the concentration distribution for COPCs appears similar across the Site. To the extent that this assumption is not valid the risk assessment might underestimate risks. However, considering the sampling protocols employed and the physical remediation activities ~~that have been~~ performed, the risk estimates are considered both reasonable from this perspective and unlikely to have resulted in an underestimation of risk at the Site.

### 7.2.2 Types of Exposures Examined

In an evaluation, risks are sometimes not calculated for all of the exposure pathways that may occur, possibly causing some underestimation of risk. However, in this case, all principal potential exposure pathways were evaluated. In this assessment, risks were estimated for future on-site residents, and indoor and outdoor worker receptors. Risks for the most likely routes of exposure to these receptors were estimated. For example, risks to residents were estimated for soil ingestion, skin contact with soil, inhalation of outdoor air (including dust generation), inhalation of indoor air, and ingestion of homegrown produce. Although it is possible that other exposure routes could exist (e.g.~~for example~~, downwind off-site residents), these exposures are expected to be lower than the risks associated with the pathways considered.

As noted in Section 2.5.3, because an NFAD is sought for unrestricted land use (*i.e.*, residential, recreational, commercial civic, or industrial use), the Closure Plan methodology includes the

evaluation of residential receptors, but not school receptors. Because of the higher exposure potential for residential receptors versus school receptors (e.g., students), if the Site is developed as a middle or high school as planned, risks are likely overestimated rather than underestimated.

### 7.2.3 Intake Assumptions Used

The risks calculated depend largely on the assumptions used to calculate the rate of COPC intake. For this assessment, standard default values developed by USEPA are used for reasonable maximum exposures frequency and exposure duration for all receptors. These estimates are conservative values, and the possibility that they underestimate the risk is low. The uncertainties associated with particular parameters used in this risk assessment are described below.

The amount of COPCs the human body absorbs may be different from the amount of a COPC contacted, and the percentage absorbed may vary from one person to another. In this HHRA, absorption of ingested and inhaled COPCs is conservatively assumed to be 100 percent.

Current USEPA guidance (USEPA 2004e) states that "There are no default dermal absorption values presented for volatile organic compounds nor inorganic classes of compounds. The rationale for this is that in the considered soil exposure scenarios, volatile organic compounds would tend to be volatilized from the soil on skin and should be accounted for via inhalation routes in the combined exposure pathway analysis. For inorganics, the speciation of the compound is critical to the dermal absorption and there are too little data to extrapolate a reasonable default value." ~~However, as requested by NDEP, the risk estimates were calculated using default dermal absorption values for inorganics from California EPA (1994) and California SCAQMD (1988) guidance.~~ While USEPA guidance does not specifically state that this pathway should be dismissed, consistent with the approach utilized in current USEPA guidance, the risk estimates in this HHRA do not include a dermal absorption value for VOCs or inorganics (unless a specific value has been identified). Thus, the risks presented in this assessment could be underestimated as a result.

While there have been numerous studies in recent years detailing the presence of perchlorate in vegetable and fruit produce, the homegrown exposure pathway was not evaluated for perchlorate in the HHRA. BRC has not been able to identify an appropriate soil-to-plant uptake factor for this pathway. The studies predominantly~~predominately~~ focus on water-to-plant uptake. Dr. W. Andrew Jackson at Texas Tech University has been studying perchlorate plant uptake and does not believe that the soil-to-plant pathway for a garden scenario is realistic for perchlorate (Jackson 2010). Perchlorate is extremely soluble and in surface soil would rapidly be flushed

away due to application of irrigation water (Jackson 2010). In addition, laboratory experiments have demonstrated that perchlorate may be reduced to chloride in some plants (ATSDR 2008b). Also, concentrations of perchlorate in soils at this Site~~site~~ are quite low relative to risk levels of concern, so the contribution of perchlorate to risk is quite small. Adding the soil-to-plant component is unlikely to contribute~~add~~ significantly to the risk. Consequently, the effect on the risk assessment of excluding perchlorate from the soil-to-plant pathway is likely to be small.

Soil preparation for a backyard garden is not accounted for in the HHRA and would result in reduced soil concentrations. Las Vegas area soils are "*…alkaline, clayish, caliche or hard and salty*. [~~" (Mills, 2000).~~ In addition,]…, ~~"…~~*soils are lacking organic matter and nutrients*" (Mills, 2000). Therefore, residential gardening cannot occur in Site soils in its existing condition. For non-native vegetation to grow, soil amendments must be added. Recommended soil preparations for the area include thoroughly blending equal amounts of organic matter with the soil as well as the addition of other soil amendments (*e.g.*, fertilizers). As~~Also, as~~ noted above, if the re~~planned~~ development for the Site includes~~is as~~ a middle or high school, it~~. It~~ is doubtful that the homegrown produce exposure pathway is a complete pathway under those ~~this~~ exposure conditions~~scenario~~.

The construction activity dust emissions did not take into account dust control measures that~~which~~ would reduce the amount of dust generated to below those levels used in the HHRA. The Clark County Department of Air Quality and Environmental Management has dust control permitting requirements, and an inhalable particulate matter action level of 50 µg/m$^3$. The construction activity dust emissions predicted and used in the HHRA exceeded this level. Therefore, dust suppression activities would need to be implemented, thus reducing dust levels and exposures.

The dispersion factor for the construction worker is not adjusted to account for soil intrusion activities. Because these activities may cause increased air concentrations than that evaluated, risks to VOCs in soil may be underestimated for this receptor. However, VOCs are primarily associated with groundwater, this potential underestimation is considered low.

## 7.3 TOXICITY ASSESSMENT

The availability and quality of toxicological data is another source of uncertainty in the risk assessment. Uncertainties associated with animal and human studies may have influenced the toxicity criteria. Carcinogenic criteria are classified according to the amount of evidence

available that suggests human carcinogenicity. In the establishment of the non-carcinogenic criteria, conservative safety factors, known as uncertainty and modifying factors, are used.

### 7.3.1 COPCs Lacking Toxicological Data

Toxicity criteria have not been established for some of the chemicals detected at the Site. These chemicals were not quantitatively evaluated in the HHRA. For example, potassium is a COPC for which no USEPA toxicity criteria have been established. The health effects and levels of concern for potassium in soil are not known. While not including potassium may have resulted in a low degree of underestimation of quantitative Site risk estimates, the available toxicological information suggests that this underestimation will not likely affect the decisions made relative to Site risks.

Because of the inconclusive nature of TICs as potentially SRCs~~site-related chemicals~~, non-cancer surrogate toxicity criteria were not applied. Non-cancer surrogate toxicity criteria were not applied to the inorganic chemicals because of the complexity of ion and metal toxicity. A quantitative estimation of risk was not conducted for these COPCs. Thus, the risks presented in this assessment could be underestimated as a result.

For the surface flux results, ~~there are~~ a few organic chemicals detected (*e.g.*, n-heptane, 2-hexanone, cymene) ~~detected that~~ do not have toxicity criteria available. Surrogate toxicity criteria were applied for these chemicals. Thus, the risks presented in this assessment could be under- or overestimated as a result.

### 7.3.2 Uncertainties in Animal and Human Studies

Extrapolation of toxicological data from animal tests is one of the largest sources of uncertainty in a risk assessment. There may be important, but unidentified, differences in uptake, metabolism, and distribution of chemicals in the body between the test species and humans. For the most part, these uncertainties are addressed through use of conservative assumptions in establishing values for RfDs, RfCs, CSFs, and IURs, which results in the likelihood that the risk is overstated.

Typically, test animals are administered high doses (*e.g.*, maximum tolerated dose) of a chemical in a standard diet or in air. Humans are generally exposed to much lower doses in the environment, which may affect the toxicity of the chemical. In these studies, test animals, often laboratory rodents, are exposed daily to the chemical agent for various periods of time up to their 2-year lifetimes. Humans have an average 70-year lifetime and may be exposed either

intermittently or regularly for an exposure period ranging from weeks~~months~~ to a full lifetime. Because of these differences, it is not surprising that extrapolation error is a large source of uncertainty in a risk assessment.

### 7.3.3 Non-Carcinogenic Toxicity Criteria

In the establishment of the non-carcinogenic criteria, conservative safety factors, known as uncertainty factors, are used. Most of the chronic non-carcinogenic toxicity criteria that were located in the IRIS database have uncertainty factors of 1,000. This means that the dose corresponding to a toxicological effect level (*e.g.*, LOAEL) is divided by 1,000 to deem~~establish~~ a safe, or "reference,"~~"~~, dose. The purpose of the uncertainty factor is to account for the extrapolation of toxicity data from animals to humans and to ensure~~insure~~ the protection of sensitive individuals.

### 7.3.4 Sub-Chronic Non-Carcinogenic Toxicity Criteria

Construction worker exposures are evaluated for an exposure duration of 1 ~~one~~ year, which is more representative of a sub-chronic exposure rather than a chronic exposure. As such, where available, sub-chronic RfDs were used to characterize non-cancer effects for the construction worker. However, for many COPCs, a sub-chronic RfD was not available and the chronic RfD was used. This likely presented an overestimation of non-cancer health risks to the construction worker.

### 7.3.5 Carcinogenic Toxicity Criteria

Uncertainty due to extrapolation of toxicological data for potential carcinogens tested in animals to human response is commonly the case for potentially carcinogenic chemicals. USEPA frequently uses the LMS model, or other non-threshold low-~~-~~dose extrapolation models, to extrapolate the toxicological data to estimate human response. These low-~~-~~dose extrapolation models assume that there is no threshold for carcinogenic substances; that is, exposure to even one molecule, fiber, or picocurie~~picocuries~~ of a carcinogen is sufficient to cause cancer. This is a highly conservative assumption, because the body has several mechanisms to protect against cancer.

The use of the LMS model to extrapolate is a well-recognized source of significant uncertainty in the development of carcinogenic toxicity criteria and, subsequently, theoretical carcinogenic risk estimates. At high levels of exposure, there may indeed be a risk of cancer regardless of whether or not the effect occurs via a threshold mechanism~~ or not~~. An animal bioassay cannot~~can't~~

determine what happens at low levels of exposure, however, which are generally typical of human exposure levels.

At low levels of exposure, the probability of cancer cannot be measured but must be extrapolated from higher dosages. To do this, test animals are typically exposed to carcinogens at levels that are orders of magnitude greater than those likely to be encountered by humans in the environment. It would be difficult, if not impossible, to perform animal experiments with a large enough number of animals to directly estimate the level of risk at the low exposure levels typically encountered by humans. Thus, to estimate the risk to humans exposed at low levels, dose-response data derived from animals given high dosages are extrapolated downward using mathematical models such as the LMS model, which assumes that there is no threshold of response. The dose-response curve generated by the model is known as the maximum likelihood estimate. The slope of the 95 percent lower confidence interval (*i.e.*, upper-bound limit) curve, which is a function of the variability in the input animal data, is taken as the CSF. CSFs are then used directly in cancer risk assessment.

The U.S. federal government, including USEPA itself, has acknowledged the limitations of the high-to-low dose extrapolation models, particularly the LMS model (USEPA 1991c). In fact, this aspect of cancer risk assessment has been criticized by many scientists (including regulatory scientists) in recent years. USEPA has recently released revised cancer risk assessment guidelines (USEPA 2005c).

Even for genotoxic (*i.e.*, non-threshold) substances, there are two major sources of bias embedded in the LMS model: (1) its inherent conservatism at low doses and (2) the routine use of the linearized form in which the 95 percent upper confidence interval is used instead of the unbiased maximum likelihood estimate. The inherent conservatism at low doses is due in part to the fact that the LMS model ignores all of the numerous biological factors that argue against a linear dose-~~-~~response relationship for genotoxic effects (*e.g.*, DNA repair, immunosurveillance, toxicokinetic factors).

Several other factors inherent in the LMS model result in overestimated carcinogenic potency: (1) any exaggerations in the extrapolation that can be produced by some high dose responses (if they occur) are generally neglected~~;~~, (2) UCLs~~upper confidence limits~~ on the actual response observed in the animal study are used rather than the actual response, resulting in upper-bound low dose extrapolations, which can greatly overestimate risk~~;~~, and (3) non-genotoxic chemicals (*i.e.*, threshold carcinogens) are modeled in the same manner as highly genotoxic chemicals.

### 7.3.6 Uncertainties with the Asbestos Risk Assessment

For the risk assessment, asbestos concentrations were presented two ways, as a best estimate and upper bound based upon the UCL of the mean of the Poisson distribution. No detections of amphibole fibers were observed. However, when zero fibers are observed, the UCL of the mean is approximately three fibers, and this value is used as the basis for the reasonable maximum exposure point concentration for the asbestos risk assessment. Considering the remediation activities that have been performed, and the observation of zero amphibole fibers, this approach might result in overestimation of amphibole related risks.

Asbestos risk estimates are highly dependent on the number of samples to increase or decrease the pooled analytical sensitivity. That is, a larger number of non-detect samples with similar individual analytical sensitivity results in a lower pooled analytical sensitivity and subsequently a lower estimated ARR, whereas~~asbestos related risk. Whereas,~~ a smaller number of non-detect samples results in a higher ARR.~~asbestos related risk.~~ Uncertainty is, thus, reduced as more samples are collected.

## 7.4 CUMULATIVE EFFECT OF UNCERTAINTIES

Uncertainties from different sources are compounded in the HHRA. For example, if a person's daily intake rate for a chemical is compared to an RfD to determine potential health risks, the uncertainties in the concentration measurements, exposure assumptions, and toxicities are all expressed in the result. Because the exposure assumptions and toxicity criteria are considered conservative, the risk estimates calculated in this HHRA are likely to overestimate rather than underestimate potential risks.

# 8.0 SUMMARY OF RESULTS

This HHRA has evaluated potential risks to human health associated with chemicals and asbestos detected in soil at the Galleria North -School Site sub-area located within the BMI Common Areas in Clark County, Nevada. All~~The~~ calculation spreadsheets for this HHRA are presented in Appendix I (on the report CD in Appendix B), including calculations of chemical theoretical upper-bound ILCRs and non-cancer health effects and asbestos~~are presented in Appendix H (included on the report CD in Appendix B). Asbestos~~ risk calculations~~ are also presented in Appendix H (included on the report CD in Appendix B). All calculation spreadsheets for this HHRA are included in Appendix H (included on the report CD in Appendix B)~~.

The risk estimates are based on reasonable maximum exposure scenarios, which results in estimates of the potential reasonable maximum, or high-end, risks associated with the Site. The calculated chemical theoretical upper-bound ILCRs and HIs are presented in Tables 6-13~~Tables 22~~ through 6-16~~25~~ for residential, construction worker, commercial (indoor) worker, and maintenance (outdoor) worker receptors, respectively. Asbestos estimated risk of death from lung cancer or mesothelioma on a Site~~site~~-wide basis are presented in Table 6-17~~26~~.

## 8.1 RESIDENTS

For chemical exposures, the total cumulative non-cancer HI for future residential receptors at the Site is 0.14~~31~~ (including the surface flux air risk estimates[53]) (~~see~~ Table 6-13~~22~~), with ~~vanadium and~~ perchlorate soil exposures via the oral ingestion pathway being the primary contributors. The HI does not exceed the target HI of 1.0. Accordingly, the evaluation of~~As a result, BRC did not evaluate~~ target-organ HI values is moot.

The maximum theoretical upper-bound ILCR for future residential receptors at the Site is 2~~1~~ $\times 10^{-6}$ (including the surface flux air risk estimates see Table 6-13~~22~~). The range of theoretical upper-bound ILCRs is 6~~5~~ $\times 10^{-7}$ to 2~~1~~ $\times 10^{-6}$. The theoretical upper-bound ILCR is near~~at~~ the risk goal of $1 \times 10^{-6}$ and is driven primarily by the indoor air theoretical upper-bound ILCR for surface flux sample GNC1-BE21 due to 1,2-dibromoethane (note that this chemical is

[53] The minimum and maximum surface flux risk estimates are summed with the soil risk estimates to provide a range of cumulative risks. The minimum and maximum surface flux risk estimates are provided in Appendix I~~Appendix H~~ (included on the report CD in Appendix B) and the receptor-specific chemical risk summary tables. The risks shown are cumulative risks using the maximum surface flux risk estimate.

not an SRC), as well as benzo(a)pyrene and dibenzo(a,h)anthracene soil exposures via the oral ingestion and dermal contact pathways.

The estimated risks for death from lung cancer or mesothelioma for asbestos exposures to future residential receptors were below $1 \times 10^{-6}$. For residential receptors, the best estimate and upper bound concentrations for chrysotile fibers are $1 \times 10^{-9}$ and $6 \times 10^{-9}$; and zero and $4 \times 10^{-7}$ for amphibole fibers (Table 6-17~~26~~). These estimated risks are below the low end of the risk goal of $1 \times 10^{-6}$. The upper-bound estimated risk of death from lung cancer or mesothelioma is estimated based on the 95 percent UCL of the count of the number of fibers detected, assuming a Poisson distribution for the count. Note that when the observed count is zero, the 95 percent UCL is approximately three fibers. Therefore, the high-end risk estimate for deaths from lung cancer or mesothelioma is a conservative value since it is based on a 95 percent UCL of the Poisson distribution of three long amphibole structures although no long amphibole structures have been detected at the Site.

## 8.2 CONSTRUCTION WORKERS

For chemical exposures, the total cumulative non-cancer HI for construction worker receptors at the Site is 0.040~~079~~ (including the surface flux air risk estimates) (~~see~~ Table 6-14~~23~~), with ~~vanadium and~~ perchlorate soil exposures via the oral ingestion pathway being the primary contributors. The HI does not exceed the target HI of 1.0. As a result, BRC did not evaluate target-organ HI values.

The maximum theoretical upper-bound ILCR for construction worker receptors at the Site is $2 \times 10^{-8}$ (including the surface flux air risk estimates see Table 6-14~~23~~) with benzo(a)pyrene and dibenzo(a,h)anthracene soil exposures via the oral ingestion and dermal contact pathways the primary contributors. The theoretical upper-bound ILCRs are all below the low end of the risk goal of $1 \times 10^{-6}$.

The estimated risks for death from lung cancer or mesothelioma for asbestos exposures to construction workers were below $1 \times 10^{-6}$. For construction worker receptors, the best estimate and upper-bound concentrations for chrysotile fibers are $2 \times 10^{-9}$ and $1 \times 10^{-8}$~~,~~; and zero and $7 \times 10^{-7}$ for amphibole fibers (Table 6-17~~26~~). These estimated risks are below the low end of the risk goal of $1 \times 10^{-6}$.

## 8.3 COMMERCIAL (INDOOR) WORKERS

For chemical exposures, the total cumulative non-cancer HI for commercial (indoor) worker receptors at the Site is 0.0059~~012~~ (including the surface flux air risk estimates) (~~see~~ Table 6-15~~24~~), with vanadium and perchlorate soil exposures via the oral ingestion pathway being the primary contributors. The HI does not exceed the target HI of 1.0. As a result, BRC did not evaluate target-organ HI values.

The maximum theoretical upper-bound ILCR for commercial (indoor) worker receptors at the Site is 2~~1~~ × $10^{-7}$ (including the surface flux air risk estimates see Table 6-15~~24~~) with the indoor air theoretical upper-bound ILCR for surface flux sample GNC1-BE21 due to 1,2-dibromoethane the primary contributor, as well as benzo(a)pyrene and dibenzo(a,h)anthracene soil exposures via the oral ingestion and dermal contact pathways. The theoretical upper-bound ILCRs are all below the low end of the risk goal of 1 × $10^{-6}$.

The estimated risks for death from lung cancer or mesothelioma for asbestos exposures to commercial (indoor) workers were below 1 × $10^{-6}$. For commercial (indoor) worker receptors, the best estimate and upper-bound concentrations for chrysotile fibers are 3~~2~~ × $10^{-10}$ and 1 × $10^{-9}$~~,~~; and zero and 8 × $10^{-8}$ for amphibole fibers (Table 6-17~~26~~). These estimated risks are below the low end of the risk goal of 1 × $10^{-6}$.

## 8.4 MAINTENANCE (OUTDOOR) WORKERS

For chemical exposures, the total cumulative non-cancer HI for commercial (outdoor) worker receptors at the Site is 0.0099~~020~~ (including the surface flux air risk estimates) (~~see~~ Table 6-16~~25~~), with ~~vanadium and~~ perchlorate soil exposures via the oral ingestion pathway being the primary contributors. The HI does not exceed the target HI of 1.0. Accordingly, the evaluation of~~As a result, BRC did not evaluate~~ target-organ HI values is moot.

The maximum theoretical upper-bound ILCR for commercial (outdoor) worker receptors at the Site is 2 × $10^{-7}$ (including the surface flux air risk estimates see Table 6-16~~25~~) with the soil theoretical upper-bound ILCRs for dibenzo(a,h)anthracene and benzo(a)pyrene via the oral ingestion and dermal contact pathways the primary contributors. The theoretical upper-bound ILCRs are all below the low end of the risk goal of 1 × $10^{-6}$.

The estimated risks for death from lung cancer or mesothelioma for asbestos exposures to maintenance (outdoor) workers were below 1 × $10^{-6}$. For maintenance (outdoor) worker receptors, the best estimate and upper-bound concentrations for chrysotile fibers range from

6~~5~~ × $10^{-10}$ to 3 × $10^{-9}$ and zero and 2 × $10^{-7}$ for amphibole fibers (Table 6-17~~26~~). These estimated risks are below the low end of the risk goal of 1 × $10^{-6}$.

# 9.0 POTENTIAL IMPACTS TO GROUNDWATER

This section~~Section~~ presents the evaluation of the potential impacts to groundwater of residual chemicals in soil and considering the future land use of the Site. In general, this evaluation is conducted using two basic analytical tools: (1) screening of COPCs, resulting in selection of indicator COPCs for modeling, and (2) use of both the VLEACH and SESOIL (as appropriate) vertical unsaturated zone migration models and Site~~site~~-specific analytical results of soil samples collected from the Site. The SESOIL modeling was conducted for all non-volatile COPCs identified in the HHRA and selected for modeling.[54] The SESOIL modeling was selected because it can provide a consistent framework for evaluating potential groundwater impacts for the non-volatile COPCs. However, SESOIL does not simulate downward vapor-phase diffusion. Therefore, in cases where VOCs are potential COPCs selected for modeling, VLEACH is used for the volatile COPCs identified in the HHRA in the soil matrix and selected for modeling. However, since no volatile COPCs were identified in the HHRA, ~~therefore,~~ the VLEACH model was not used for the Site. The evaluation was conducted using the SESOIL model as distributed by Waterloo Hydrogeologic, Inc., in the model software package WHI UnSat Suite Plus 2.2.03.

## 9.1 PRELIMINARY IMPACTS TO GROUNDWATER SCREENING

A tiered process is carried out for the evaluation of potential impacts to groundwater. Consistent with Section 9.6.1 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), several criteria are utilized to evaluate whether chemicals may present a potential threat to groundwater quality prior to inclusion in quantitative unsaturated zone modeling.

### ~~9.1.1Comparison to Leaching-Based Basic Comparison Levels~~

Only those chemicals selected as COPCs in the HHRA (Section 5) are considered further for evaluation as a potential threat to groundwater quality. The COPCs considered in the evaluation are listed in Table K~~J~~-1. Initial quantitative evaluation of the potential for residual COPC concentrations to impact groundwater quality was conducted by comparison of detected concentrations of each COPC to the NDEP (2011a~~2010a~~) LBCLs. While this comparison is also conducted as part of the confirmation and data process summary (Table 3-4), in Section 3 this process is utilized for discussion and comparative purposes only.

[54] Although the *BRC Closure Plan* identifies the use of SESOIL for inorganic compounds, PESTAN for pesticides, and VLEACH for other organic compounds; subsequent information indicates that PESTAN is inappropriate for this type of modeling. Therefore, because SESOIL is an appropriate model for inorganics, pesticides, and other organic compounds, for consistency, SESOIL was used for all non-VOCs at the Site.

LBCLs have been developed by the NDEP (2011a)~~2010a),~~ and are based on a simple, conservative soil/water partitioning and groundwater dilution model provided in the USEPA's *Soil Screening Guidance* (1996). This process is described in detail in Section 9.6.1 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010). In calculating the LBCL, a DAF is applied. A DAF of 1~~one~~ is used when little or no dilution or attenuation of soil leachate concentrations is expected, and a DAF of 20 may be used when significant attenuation of the leachate is expected due to Site~~site~~-specific conditions.

For the Site, the LBCLs based on a DAF of 1 were used for comparison purposes ($LBCL_{DAF1}$). Those chemicals with maximum detected concentrations less than the $LBCL_{DAF1}$ for that COPC are considered unlikely to pose a significant threat to groundwater quality, and are eliminated from further consideration. This comparison is presented in Table K~~J~~-1. Of the 10~~12~~ chemicals selected as COPCs in Section 5, eight~~nine~~ do not have detected concentrations greater than their respective $LBCL_{DAF1}$. Therefore, these eight~~nine~~ chemicals are considered unlikely to present a significant threat to future groundwater quality and are eliminated from further evaluation. Two~~Three~~ COPCs, ammonia and perchlorate, do not have LBCLs~~;~~ therefore, these COPCs are considered further.

### ~~9.1.2 Selection of Representative COPCS for Modeling~~

~~For those COPCs that do not have LBCLs, further evaluation was conducted to select a subset of COPCs for modeling considered representative of these chemicals. In selecting representative chemicals for modeling, evaluation criteria included: physical/chemical parameters, 2) anticipated vadose mobility relative to other members of the chemical class, 3) relative relationship between maximum detected concentrations and LBCL (Max/LBCL ratio), and 4) relative relationship between residential soil BCLs (indications of relative toxicity). The results of this evaluation are presented in Table J-1. As a result of the evaluation, the following chemicals were selected for quantitative unsaturated zone modeling: ammonia, nitrate, and perchlorate.~~

## 9.2 SESOIL MODEL

SESOIL is designed for long-term environmental hydrologic, sediment, and pollutant fate simulations. The model is structured around three cycles: (1) the hydrologic cycle, which takes into account rainfall, infiltration, soil moisture, surface runoff, exfiltration, evapotranspiration, groundwater discharge, and capillary rise; (2) the sediment cycle, which is currently not available in the model; and (3) the pollutant cycle, which takes into account advection, diffusion,

volatilization, adsorption/desorption, chemical degradation/decay, biological transformation and uptake, hydrolysis, photolysis, oxidation, and cation exchange. A complete description of the model equations and assumptions is provided in *SESOIL: A Seasonal Soil Compartment Model* (Bonazountas and Wagner 1984). Extensive modifications to the original version of SESOIL are described in Hetrick *et al*. (1989). The most current version of SESOIL incorporates these modifications.

Because the SESOIL model ignores a number of possible attenuating factors, it is likely that it over--predicts the actual chemical migration rate in the vadose zone. However, because of its simplicity, this approach provides a simple method to estimate the likely maximum rate at which chemicals would be transported in the vadose zone down to groundwater. All input parameters used in the model simulations are presented in Appendix K~~J~~ (included on the report CD in Appendix B).

Inputs for SESOIL are broken out into the following elements:

- Climate Data (Table K~~J~~-2): consists of nine monthly climatological inputs. Data for this file are accessed from the climatic dataset incorporated into WHI UnSat Suite Plus. This dataset contains monthly averages for over 200 first order weather stations throughout the U.S.
- Soil Data (Table K~~J~~-3): consists of several parameters that describe the soil properties for the Site.
- Chemical Data (Table K~~J~~-4): consists of several parameters used to describe the properties of the COPC.
- Application Data (Table K~~J~~-5): consists of a number of inputs that describe soil layer specific data and the chemical application load.
- Initial Concentrations (Table K~~J~~-6): consists of the COPC concentrations used at time zero.

Data for Las Vegas, the closest first order weather station to the Site with similar meteorological conditions, are considered representative of the Site and input into this file. Input parameters for this data file include temperature, cloud cover, relative humidity, precipitation, and albedo, which relates to the fraction of light or electromagnetic radiation reflected by a surface. Evapotranspiration is calculated by the model based on temperature, cloud cover, relative humidity, and albedo (precipitation is not included as part of this calculation). Greater

evapotranspiration inhibits infiltration, leading to slower downward migration of the chemicals. The climate dataset used is shown in Table K~~J~~-2, in Appendix K.~~J.~~

The soil model input data consist~~consists~~ of several parameters that~~which~~ describe soil properties. Average values of measured Site~~site~~-specific data of soil porosity, density and organic carbon content were used in the model (Table K~~J~~-3, in Appendix K~~J~~). For parameters without measured Site data (cation exchange coefficient, Freundlich exponent), default inputs consistent with a sand soil type were used, with the exception of soil disconnectedness index. The default sand soil disconnectedness index of 3.7 was modified to 4.53, such that the overall recharge rate to groundwater predicted by the model would be consistent with the default, pre-development recharge rate predicted in the groundwater flow model developed for the Eastside property (DBS&A 2009). A recharge rate of 0.08 inch~~inches~~ per year (for undeveloped areas) was estimated as part of that model.

The chemical model input data consist~~consists~~ of several parameters used to describe the properties of the chemical of concern. USEPA Soil Screening Guidance (2002b) default chemical properties were used where available. The NDEP's BCL guidance (NDEP 2009a) was a secondary source for these parameters. Chemical parameters used in the evaluation are presented in Table K~~J~~-4, in Appendix K~~J~~.

The application model input data consist~~consists~~ of a number of inputs that describe infiltration-layer-specific data and the chemical application load. The model was run without application load. For purposes of this evaluation, the soil column was divided into four infiltration layers (Table K~~J~~-5, in Appendix K~~J~~). The designation of each layer and the width of each infiltration layer were:

| Designation | Thickness (feet) | Boundary Depths (feet) |
|---|---|---|
| Infiltration Layer One | 10 | 0 – 10 |
| Infiltration Layer Two | 5 | 10 – 15 |
| Infiltration Layer Three | 5 | 15 – 20 |
| Infiltration Layer Four | 5 | 20 – 25 |

For the purposes of inputting the initial soil chemical concentrations, the first layer was divided into 10~~ten~~ individual 1-~~one~~ foot-~~-~~thick sub-layers, and the three remaining layers were divided

into five individual 1-~~.0~~ foot-~~-~~thick sub-layers. The initial soil chemical concentration in each sub-layer for the simulation was the maximum detected concentration in each soil depth horizon corresponding to each sub-layer (Table K~~J~~-6, in Appendix K~~J~~).

The depth to groundwater has been observed to vary from approximately 25 to 33 feet bgs in recent (July-August 2009) sampling (~~see~~ Figure 3~~2~~). Therefore, groundwater was conservatively assumed to be at a depth of 25 feet bgs. The SESOIL model is one-~~-~~dimensional, that is, it is limited to calculations and predictions within the soil column defined by the input parameters.

## 9.3 POTENTIAL IMPACTS TO CHEMICAL MIGRATION MECHANISMS FOLLOWING REDEVELOPMENT

Migration of chemicals in soil to groundwater may be affected following redevelopment. Future redevelopment will likely result in increased surface water infiltration due to sources such as buried water lines, sewer lines, irrigation lines and/or over-watering of parks and lawns. These sources have the potential to enhance the migration to groundwater of the post-remediation levels of chemicals remaining in soils. Subsequently, three surface water infiltration scenarios were evaluated.

The first scenario evaluates recharge relative to baseline, pre-development conditions. This scenario assesses the potential for surface precipitation on unimproved ground surface (titled a "baseline" scenario~~)),~~ to influence migration of chemicals to groundwater. This is consistent with recharge rate predicted in the groundwater flow model developed for the Eastside property (DBS&A 2009). A recharge rate of 0.08 inch~~inches~~ per year (for undeveloped areas) was estimated as part of that model.

The second scenario evaluates recharge relative to normal post-development conditions. This scenario assesses the potential for surface water recharge in improved areas associated with commercial and residential construction, to influence migration of chemicals to groundwater. This is consistent with recharge rate predicted in the groundwater flow model developed for the Eastside property (DBS&A 2009). A recharge rate of 0.57 inch~~inches~~ per year (for undeveloped areas) was estimated as part of that model (titled the "normal" scenario).

Last~~ly~~, a scenario of post-development enhanced recharge was also evaluated as part of the groundwater flow model developed for the Eastside property (DBS&A 2009), and incorporated into the vadose zone modeling. This scenario evaluates surface water recharge associated with

overwatering of open space. A recharge rate of 8.672 inches per year was estimated as part of that model (titled the "enhanced" scenario).

Therefore, additional modeling runs were conducted using the SESOIL model to account for the potential increased recharge to groundwater for each of the two post-development scenarios. For SESOIL, the only modification was to increase the monthly rainfall to 1.522 centimeters per month (cm/month) for the normal post-development scenario~~,~~ and 5.42 cm/month for the enhanced recharge scenario. While the input of additional applied precipitation is more than the amount of post-development modeled water infiltration (DBS&A 2009), this is necessary to offset the effect of model estimated evapotranspiration (because the model only applies infiltration as a surface rather than as a sub-surface source). The values of 1.522 and 5.42 cm/month are values selected by iterative model runs conducted to identify a precipitation rate that approximates and results in the desired recharge(s) to groundwater. The modified rainfall totals used for this modeling run are provided in Table KJ-2, in Appendix KJ.

## 9.4 MODEL UNCERTAINTY

Use of Site~~site~~-specific values, where available, is recommended. A number of limitations exist for the models, including~~. These include~~:

- Data gaps/ uncertainties in site-specific properties;
- Omission of certain chemical and physical processes; and
- Lack of an appropriate model validation opportunity.

Data gaps, uncertain and/or variable input values that may exist for the Site include:

- Site-specific meteorological data (uncertain/variable);
- Soil input parameter measurements for the different soil layers incorporated in the model (*e.g.*, intrinsic permeability, organic carbon content [uncertain/variable]); and
- Site-specific chemical data (*e.g.*, degradation rates [gap]).

Any interactions that may occur among the different chemicals present in the soil that~~which~~ may influence the migration and/or fate of the various chemicals are~~is~~ not taken into account in the model (*e.g.*, chemical mobility may decrease or increase in the presence of other solvent-related chemical components). Reasonable effort has been made to obtain results that provide reasonable

estimates of actual Site conditions. Uncertain input values were selected based on available scientific and regulatory information to err on the conservative side.

## 9.5 RESULTS

SESOIL results are provided in Tables KJ-7 through KJ-9 in Appendix KJ, and are summarized in Table 9-1~~.28.~~ The results include maximum depth of infiltration, the maximum pore water concentrations in the vadose zone at the groundwater interface and the maximum measured groundwater concentration (observed during the latest groundwater monitoring event~~,~~; July-August 2009). The SESOIL outputs provided electronically in Appendix KJ (included on the report CD in Appendix B) contain the results of the evaluation for each of the COPCs and scenarios.

For the inorganics selected for modeling, ammonia (1,108~~100~~,000 micrograms per liter [µg/L], 638~~, 2~~,000 ~~,000~~µg/L, and 166,800~~175,000~~ µg/L, respectively~~)), nitrate (2,000,000 µg/L, 2,000,000 µg/L, and 1,950,000 µg/L, respectively),~~ and perchlorate (2,000,000 ~~µg/L~~, 2,000,000 ~~µg/L~~, and 5,880~~950~~,000 µg/L, respectively) are ~~all~~ predicted to reach groundwater at concentrations that exceed their respective residential water BCLs (730 ~~µg/L, 10,000 µg/L,~~ and 18 µg/L, respectively) under all three scenarios. Of note, ~~is that~~ for ~~nitrate and~~ perchlorate~~,~~ these concentrations approach or equal the COPCs solubility shortly into the simulation.

~~Also relevant to this discussion is consideration that some constituents such as nitrate have naturally-occurring/background concentrations; however, only metals and radionuclides are evaluated in the background comparison analyses. Thus, it is plausible that naturally occurring concentrations of nitrate, when modeled, might also produce estimated water concentrations that exceed BCLs and measured groundwater concentrations. To test this hypothesis under the baseline scenario, the maximum detected and average (non-detects at one-half the SQL) background concentrations of nitrate (102 mg/kg and 8.27 mg/kg, respectively) were modeled similarly to the site-measured concentrations. The input concentrations are presented in Table J-6. All other modeling parameters were held consistent with the site-related modeling. The results of this modeling effort are presented in Table J-8 (conservatively, only the baseline scenario was modeled). The modeled water concentrations approach (average background nitrate) or equal (maximum background nitrate) the solubility limit as well, and are similar to the results for the site-related modeling. These results provide a line of evidence suggesting that for the highly soluble COPCs with low Kd values, even background concentrations when modeled may yield concentrations that both exceed residential BCLs as well as measured concentrations.~~

This is consistent with the physical chemical parameters selected for the inorganics (non-metals). Because for ammonia~~, nitrate,~~ and perchlorate the adsorption to soils is very variable and uncertain, the modeling assumed very low Kd values for these constituents to maximize the downward migration to groundwater. With such low adsorption coefficients the model also predicted such rapid mass migration to groundwater that they~~all~~ would hit groundwater within 2~~seven~~ to 17~~20~~ years and exceed their BCLs within a few~~two~~ years thereafter. However, while these chemicals are detected in shallow groundwater at the Site, the concentrations are from approximately 2 (perchlorate~~two (nitrate~~) to more than 4~~four~~ (ammonia) orders of magnitude less than predicted (it is also noted that use of the Summers groundwater mixing model would likely do little to affect these results). Further, ammonia (89.6 µg/L) and perchlorate (148 µg/L) are detected in SPLP data collected in the soil source material ~~(nitrate was not analyzed for in the SPLP sample)~~, but are detected at concentrations that are significantly less than the soil moisture concentrations predicted at the groundwater interface through modeling.

The time since discontinued use of the ponds and ditches exceeds the timeframes for COPCs to reach groundwater at the concentrations predicted to exceed BCLs. Based upon the differences in the modeling predicted results and the observed measurements in groundwater, it is considered probable that processes not accounted for in the model are reducing/attenuating concentrations of COPCs as they migrate through the vadose zone towards groundwater. Based on the elapsed time since any Site vicinity use, the lack of observations of the evaluated chemicals in groundwater at the Site or concurrence between measured and predicted concentrations, and the reasonably mobile nature of the COPCs evaluated, these cumulative lines of evidence suggest that (1) the modeling environment utilized in this evaluation is likely to be overly conservative~~,~~ and (2) there is insufficient evidence to suggest that the concentrations of constituents detected in Site soils represent a risk to groundwater quality.

It should also be noted that potential groundwater impacts for the entire Eastside property are the subject of a separate comprehensive RAS wherein all potential impacts to groundwater will be addressed.

# 10.0DATA QUALITY ASSESSMENT

Sample size calculations were conducted for 11 constituents (arsenic, total chromium, hexavalent chromium, cobalt, formaldehyde, radium-226, TCDD TEQ, and vanadium) for the Site. Rationale for the inclusion of these constituents in the sample size calculations is~~are~~ provided below:

- Arsenic – a chemical of primary concern for the overall project, often exceeding comparison levels;
- Benzo(a)pyrene – a COPC representative of SVOCs and PAHs with several detected results and a low residential BCL;
- beta-BHC – a COPC representative of organochlorine pesticides with several detected results and a low residential BCL;
- Chromium – a metal with several results in excess of background concentrations resulting in high sample variability;
- Hexavalent chromium – the metal (besides arsenic) with the most exceedances of background concentrations;
- Total Cyanide – a COPC representative of inorganics other than metals with a relatively low BCL and several detects;
- Formaldehyde – the non-dioxins/furans/PCB congeners organic chemical with the highest number of detected results;
- Lead – a metal with a single high value in comparison to other results across the Site;
- Perchlorate – an inorganic chemical that is a primary risk contributor;
- 2,3,7,8-TCDD – a chemical of primary concern for the overall project; and
- Vanadium – a metal with several results in excess of background concentrations resulting in high sample variability.

The formula used here for calculation of sample size is based on a non-parametric test (the Wilcoxon signed rank test), and on simulation studies performed by Pacific Northwest National Laboratories (PNNL 2009) that formed the basis for an approximate formula that is based on the

normal distribution. Essentially, the formula is the one that would be used if a normal-based test were being performed, but an adjustment is made (multiply by 1.16) to account for the intent to perform a non-parametric test. The formula is as follows:

$$n = 1.16\left[\frac{s^2}{\Delta^2}(z_{1-\alpha} + z_{1-\beta(\mu)})^2 + 0.5z_{1-\alpha}^2\right]$$

where,

| | | |
|---|---|---|
| n | = | number of samples |
| s | = | estimated standard deviation of concentrations/fibers |
| Δ | = | width of the gray region (the difference between the threshold value stated in the null hypothesis and the point at which β is specified) |
| α | = | significance level or Type I error tolerance |
| β (μ) | = | Type II error tolerance; and |
| z | = | quantile from the standard normal distribution |

For each chemical, inputs for the calculations include an estimate of the variance from the measured data, a desired significance level, and desired power of the test that must be specified at a concentration of interest (which determines the tolerable difference from the threshold value). For arsenic, the Site mean concentration exceeds its BCL based on the target cancer risk level of $10^{-6}$. It is not appropriate to apply this calculation where the threshold value is less than the mean concentration. Therefore, the maximum shallow background concentration was used for its threshold value. The calculations provided here cover a range of Type I and Type II error tolerances, and the point at which the Type II error is specified. Results are presented in Table 10-1.~~29.~~ In this table~~Table 29~~, various combinations of input values are used, including~~:~~ values of α of 5~~%~~, 10~~,%~~ and 15 percent~~%~~; values of β of 15~~%~~, 20~~%~~, and 25 percent~~%~~; and a gray region of width 10~~%~~, 20~~,%~~ and 30 percent~~%~~ of the threshold level. It is clear from Table 10-1~~29~~ that the number of samples collected is adequate for the Site. That is, all calculated adequate sample numbers are less than those actually collected at the Site for use in the HHRA.

Note also that there are 25~~26~~ samples collected for amphibole asbestos analysis. Amphibole was not detected in any of these samples~~;~~, however, because of the number of samples collected, the ARRs~~asbestos related risks~~ are all less than $1 \times 10^{-6}$. Consequently, sufficient samples have been collected to address ARRs~~asbestos related risks~~.

## 11.0 SUMMARY

BRC has prepared this HHRA and Closure Report for the ~~Galleria North School~~ Site~~ sub-area~~. The purpose of this report is to request an NFAD by the NDEP. The~~ for this Site. As noted in Section 1,~~ NDEP acknowledges that discrete portions of the Eastside may be issued an NFAD as remedial actions are completed for selected environmental media (NDEP 2006). The portion of the Eastside for which the NFAD is being requested based on this HHRA and Closure Report is shown in red on Figure 1. The legal description of the Site is provided in Appendix L.

The HHRA evaluated the potential for adverse human health impacts that may occur as a result of potential exposures to residual concentrations of chemicals in soil, groundwater, and air following remediation, and assessed whether any additional remedial actions are necessary in order to obtain an NFAD from the NDEP to allow redevelopment of the Site to proceed. The results of the risk assessment provide risk managers with an understanding of the potential human health risks associated with background conditions and additional risks associated with past Site activities.

For human health protection, BRC's goal is to remediate the Site soils such that they are suitable for unrestricted residential uses. Human health risks are represented by estimated theoretical upper-bound cancer risks and non-cancer hazards derived in accordance with standard USEPA and NDEP methods. If the carcinogenic risks or non-cancer hazards exceed USEPA acceptable levels or NDEP risk goals, then remedial action alternatives must be considered. Findings of the HHRA are intended to support the Site closure process. The major findings~~Major finding~~ of this report are the following~~that~~:

- Data~~data~~ collected for use in the HHRA are adequate and usable for their intended purpose;
- All ~~all~~ relevant and reasonable exposure scenarios and pathway have been evaluated;
- Residential~~residential~~, construction worker, commercial (indoor) worker, and maintenance (outdoor) worker cancer and non-cancer risk estimates are within or below the risk goals for the project; and
- Residual~~residual~~ levels of chemicals in soil should not pose an unacceptable risk to groundwater quality beneath the Site.

Following the Tiered approach from the USEPA 2002 Vapor Intrusion Guidance, BRC believes that it has demonstrated that there is no likelihood of adverse vapor intrusion into any indoor spaces that may be constructed in the Galleria North School Site sub-area. Therefore, based on

the results of the HHRA, and the conclusions in this report, exposures to residual levels of chemicals in soil at the Galleria North -School Site sub-area should not result in adverse health effects to all future receptors, or to groundwater quality beneath the Site. Therefore, BRC concludes that an NFAD for the Galleria North -School Site sub-area is warranted and requests that the NDEP issue the NFAD (see Appendix L for the legal description of the Site).

# APPENDIX B

## GALLERIA NORTH SCHOOL SITE SUB-AREA INVESTIGATION DATA TABLES

(Note that all report files, including the database, are on the report CD included in this appendix)

## LIST OF TABLES (APPENDIX B)


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Table B-9 Soil Aldehydes and Semi-Volatile Organic Compounds (SVOCs) Data

Table B-10 Soil Volatile Organic Compounds (VOCs) Data

Table B-11 Surface Flux Data

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**TABLE B-1**
**ASBESTOS RESULTS AND ANALYTICAL SENSITIVITIES**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Analytical Sensitivity ($10^6$ s/gPM$_{10}$) | Concentration Protocol Structures[1] | | Number of Protocol Structures[2] | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Chrysotile | Amphibole | Chrysotile | | Amphibole | |
| | | | | | ($10^6$ s/gPM$_{10}$) | ($10^6$ s/gPM$_{10}$) | Total | Long | Total | Long |
| GNC1-BD19 | 0 | NORM | 1/29/09 | 2.987 | < 8.930 E+6 | < 8.930 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BD20 | 0 | NORM | 1/26/09 | 2.991 | 1.418 E+7 | < 8.944 E+6 | 4 | 1 | 0 | 0 |
| GNC1-BD21 | 0 | NORM | 1/29/09 | 2.967 | < 8.870 E+6 | < 8.870 E+6 | 0 | 0 | 1 | 0 |
| GNC1-BE19 | 0 | NORM | 1/29/09 | 2.991 | < 8.944 E+6 | < 8.944 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BE20 | 0 | NORM | 1/29/09 | 2.981 | < 8.912 E+6 | < 8.912 E+6 | 1 | 0 | 0 | 0 |
| GNC1-BE21 | 0 | NORM | 1/29/09 | 2.979 | < 8.908 E+6 | < 8.908 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BE22 | 0 | NORM | 1/29/09 | 2.987 | < 8.930 E+6 | < 8.930 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BF19 | 0 | NORM | 1/29/09 | 2.979 | < 8.908 E+6 | < 8.908 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BF20 | 0 | NORM | 1/29/09 | 2.990 | < 8.939 E+6 | < 8.939 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BF21 | 0 | NORM | 1/29/09 | 2.943 | < 8.799 E+6 | < 8.799 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BF22 | 0 | NORM | 1/29/09 | 2.979 | < 8.908 E+6 | < 8.908 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BG19 | 0 | NORM | 1/29/09 | 2.900 | < 8.671 E+6 | < 8.671 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BG20 | 0 | NORM | 1/29/09 | 2.987 | < 8.930 E+6 | < 8.930 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BG20 | 0 | FD | 1/29/09 | 2.991 | < 8.944 E+6 | < 8.944 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BG21 | 0 | NORM | 1/29/09 | 2.960 | < 8.851 E+6 | < 8.851 E+6 | 0 | 0 | 0 | 0 |
| GNC1-BG22 | 0 | NORM | 1/26/09 | 2.987 | < 8.930 E+6 | < 8.930 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JD07 | 0 | NORM | 1/29/09 | 2.987 | < 8.930 E+6 | < 8.930 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JD08 | 0 | NORM | 1/29/09 | 2.966 | < 8.869 E+6 | < 8.869 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JD09 | 0 | NORM | 1/29/09 | 2.959 | < 8.846 E+6 | < 8.846 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JD10 | 0 | NORM | 1/29/09 | 2.963 | < 8.859 E+6 | < 8.859 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JD11 | 0 | NORM | 1/29/09 | 2.967 | < 8.870 E+6 | < 8.870 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JS09 | 0 | NORM | 1/29/09 | 2.967 | < 8.870 E+6 | < 8.870 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JS10 | 0 | NORM | 1/29/09 | 2.961 | < 8.854 E+6 | < 8.854 E+6 | 0 | 0 | 0 | 0 |
| GNC1-JS11 | 0 | NORM | 1/26/09 | 2.987 | < 8.930 E+6 | < 8.930 E+6 | 0 | 0 | 0 | 0 |
| GNC2-JD10 | 0 | NORM | 6/25/10 | 2.970 | < 8.870 E+6 | < 8.870 E+6 | 0 | 0 | 0 | 0 |
| GNC3-BE20C | 0 | NORM | 6/25/10 | 2.990 | < 8.940 E+6 | < 8.940 E+6 | 0 | 0 | 0 | 0 |
| GNC3-BE20C | 0 | FD | 6/25/10 | 3.000 | < 8.960 E+6 | < 8.960 E+6 | 0 | 0 | 0 | 0 |
| GNC3-JS09C | 0 | NORM | 8/4/10 | 2.990 | < 8.940 E+6 | < 8.940 E+6 | 0 | 0 | 0 | 0 |

[1]Fiber dimensions are presented in the respective analytical reports for each sample.

[2]Only long structures present a potential risk and are used for estimating asbestos risks. Total fiber concentrations are presented for informational purposes only.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-2**
**SOIL DIOXINS/FURANS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 4)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Dioxins/Furans | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1,2,3,4,6,7,8-HpCDF | 1,2,3,4,6,7,8-HpCDD | 1,2,3,4,7,8,9-HpCDF | 1,2,3,4,7,8-HxCDF | 1,2,3,4,7,8-HxCDD | 1,2,3,6,7,8-HxCDF | 1,2,3,6,7,8-HxCDD | 1,2,3,7,8,9-HCDF | 1,2,3,7,8,9-HxCDD |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | 13 | 5.6 | 4.7 J | 4.6 J | < 0.3 U | 4.2 J | < 0.67 U | < 0.41 U | < 0.71 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | 180 | 39 | 60 | 71 | 2.6 J | 49 | 6 | 5.8 | 5.7 |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | 150 | 1600 | 48 | 51 | 3.3 J | 36 | 22 | 4.9 J | 12 |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | 130 | 40 | 50 | 55 | < 1.7 U | 36 | 3.3 J | 6.5 J+ | 3.6 J |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | 250 J | 53 | 120 J | 100 J | 3.6 J | 82 | 8.5 J | 14 J | 5.8 |
| GNC1-BE20 | 0 | FD | 2/6/2009 | 64 J | 40 | 28 J | 16 J | < 1.5 U | 22 | 2.8 J | < 2.5 UJ | 2.7 J |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | 22 | 3.2 J | 9.1 | 8.3 | < 0.3 U | 6.8 | < 0.72 U | < 1.1 U | < 0.74 U |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | 240 | 5800 J | 59 | 96 | 76 | 63 | 230 | 6.8 J+ | 410 |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | 22 | 4.8 J | 9.6 | 11 | < 0.48 U | 7.3 | < 0.88 U | < 1.5 U | < 0.97 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | 54 | 7.7 | 21 | 20 | < 0.72 U | 16 | < 1.5 U | < 2.2 U | < 1.5 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | 28 | 7.6 | 10 | 13 | < 0.39 U | 9.6 | < 0.99 U | < 2.3 U | < 0.74 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | 71 | 14 | 29 | 24 | < 0.98 U | 20 | < 2.5 U | 3.1 J | < 2.1 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | 22 | < 2.2 U | 9.7 | 12 | < 0.37 U | 8.3 | < 0.64 U | < 1.2 U | < 0.71 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | 110 | 24 J | 39 J | 46 | < 1.7 U | 31 J | 3.2 J | 5.3 J+ | 4 J |
| GNC1-BG20 | 0 | FD | 2/5/2009 | 69 | 45 J | 22 J | 32 | < 1.8 U | 21 J | 3.5 J | 3.4 J+ | 4.2 J |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | 16 | < 1.8 U | 5.7 | 6.7 | < 0.63 U | 5.2 | < 0.51 U | < 0.81 U | < 0.54 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | 22 | 3 J | 8.5 | 9.3 | < 0.48 U | 6.6 | < 0.59 U | < 1 U | < 0.56 U |
| GNC1-JA04 | 0 | NORM | 8/13/2009 | 240 | 97 | 75 | 100 | 3.6 J | 69 | 8.7 | 7.6 | 7.5 |
| GNC1-JA05 | 0 | NORM | 8/13/2009 | 23 | 2.7 J | 7.8 | 9.5 | < 5 U | 6.5 | < 5 U | < 5 U | < 5 U |
| GNC1-JA06 | 0 | NORM | 8/13/2009 | 33 | 51 | 12 | 21 | < 4.8 U | 11 | 3.1 J | < 4.8 U | < 4.8 U |
| GNC1-JA07 | 0 | NORM | 8/13/2009 | 35 | 3.4 J | 11 | 16 | < 4.9 U | 10 | < 4.9 U | < 4.9 U | < 4.9 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | 8.5 | 3.9 J | 3.7 J | 4.4 J | < 0.55 U | 2.7 J | < 0.44 U | < 0.47 U | < 0.44 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | 3.6 J | < 1.2 U | < 1.2 U | < 1.5 U | < 0.075 U | < 0.89 U | < 0.23 U | < 0.41 U | < 0.26 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | 13 | < 3.8 U | 4.6 J | 5.2 J | < 0.25 U | 3 J | < 0.5 U | < 0.49 U | < 0.42 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | 14 | < 3 U | 5.5 J | 7.7 J | < 0.24 U | 4.3 J | < 0.55 U | < 0.56 U | < 0.53 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | 120 | 11 | 60 | 51 | < 1.9 U | 44 | 4 J | 9 | 3.7 J |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | 24 | 3.6 J | 9.3 | 10 | < 0.4 U | 7.4 | < 0.81 U | < 1.1 U | < 0.63 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | 87 | 46 | 29 | 38 | < 1.4 U | 23 | 3.7 J | 2.8 J | 3.1 J |
| GNC1-JS09 | 0 | FD | 1/30/2009 | 82 | 63 | 26 | 30 | < 1.3 U | 21 | 3.8 J | 2.7 J | 3 J |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | 550 | 84 | 190 | 210 | 7.5 | 130 | 16 | 19 | 15 |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | 32 J | 12 J | 13 J | 14 J | < 0.58 U | 11 J | < 1.3 U | < 1.5 U | < 1.4 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | 66 J | 49 J | 21 J | 26 J | < 1.3 U | 17 J | 3.2 J | 2.7 J | 3.2 J |
| GNC2-BE20C | 0 | NORM | 1/8/2010 | 190 | 94 J | 76 | 79 | < 5.2 U | 53 | 6.1 | 6 | 5.1 J |
| GNC2-BE20C | 0 | FD | 1/8/2010 | 200 | 44 J | 76 | 85 | < 5.1 U | 57 | 5.6 | 6.5 | 4.8 J |
| GNC2-BE22C | 0 | NORM | 1/6/2010 | 10 | 2.9 J | 4.8 J | 6 | < 5.3 U | 3.7 J | < 5.3 U | < 5.3 U | < 5.3 U |

**TABLE B-2**
**SOIL DIOXINS/FURANS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Dioxins/Furans | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1,2,3,4,6,7,8-HpCDF | 1,2,3,4,6,7,8-HpCDD | 1,2,3,4,7,8,9-HpCDF | 1,2,3,4,7,8-HxCDF | 1,2,3,4,7,8-HxCDD | 1,2,3,6,7,8-HxCDF | 1,2,3,6,7,8-HxCDD | 1,2,3,7,8,9-HCDF | 1,2,3,7,8,9-HxCDD |
| GNC2-JA04 | 0 | NORM | 8/2/2010 | 3.9 J | < 4.9 U | < 4.9 U | < 4.9 U | < 4.9 U | < 4.9 U | < 4.9 U | < 4.9 U | < 4.9 U |
| GNC2-JA04 | 0 | FD | 8/2/2010 | 6 | < 4.9 U | < 4.9 U | < 4.9 U | < 4.9 U | < 4.9 U | < 4.9 U | < 4.9 U | < 4.9 U |
| GNC2-JD07C | 0 | NORM | 1/6/2010 | 6 | < 5.1 U | 2.6 J | 3.9 J | < 5.1 U | < 5.1 U | < 5.1 U | < 5.1 U | < 5.1 U |
| GNC2-JE01 | 0 | NORM | 4/26/2010 | 170 J | 19 J | 64 J | 83 | < 5.8 U | 49 | 4.2 J | 7.3 | 4.3 J |
| GNC2-JE02 | 0 | NORM | 4/26/2010 | 110 J | 29 J | 38 J | 53 | < 5.5 U | 30 | 3.3 J | 4.8 J | 3.1 J |
| GNC2-JS09C | 0 | NORM | 1/8/2010 | < 5.1 U | < 5.1 U | < 5.1 U | < 5.1 U | < 5.1 U | < 5.1 U | < 5.1 U | < 5.1 U | < 5.1 U |
| GNC2-JS10C | 0 | NORM | 1/8/2010 | 120 J | 13 J | 51 J | 51 J | < 5.2 U | 36 J | 2.9 J | 5.4 | 3.2 J |
| GNC2-JS10C | 0 | FD | 1/8/2010 | 56 J | 6 J | 23 J | 24 J | < 5.3 U | 15 J | < 5.3 U | < 5.3 U | < 5.3 U |

All units in pg/g.

-- = no sample data.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-2**
**SOIL DIOXINS/FURANS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 3 of 4)**

| | | | | Dioxins/Furans | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | 1,2,3,7,8-PeCDF | 1,2,3,7,8-PeCDD | 2,3,4,6,7,8-HxCDF | 2,3,4,7,8-PeCDF | 2,3,7,8-TCDF | 2,3,7,8-TCDD | OCDF | OCDD | TCDD TEQ |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | 3.5 J | < 0.32 U | < 0.97 U | < 2.1 U | 4.3 | < 0.19 U | 42 | 55 | 4.1 |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | 43 | 3.6 J | 18 | 23 | 25 | 0.93 J | 160 | 670 | 40.3 |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | 31 | < 2.5 U | 12 | 16 | 17 | 0.73 J | 11000 | 420 | 47 |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | 32 | < 2.4 U | 9.9 | 16 | 22 | 1.1 | 420 | 440 | 28.6 |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | 83 J | 5.6 | 25 J | 42 J | 43 J | 1.7 J | 210 J | 770 J | 66.2 |
| GNC1-BE20 | 0 | FD | 2/6/2009 | 22 J | < 1.5 U | 6.4 J | 11 J | 14 J | < 0.41 UJ | 360 J | 210 J | 16.5 |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | 6.8 | < 0.41 U | < 2 U | 3.3 J | 3.2 | < 0.18 U | 9.5 J | 66 J | 4.8 |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | 41 | 50 | 18 | 39 | 37 | 7.5 | 16000 J | 530 | 307 |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | 7.8 | < 0.75 U | < 2.6 U | 4 J | 7.9 | < 0.35 U | 30 | 110 | 6.4 |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | 16 | < 1.1 U | 5 J | 8.5 | 9.3 | < 0.33 U | 45 | 180 | 12.1 |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | 6.5 | < 0.58 U | < 2.5 U | 3.3 J | 3.3 | < 0.28 U | 42 | 70 | 5.9 |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | 19 | < 1.3 U | 6.3 | 9.9 | 9.1 | < 0.42 U | 27 J | 250 J | 14.8 |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | 7.9 | < 0.57 U | < 2.5 U | 3.9 J | 5.5 | < 0.23 U | < 4.3 U | 61 | 6.8 |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | 26 J | < 2.3 U | 11 | 12 | 14 | 0.73 J | 130 J | 280 J | 23 |
| GNC1-BG20 | 0 | FD | 2/5/2009 | 20 J | < 2.1 U | 6.8 | 10 | 13 | 0.81 J | 340 J | 160 J | 18.4 |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | 3.3 J | < 0.54 U | < 1.6 U | < 1.2 U | 1.7 | < 0.27 U | 5.4 J | 44 | 2.8 |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | 5.4 | < 0.48 U | < 2 U | < 2.5 U | 2.9 | < 0.3 U | 7.3 J | 57 | 3.9 |
| GNC1-JA04 | 0 | NORM | 8/13/2009 | 53 | 4.8 J | 18 | 27 | 29 | 1.1 | 2200 | 670 | 50.8 |
| GNC1-JA05 | 0 | NORM | 8/13/2009 | 4.5 J | < 5 U | < 5 U | < 5 U | 3.2 | < 1 U | < 8.1 U | 59 | 8.1 |
| GNC1-JA06 | 0 | NORM | 8/13/2009 | 13 | < 4.8 U | 3 J | 6.2 | 8.6 | < 0.97 U | 120 | 71 | 13.5 |
| GNC1-JA07 | 0 | NORM | 8/13/2009 | 10 | < 4.9 U | 2.7 J | 5 | 7.1 | < 0.97 U | < 7.2 U | 88 | 11.5 |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | 3.2 J | < 0.3 U | < 0.73 U | < 1.7 U | 3.4 | < 0.092 U | 24 | 42 | 2.4 |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.76 U | < 0.1 U | < 0.5 U | < 0.39 U | < 0.5 U | < 0.051 U | < 10 U | 10 | 0.58 |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | 2.8 J | < 0.26 U | < 0.79 U | < 1.5 U | 2.6 J | < 0.09 U | < 20 U | 61 | 2.2 |
| GNC1-JD09 | 0 | FD | 1/30/2009 | 4.3 J | < 0.32 U | < 0.85 U | < 1.7 U | 4.1 J | < 0.13 U | < 18 U | 67 | 3 |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | 46 | 3.6 J | 11 | 21 | 57 | 1.2 | 19 J | 840 J | 38.3 |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | 6.6 | < 0.65 U | < 1.6 U | 3.3 J | 6.7 | < 0.27 U | 13 | 95 | 5.8 |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | 19 | < 1.8 U | 7.6 | 9.4 | 13 | < 0.37 U | 300 J | 380 | 19.1 |
| GNC1-JS09 | 0 | FD | 1/30/2009 | 17 | < 1.7 U | 6.9 | 9 | 11 | < 0.47 U | 540 J | 390 | 17.7 |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | 120 | 10 | 45 | 63 | 75 | 2.9 | 290 | 2300 | 113 |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | 10 J | < 0.77 U | 2.8 J | 5.1 J | 7.6 | < 0.27 U | 69 J | 85 J | 8.3 |
| GNC1-JS11 | 0 | FD | 1/29/2009 | 17 J | < 1.7 U | 4.1 J | 7.7 | 11 | < 0.42 U | 280 J | 180 J | 14.6 |
| GNC2-BE20C | 0 | NORM | 1/8/2010 | 41 | < 5.2 U | 14 | 24 | 23 | 0.66 J | 670 J | 510 | 40.5 |
| GNC2-BE20C | 0 | FD | 1/8/2010 | 48 | 3.4 J | 14 | 26 | 26 | 0.84 J | 220 J | 530 | 43.7 |
| GNC2-BE22C | 0 | NORM | 1/6/2010 | 3.2 J | < 5.3 U | < 5.3 U | < 5.3 U | 2.2 | < 1.1 U | 9.2 J | 34 | 7.7 |

**TABLE B-2**
**SOIL DIOXINS/FURANS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Dioxins/Furans | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1,2,3,7,8-PeCDF | 1,2,3,7,8-PeCDD | 2,3,4,6,7,8-HxCDF | 2,3,4,7,8-PeCDF | 2,3,7,8-TCDF | 2,3,7,8-TCDD | OCDF | OCDD | TCDD TEQ |
| GNC2-JA04 | 0 | NORM | 8/2/2010 | < 4.9 U | < 4.9 U | < 4.9 U | < 4.9 U | 0.78 J | < 0.97 U | 16 | 11 | 6.3 |
| GNC2-JA04 | 0 | FD | 8/2/2010 | < 4.9 U | < 4.9 U | < 4.9 U | < 4.9 U | 0.84 J | < 0.98 U | 15 | 12 | 6.3 |
| GNC2-JD07C | 0 | NORM | 1/6/2010 | 2.9 J | < 5.1 U | < 5.1 U | < 5.1 U | 3.2 | < 1 U | 6.9 J | 26 | 7 |
| GNC2-JE01 | 0 | NORM | 4/26/2010 | 42 | 3.3 J | 14 | 22 | 22 | 1 J | 66 J | 610 J | 39.5 |
| GNC2-JE02 | 0 | NORM | 4/26/2010 | 27 | < 5.5 U | 7.1 | 14 | 18 | 0.71 J | 220 J | 390 J | 27 |
| GNC2-JS09C | 0 | NORM | 1/8/2010 | < 5.1 U | < 5.1 U | < 5.1 U | < 5.1 U | 0.54 J | < 1 U | < 10 U | < 10 U | 6.5 |
| GNC2-JS10C | 0 | NORM | 1/8/2010 | 32 J | < 5.2 U | 9.2 | 18 J | 21 J | 0.87 J | 41 J | 450 J | 29.6 |
| GNC2-JS10C | 0 | FD | 1/8/2010 | 15 J | < 5.3 U | 4.1 J | 8 J | 9.7 J | < 1.1 U | 21 J | 210 J | 15.4 |

All units in pg/g.

-- = no sample data.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-3**
**SOIL GENERAL CHEMISTRY/IONS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 2)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | General Chemistry/Ions | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ammonia | Bromide | Chlorate | Chloride | Cyanide (Total) | Fluoride | Nitrate (as N) | Nitrite (as N) | Orthophosphate as P | Perchlorate | Sulfate | Sulfide | Total Kjeldahl Nitrogen (TKN) |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | 2.6 J | 1.1 J | < 0.52 U | 123 | < 0.087 UJ | 0.55 J | 6.6 | < 0.036 U | < 0.55 U | 0.0841 | 308 | < 1.9 U | 106 |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.83 U | < 0.28 U | < 0.5 U | 32.2 | < 0.53 UJ | 1.1 | 1.3 | < 0.035 U | < 0.53 U | 0.449 | 791 | < 1.9 U | 65.9 |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.79 U | < 0.26 U | < 0.48 U | 3.9 | < 0.5 U | < 0.1 U | 5.2 | < 0.033 U | 5.3 | 0.161 | 153 | < 1.8 U | 242 J+ |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.82 U | < 0.27 U | 1.2 J | 153 | < 0.53 U | 1.1 | 8.7 | < 0.035 U | < 0.53 U | 0.657 | 589 | < 1.9 U | 44.4 J+ |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | 3.3 J | < 0.27 U | 0.99 J | 463 | < 0.53 U | 0.18 J | 31.8 | 2.1 | 9 | 5.99 | 17000 | < 1.9 U | 76.6 |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.82 U | < 0.27 U | < 0.5 U | 55.3 | < 0.52 U | 1.2 | 1.6 | < 0.035 U | < 0.52 U | 0.318 | 196 | < 1.9 U | 47.1 J |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | 8.2 | 1.3 J | 12.2 | 1490 | 0.59 | 0.21 J | 107 | < 3.4 U | 11.4 | 23.2 | 8820 | < 1.8 U | 1600 |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.83 U | 0.44 J | 10.7 | 689 | < 0.53 U | 0.89 J | 9.1 | < 1.8 U | 0.85 J | 3.83 | 5410 | < 1.9 U | 106 |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.82 U | < 0.27 U | < 0.49 U | 34.2 | < 0.52 U | 0.71 J | 4.7 | < 0.035 U | 12.5 | 0.382 | 7960 | < 1.9 U | 463 |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.82 U | < 0.27 U | < 0.49 U | 52.5 | 0.65 | 0.62 J | 5.8 | 0.13 J | 14.4 | 0.338 | 9710 | < 1.9 U | 430 |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.85 U | < 0.28 U | 2.2 J | 94.8 | < 0.55 U | 0.99 J | 3 | < 0.036 U | < 0.55 U | 1.5 | 13700 | < 1.9 U | 108 |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | 0.89 J | 0.67 J | 41.3 | 2570 | < 0.53 U | 0.25 J | 31.6 | < 0.7 U | 6.2 | 21.1 | 10200 | < 1.9 U | 230 |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | | < 0.28 U | 6.7 | 490 | < 0.54 U | 1.9 | 8.3 | < 0.035 U | < 0.54 U | | 9460 | < 1.9 U | 113 |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.81 U | < 0.27 U | < 0.49 U | 7.5 | < 0.52 U | < 0.1 U | 3.4 | < 0.034 U | 2.1 J | 0.0172 J | 375 | < 1.8 U | 320 |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.82 U | < 0.27 U | < 0.5 U | 94.4 | < 0.083 U | 0.6 J | 7 | < 0.035 U | < 0.53 U | 0.737 | 195 | < 1.9 U | 76.9 |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.82 U | < 0.27 U | 0.71 J | 142 | 5.8 | 1 J | 30.9 | 0.23 | 2.1 J | 1.27 | 1110 | < 1.9 U | 354 |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | R | < 0.27 U | 2.9 J | 151 | < 0.53 U | 0.56 J | 8.5 | < 0.035 U | < 0.53 U | 1.83 | 2330 | < 1.9 U | 103 |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.81 U | < 0.27 U | < 0.49 U | 15.9 | < 0.52 U | < 0.1 U | 2.5 | < 0.034 U | < 5.2 U | 0.0555 | 5810 | < 1.8 U | 156 |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.88 U | < 0.29 U | 5.5 J | 242 | < 0.57 U | 0.36 J | 4.1 | < 0.037 U | < 5.7 U | 4.55 | 17300 | < 2 U | 79.7 |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.82 U | < 0.27 U | < 0.49 U | 127 | < 0.52 U | < 0.1 U | 5.7 | 0.55 | 1.2 J | 1.6 | 2740 | < 1.9 U | 229 |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.82 U | < 0.27 U | 0.6 J | 171 | < 0.53 U | 0.77 J | 2.7 | < 0.035 U | < 0.53 U | 1.22 | 1260 | < 1.9 U | 79.1 |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | 5.2 | < 0.27 U | < 0.49 U | 40.3 | < 0.52 U | < 0.1 U | 6 | < 0.034 U | 14.2 | 0.375 | 6300 | < 1.8 U | 387 |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.82 U | < 0.27 U | < 0.5 U | 446 | < 0.53 U | 0.78 J | 16 | < 0.035 U | < 5.3 U | 0.955 | 3620 | < 1.9 U | 88 |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | 1.2 J | 0.78 J | 1.1 J | 472 | < 0.52 U | 0.28 J | 118 | 0.76 | 9.7 | 1.96 | 3420 | < 1.9 U | 94.5 |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.82 U | < 0.27 U | 0.77 J | 67.3 | < 0.53 U | 0.72 J | 2.8 | < 0.035 U | 0.74 J | 0.419 | 894 | < 1.9 U | 72.2 |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | 3.4 J | 0.39 J | 1.4 J | 1210 J | 0.68 | < 0.1 U | 52.4 J | < 1.7 U | 6.2 | 6.89 J | 5890 | < 1.8 U | 493 J |
| GNC1-BG20 | 0 | FD | 2/5/2009 | 1.5 J | < 0.27 U | < 0.49 U | 478 J | 0.61 | 0.15 J | 27.5 J | 1.4 | 3.3 J | 28.6 J | 8870 | < 1.8 U | 939 J |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.8 U | < 0.27 U | 0.98 J | 112 | < 0.52 U | 0.6 J | 4.8 | < 0.034 U | 0.91 J | 0.805 | 361 | < 1.8 U | 56.9 |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.81 U | < 0.27 U | < 0.49 U | 50.4 | < 0.52 U | 0.16 J | 4.6 | < 0.034 U | 2.3 J | 0.165 | 5770 | < 1.8 U | 148 |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.82 U | < 0.27 U | 1.9 J | 164 | < 0.53 U | 0.76 J | 4.5 | < 0.035 U | < 0.53 U | 0.81 | 2060 | < 1.9 U | 64.8 |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.81 U | < 0.27 U | < 0.49 U | 118 | 0.59 | < 0.1 U | 25.6 | < 0.034 U | 6 | 0.326 | 2110 | < 1.8 U | 324 |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.81 U | < 0.27 U | < 0.49 U | 57.8 | < 0.52 U | 0.8 J | 4.3 | < 0.035 U | < 0.52 U | 0.278 | 547 | < 1.9 U | 58.5 |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.83 U | < 0.28 U | < 0.5 U | 19.4 | < 0.53 U | 0.98 J | 4.3 | < 0.035 U | < 0.53 U | 0.0337 J | 1210 | < 1.9 U | 88.3 J+ |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.83 U | < 0.28 U | 14.7 | 798 | < 0.53 U | 1.7 | 22.9 | < 0.035 U | < 0.53 U | 10.1 | 1790 | < 1.9 U | 61 J+ |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | 1.9 J | 1.1 J | 0.88 J | 807 | < 0.51 U | 0.98 J | 13.6 | < 0.034 U | < 0.51 U | 3.76 | 2360 | < 1.8 U | 172 |

**TABLE B-3**
**SOIL GENERAL CHEMISTRY/IONS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 2 of 2)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | General Chemistry/Ions | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ammonia | Bromide | Chlorate | Chloride | Cyanide (Total) | Fluoride | Nitrate (as N) | Nitrite (as N) | Orthophosphate as P | Perchlorate | Sulfate | Sulfide | Total Kjeldahl Nitrogen (TKN) |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.83 U | < 0.28 U | 1.8 J | 91.9 | < 0.53 U | 1.2 | 3.2 | < 0.035 U | < 0.53 U | 0.311 | 1560 | < 1.9 U | 55.3 |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.82 U | < 0.27 U | < 0.5 U | 15 | 0.54 | 1.2 | 2.4 | 0.087 J | < 0.53 U | 0.116 J | 808 | < 1.9 U | 149 |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.84 U | < 0.28 U | < 0.51 U | 45.5 | < 0.54 U | 1 J | 9.3 | < 0.035 U | < 0.54 U | 0.0652 J | 2450 | < 1.9 U | 103 |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.83 U | < 0.28 U | 5.9 | 383 | < 0.53 U | 1.5 | 22.3 | < 0.035 U | < 0.53 U | 3.31 | 1120 | < 1.9 U | 71.7 |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 5.3 U | < 0.28 U | 14.1 | 2830 | < 0.084 U | 0.4 J | 121 | < 0.71 U | < 0.53 U | 20.1 | 2370 | < 1.9 U | 151 |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.83 U | < 0.28 U | 3.1 J | 107 | < 0.084 U | < 0.11 U | 3.4 | < 0.035 U | < 0.53 U | 0.176 | 2970 | < 1.9 U | 59.4 |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 5.5 U | < 0.29 U | 2.7 J | 505 | < 0.087 U | 0.61 J | 21.3 | < 0.036 U | < 0.55 U | 7.48 | 1810 | < 1.9 U | 108 |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.87 U | < 0.29 U | 2.3 J | 74 | < 0.088 U | 0.62 J | 2.1 | < 0.037 U | < 0.56 U | 0.462 | 616 | < 2 U | 57.3 |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.81 U | < 0.27 U | < 0.49 U | 67.7 | < 0.52 U | < 0.1 U | 11.8 | 0.82 | < 5.2 U | 1.55 | 891 J | < 1.8 U | 300 J+ |
| GNC1-JS09 | 0 | FD | 1/30/2009 | 0.98 J | < 0.26 U | < 0.48 U | 81.4 | < 0.5 U | < 0.1 U | 11.1 | 1.3 | < 5 U | 3.36 | 3120 J | < 1.8 U | 191 J+ |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.83 U | < 0.28 U | 3.3 J | 189 | < 0.084 U | 2.1 | 5.1 | < 0.035 U | < 0.53 U | 0.653 | 407 | < 1.9 U | 78.3 J+ |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.83 U | < 0.28 U | < 0.5 U | 28.2 | < 0.53 U | < 0.11 U | 13.9 | < 0.035 U | 12.1 | 0.637 | 943 | < 1.9 U | 1660 J+ |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.82 U | < 0.27 U | < 0.49 U | 21.6 | < 0.52 U | 1.8 | 5.9 | < 0.035 U | < 0.52 U | 0.602 | 4070 | < 1.9 U | 69.7 |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.81 U | < 0.27 U | < 0.49 U | 3.3 J | 0.81 | 0.65 J | 1.3 J | < 0.034 U | < 5.2 U | 0.0553 | 48.4 | < 1.8 U | 513 J+ |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.81 U | < 0.27 U | < 0.49 U | 5.5 J | 0.81 | < 0.1 U | 4.9 J | < 0.034 U | < 5.2 U | 0.0282 J | 58.8 | < 1.8 U | 474 J+ |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.82 U | < 0.27 U | 2 J | 288 | 1.1 | 1.4 | 7 | < 0.035 U | < 0.52 U | 1.65 | 1390 | < 1.9 U | 64.6 J+ |

All units in mg/kg.
-- = no sample data.

**TABLE B-4**
**SOIL METALS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Metals | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Aluminum | Antimony | Arsenic | Barium | Beryllium | Boron | Cadmium | Calcium |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | 7940 | < 0.315 UJ | 5.8 | 235 J+ | 0.53 J | < 16.5 U | < 0.1 U | 27700 |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | 9250 | < 0.315 UJ | 7.1 | 378 J+ | 0.5 J | < 16.5 U | < 0.1 U | 28900 |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | 9620 J | < 0.315 UJ | 4.3 J | 281 | 0.59 | < 16.5 U | 0.23 J | 24400 |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | 8700 J | < 0.315 UJ | 3.4 J | 284 | 0.5 J | < 16.5 U | < 0.1 U | 27000 |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | 10100 J | < 0.315 UJ | 4.4 J | 272 | 0.54 | < 16.5 U | 0.28 | 42500 |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | 9400 J | < 0.315 UJ | 7 | 391 | 0.52 J | < 16.5 U | 0.12 J | 43000 |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | 9440 | < 0.315 UJ | 3.8 J | 253 J | 0.55 | 47.1 J | 0.17 J | 40100 |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | 12000 | < 0.315 UJ | 3 J | 328 J | 0.68 | < 16.5 U | 0.12 J | 24000 |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | 8900 | < 0.315 UJ | 4.7 J | 306 J | 0.55 | 21.5 J | 0.22 J | 72000 |
| GNC1-BE20 | 0 | FD | 2/6/2009 | 9480 | < 2.6 UJ | 4 J | 307 J | 0.58 | 20 J | 0.29 | 66500 |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | 9320 | < 0.315 UJ | 7.8 | 295 J | 0.55 | < 16.5 U | < 0.1 U | 37200 |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | 10200 | < 0.315 UJ | 3.6 J | 346 J | 0.63 | 38.9 J | 0.12 J | 22800 |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | 10300 | < 0.315 UJ | 4.2 J | 433 J | 0.58 | 18.3 J | 0.14 J | 37300 |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | 10200 | < 2.6 UJ | 5.4 | 563 J | 0.61 | < 16.5 U | 0.44 | 34400 |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | 10500 | < 0.315 UJ | 3.7 J | 362 J | 0.6 | < 16.5 U | 0.11 J | 29500 |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | 7780 | < 0.315 UJ | 5.3 | 175 J | 0.4 J | < 16.5 U | 0.3 | 103000 |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | 13200 | < 0.315 UJ | 2.9 J | 395 J | 0.74 | < 16.5 U | 0.13 J | 24200 |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | 11100 | < 0.315 UJ | 2.6 J | 338 J | 0.66 | < 16.5 U | 0.14 J | 22200 |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | 10100 | < 0.315 UJ | 6.1 | 472 J | 0.64 | < 16.5 U | 0.12 J | 36400 |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | 12600 | < 0.315 UJ | 6.2 | 310 J | 0.77 | < 16.5 U | 0.19 J | 41600 |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | 8810 | < 0.315 UJ | 4.2 J | 371 J | 0.56 | < 16.5 U | 0.11 J | 35000 |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | 8340 | < 0.315 UJ | 3.2 J | 344 J | 0.6 | 17.2 J | 0.13 J | 19700 |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | 7990 | < 0.315 UJ | 5.5 | 318 J | 0.54 | < 16.5 U | < 0.1 U | 23900 |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | 10900 | < 0.315 UJ | 5.1 J | 341 J | 0.61 | < 16.5 U | 0.3 | 27600 |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | 11400 | < 0.315 UJ | 4.9 J | 384 J | 0.71 | < 16.5 U | 0.15 J | 24500 |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | 11500 | < 2.6 UJ | 4.1 J | 351 J | 0.65 | 23 J | 0.21 J | 27700 |
| GNC1-BG20 | 0 | FD | 2/5/2009 | 10000 | < 0.315 UJ | 4.5 J | 266 J | 0.61 | 20.7 J | 0.18 J | 32100 |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | 9260 | < 0.315 UJ | 5.7 | 268 J | 0.57 | < 16.5 U | 0.14 J | 29600 |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | 10600 | < 0.315 UJ | 3.7 J | 290 J | 0.61 | 18.6 J | 0.16 J | 30200 |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | 10900 | < 0.315 UJ | 4.7 J | 362 J | 0.63 | < 16.5 U | 0.15 J | 31000 |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | 10400 | < 0.315 UJ | 5.3 | 408 J | 0.62 | < 16.5 U | 0.14 J | 23200 |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | 10400 | < 0.315 UJ | 4 J | 382 J | 0.65 | < 16.5 U | 0.14 J | 20400 |
| GNC1-JA04 | 0 | NORM | 8/13/2009 | 11000 | < 2.5 UJ | 7.7 J+ | 286 J | 0.68 | < 50.8 U | 0.47 J+ | 31400 J |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | 10000 J | < 0.315 UJ | 3.7 J | 307 | 0.66 | < 16.5 U | 0.13 J | 34700 |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | 10600 J | < 0.315 UJ | 6.7 | 329 | 0.59 | < 16.5 U | 0.11 J | 28300 |

**TABLE B-4**
**SOIL METALS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Metals | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Aluminum | Antimony | Arsenic | Barium | Beryllium | Boron | Cadmium | Calcium |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | 6210 J | < 0.315 UJ | 3.8 J | 142 | 0.45 J | < 16.5 U | 0.13 J | 54300 |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | 10900 J | < 0.315 UJ | 5 J | 209 | 0.64 | < 16.5 U | < 0.1 U | 29000 |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | 10600 J | < 0.315 UJ | 4.1 J | 315 | 0.66 | < 16.5 U | 0.13 J | 30500 |
| GNC1-JD09 | 0 | FD | 1/30/2009 | 12000 J | < 0.315 UJ | 4.3 J | 303 | 0.63 | < 16.5 U | 0.11 J | 23800 |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | 11800 J | < 0.315 UJ | 4.7 J | 293 | 0.71 | < 16.5 U | < 0.1 U | 27100 |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | 11700 J | < 2.7 UJ | 7.4 | 613 J- | 1.1 J+ | < 16.5 U | 0.18 J | 26000 |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | 11100 J | < 0.315 UJ | 3.1 J | 309 J- | 1 J+ | < 16.5 U | 0.12 J | 34300 |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | 10800 J | < 0.315 UJ | 3.9 J | 383 J- | 0.77 J+ | < 16.5 U | 0.15 J | 24300 |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | 14700 J | < 0.315 UJ | 4.8 J | 184 J- | 1.1 J+ | < 16.5 U | < 0.1 U | 18200 |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | 10300 J | < 2.6 UJ | 6.5 | 284 | 0.63 | < 16.5 U | 0.27 | 26900 |
| GNC1-JS09 | 0 | FD | 1/30/2009 | 10200 J | < 0.315 UJ | 4.3 J | 280 | 0.6 | < 16.5 U | 0.23 J | 29500 |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | 10800 J | < 0.315 UJ | 6.7 | 314 | 0.62 | < 16.5 U | < 0.1 U | 32700 |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | 9560 J | < 2.7 UJ | 7.2 | 374 | 0.59 | < 16.5 U | 0.33 | 40500 |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | 8910 J | < 0.315 UJ | 8.8 | 383 | 0.56 | < 16.5 U | < 0.1 U | 32500 |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | 9770 | < 0.315 UJ | 4.7 J | 365 J+ | 0.64 | < 16.5 U | 0.21 J | 30100 |
| GNC1-JS11 | 0 | FD | 1/29/2009 | 9720 | < 0.315 UJ | 4.8 J | 387 J+ | 0.64 | < 16.5 U | 0.18 J | 35000 |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | 11400 | < 0.315 UJ | 5.5 | 282 J+ | 0.73 | < 16.5 U | 0.11 J | 34000 |
| GNC2-BE20C | 0 | NORM | 1/8/2010 | 11200 J | < 0.225 UJ | 5.5 J+ | 273 J | 0.7 | < 52.2 U | 0.29 J+ | 35900 J |
| GNC2-BE20C | 0 | FD | 1/8/2010 | 11200 J | < 0.225 UJ | 4.7 J+ | 280 J | 0.64 | < 51.9 U | < 0.26 UJ | 31100 J |
| GNC2-JA04 | 0 | NORM | 8/2/2010 | 12200 | < 0.83 UJ | < 5 U | 388 J+ | 0.68 | < 16.9 U | 0.17 J | 25300 J |
| GNC2-JA04 | 0 | FD | 8/2/2010 | 12200 | < 0.83 UJ | < 5.1 U | 455 J+ | 0.7 | < 16.9 U | 0.16 J | 26700 J |
| GNC2-JS09C | 0 | NORM | 1/8/2010 | 13800 J | < 0.225 UJ | 4.5 J+ | 368 J | 0.76 | < 51.3 U | < 0.26 UJ | 24300 J |
| GNC2-JS10C | 0 | NORM | 1/8/2010 | 11200 J | < 0.225 UJ | 4.3 J+ | 365 J | 0.61 | < 53 U | < 0.27 UJ | 19000 J |
| GNC2-JS10C | 0 | FD | 1/8/2010 | 10800 J | < 0.225 UJ | 3.6 J+ | 250 J | 0.66 | < 53 U | < 0.26 UJ | 15400 J |

All units in mg/kg.
-- = no sample data.
= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-4**
**SOIL METALS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Metals | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Chromium | Chromium (VI) | Cobalt | Copper | Iron | Lead | Lithium | Magnesium |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | 7.3 | < 0.11 UJ | 8.1 | 15.9 | 14300 | 19.1 | 14.4 | 9360 |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | 9.4 | < 0.11 UJ | 7.7 | 13.5 | 13000 | 10.2 | 20.3 | 10100 |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | 16.7 | < 0.1 U | 8.7 | 20.8 | 18500 | 43.6 | 11.8 | 10800 |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | 11.2 | 0.14 J | 8.7 | 16.4 | 16200 | 9.5 | 13.4 | 9190 |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | 17.3 | 0.19 J | 8.8 | 20.3 | 17600 | 40.4 | 14.1 | 10900 |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | 13.3 | 0.19 J | 8.5 | 19.1 | 17400 | 13.7 | 19.2 | 10800 |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | 19.4 | < 0.1 U | 8.9 | 18.3 | 17100 | 26.2 | 15.2 | 11800 |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | 16.1 | < 0.11 U | 10 | 18.5 | 19800 | 10.8 | 16 | 10700 |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | 18.6 J+ | < 0.1 U | 8 J | 25.5 J+ | 14500 | 661 | 15.1 | 13700 |
| GNC1-BE20 | 0 | FD | 2/6/2009 | 19.4 J+ | < 0.1 U | 17 J | 29.3 J+ | 15200 | 860 | 16 | 13500 |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | 18.3 J+ | 0.3 J | 8.5 | 18.2 J+ | 16100 | 12.7 | 19.7 | 10900 |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | 15.2 J+ | < 0.11 U | 9.2 | 18.1 J+ | 16700 | 13.5 | 16.2 | 11700 |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | 15.9 J+ | 0.2 J | 9.3 | 18.3 J+ | 15800 | 18.7 | 16.2 | 10800 |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | 62.8 | 1.8 | 12.8 | 32.5 | 26900 | 272 | 14.5 | 10900 |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | 15.4 | 0.16 J | 9.6 | 18 | 18800 | 9.3 | 16.4 | 9710 |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | 15.2 | < 0.11 U | 5.2 | 13.3 | 10200 | 9.8 | 13.8 | 28500 |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | 16.3 | 0.11 J | 12.4 | 23 | 21400 | 12 | 14.3 | 13100 |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | 17 J+ | < 0.1 U | 9.9 | 18.2 J+ | 18300 | 16.4 | 14.3 | 11100 |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | 19.3 J+ | 0.16 J | 9.3 | 18.5 J+ | 17200 | 12.5 | 18 | 11000 |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | 24.8 | 0.3 J | 10.4 | 24.7 | 21800 | 16.9 | 20.9 | 12700 |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | 15.7 | 0.3 J | 8.3 | 15.7 | 17700 | 9.5 | 14.8 | 8810 |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | 15.4 J+ | < 0.1 U | 8.8 | 16.4 J+ | 15000 | 15.8 | 14.2 | 8980 |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | 14.1 J+ | 0.19 J | 7.5 | 15.9 J+ | 13500 | 14.1 | 13.9 | 7670 |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | 19.9 | 0.16 J | 10.1 | 25.4 | 19800 | 21 | 12.5 | 10700 |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | 18.7 | 0.16 J | 11.6 | 22 | 21700 | 11.5 | 17.2 | 11300 |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | 23.4 | 0.56 | 11.5 | 22.2 | 21200 | 22.2 | 17.2 | 12600 |
| GNC1-BG20 | 0 | FD | 2/5/2009 | 20.7 | 0.34 J | 9.7 | 21 | 18800 | 25 | 15.7 | 12400 |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | 8.8 | < 0.1 U | 8.3 | 18.5 | 15600 | 8.2 | 14.7 | 8660 |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | 22 | < 0.1 U | 9.3 | 20.1 | 19000 | 18.9 | 15 | 11800 |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | 17.1 | 0.11 J | 10.5 | 20 | 19100 | 12 | 17.2 | 11500 |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | 17.1 | 0.34 J | 9.6 | 27.1 | 19300 | 13.3 | 14.9 | 9160 |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | 23 | 0.34 J | 10.5 | 22.8 | 21400 | 15.6 | 16.3 | 9780 |
| GNC1-JA04 | 0 | NORM | 8/13/2009 | 16.9 | < 0.1 U | 9.2 | 30.3 J+ | 17700 | 154 J+ | 15.7 | 12900 |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | 14 | 0.24 J | 9.9 | 18.3 | 17700 | 17.5 | 16.1 | 12000 |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | 15.5 | 0.19 J | 9.7 | 20.7 | 20500 | 25.3 | 14.7 | 9970 |

**TABLE B-4**
**SOIL METALS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 4 of 8)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Metals | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Chromium | Chromium (VI) | Cobalt | Copper | Iron | Lead | Lithium | Magnesium |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | 11.6 | 0.24 J | 8.1 | 15.9 | 14600 | 7 | 12 | 9840 |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | 11.4 | 0.24 J | 9.8 | 19.6 | 18200 | 9.3 | 12.7 | 11100 |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | 13.8 | 0.19 J | 9.5 | 19 | 18800 | 18.3 | 12.5 | 12400 |
| GNC1-JD09 | 0 | FD | 1/30/2009 | 14.5 | 0.14 J | 10.9 | 21.1 | 19400 | 14.2 | 14.9 | 11800 |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | 16.1 | < 0.11 U | 10.9 | 23 | 21200 | 11.7 | 13.6 | 11400 |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | 31.2 | 0.14 J | 10.8 | 22.3 | 20500 J | 55.9 | 13.4 J+ | 11300 J |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | 17.4 | < 0.11 U | 10.4 | 20.3 | 19800 J | 12.1 | 13.3 J+ | 11500 J |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | 18.6 | < 0.11 U | 10.4 | 21.6 | 20000 J | 21.7 | 12.6 J+ | 10700 J |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | 14.2 | < 0.11 U | 12.2 | 19.9 | 21300 J | 13.1 | 16.7 J+ | 13100 J |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | 21.7 | < 0.1 U | 10.8 | 28.8 | 41400 J | 547 J | 14.3 | 11600 |
| GNC1-JS09 | 0 | FD | 1/30/2009 | 17 | 0.18 J | 9.8 | 22 | 18400 J | 28.6 J | 13.3 | 11100 |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | 14.8 | < 0.11 U | 8.9 | 17 | 17000 | 11.7 | 15.4 | 10800 |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | 23.9 | < 0.11 U | 8.7 | 20.7 | 17500 | 67.6 | 14.6 | 12300 |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | 15.7 | 0.19 J | 7.9 | 18 | 15100 | 11.1 | 16.4 | 9890 |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | 19.4 | < 0.1 U | 8.7 | 20.2 | 17600 | 32.7 J+ | 16.3 | 10700 |
| GNC1-JS11 | 0 | FD | 1/29/2009 | 18.1 | 0.14 J | 8.8 | 19.4 | 18500 | 27.7 J+ | 15.4 | 11400 |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | 16.7 | 0.19 J | 9.3 | 21.7 | 19800 | 12 J+ | 18.8 | 11600 |
| GNC2-BE20C | 0 | NORM | 1/8/2010 | 15.2 | 0.15 J | 9.7 | 28.2 J | 19000 J | 29.6 J+ | 15.3 J+ | 15600 J |
| GNC2-BE20C | 0 | FD | 1/8/2010 | 14.3 | < 0.1 U | 10.6 | 22.6 J | 17500 J | 38.3 J+ | 15.9 J+ | 12700 J |
| GNC2-JA04 | 0 | NORM | 8/2/2010 | 20.9 | < 0.1 U | 11.2 | 19.3 | 25600 | 17.7 | 12.8 | 10500 |
| GNC2-JA04 | 0 | FD | 8/2/2010 | 23.1 | < 0.1 U | 11.2 | 20.4 | 27300 | 18.2 | 13.6 | 11100 |
| GNC2-JS09C | 0 | NORM | 1/8/2010 | 14.2 | < 0.1 U | 11.3 | 22.6 J+ | 21200 J | 17.6 J+ | 14.8 J+ | 13200 J |
| GNC2-JS10C | 0 | NORM | 1/8/2010 | 13.3 | 0.15 J | 10.9 | 19.9 J+ | 17300 J | 20.5 J+ | 12.3 J+ | 11200 J |
| GNC2-JS10C | 0 | FD | 1/8/2010 | 10.1 | 0.36 J | 9.4 | 18.7 J+ | 17000 J | 16.4 J+ | 13 J+ | 12000 J |

All units in mg/kg.
-- = no sample data.
= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-4**
**SOIL METALS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 5 of 8)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Metals | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Manganese | Mercury | Molybdenum | Nickel | Potassium | Selenium | Silver | Sodium |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | 476 | < 0.0367 U | < 0.47 U | 13.3 | 1710 J+ | < 0.4 U | 0.11 J+ | 604 |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | 349 | < 0.0355 U | 0.62 J | 14.2 | 1480 J+ | < 0.4 U | < 0.11 UJ | 1040 |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | 557 J | 0.0912 J+ | 0.58 J | 16.2 | 1820 | < 0.4 U | 0.11 J | 284 |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | 458 J | < 0.035 UJ | 0.64 J | 15.2 | 1380 | < 0.4 U | < 0.11 U | 555 |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | 608 J | 0.0575 J+ | 0.69 J | 17.2 | 2240 | < 0.4 U | 0.13 J | 433 |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | 408 J | < 0.035 UJ | 0.76 J | 15.3 | 2080 | < 0.4 U | < 0.11 U | 870 |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | 614 | 0.0742 | 0.93 J | 16.5 | 2950 | < 0.4 U | 0.13 J+ | 2390 |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | 567 | < 0.0354 U | 1.2 J | 15.7 | 2100 | < 0.4 U | 0.14 J+ | 1920 |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | 441 | 0.0915 J | 0.94 J | 15.4 | 2030 J+ | < 0.4 U | 0.18 J+ | 487 |
| GNC1-BE20 | 0 | FD | 2/6/2009 | 484 | < 0.0349 UJ | 0.98 J | 18.7 | 2070 J+ | < 0.4 U | 0.19 J+ | 437 |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | 418 | 0.0587 J- | 1.1 J | 15.5 | 2270 J+ | < 0.4 U | < 0.11 U | 788 |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | 451 | 0.0366 J- | 1.5 J | 16.7 | 2840 J+ | < 0.4 U | 0.12 J+ | 4420 |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | 513 | < 0.0357 UJ | 1.1 J | 15.7 | 2550 J+ | < 0.4 U | 0.12 J+ | 1190 |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | 619 | 0.082 | 3.2 | 20.5 | 2060 | < 0.4 U | 0.16 J+ | 292 |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | 444 | < 0.0351 U | 0.61 J | 16.3 | 1830 | < 0.4 U | 0.13 J+ | 599 |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | 295 | < 0.0351 U | 1.3 J | 13 | 2300 | < 0.4 U | 0.11 J+ | 348 |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | 716 | < 0.005 U | 1.4 J | 19.5 | 2470 | < 0.4 U | 0.13 J+ | 1260 |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | 543 | < 0.0348 UJ | 1.1 J | 17.7 | 3040 J+ | < 0.4 U | 0.14 J+ | 421 |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | 455 | < 0.005 UJ | 1.4 J | 16 | 2300 J+ | < 0.4 U | 0.12 J+ | 1290 |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | 508 | < 0.0349 U | 0.66 J | 21.6 | 3440 | < 0.4 U | 0.13 J+ | 656 |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | 441 | < 0.005 U | 1 J | 15.2 | 1820 | < 0.4 U | < 0.11 U | 801 |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | 568 | < 0.0346 UJ | 0.76 J | 15.2 | 3710 J+ | < 0.4 U | < 0.11 U | 1180 |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | 534 | < 0.005 UJ | 0.77 J | 14.4 | 1610 J+ | < 0.4 U | < 0.11 U | 649 |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | 550 | 0.047 | 0.74 J | 19.4 | 2580 | < 0.4 U | 0.19 J+ | 651 |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | 778 | < 0.0351 U | 1.1 J | 23.7 | 2210 | < 0.4 U | 0.15 J+ | 839 |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | 586 | < 0.0345 U | 0.99 J | 19.9 | 2870 | < 0.4 U | 0.14 J+ | 1160 J |
| GNC1-BG20 | 0 | FD | 2/5/2009 | 554 | 0.0369 | 0.93 J | 18.3 | 2520 | < 0.4 U | 0.12 J+ | 682 J |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | 438 | 0.0565 | 0.67 J | 13.1 | 2030 | < 0.4 U | < 0.11 U | 1080 |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | 511 | < 0.0345 U | 0.99 J | 18.5 | 2990 | < 0.4 U | 0.13 J+ | 513 |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | 596 | < 0.005 U | 0.99 J | 17 | 2230 | < 0.4 U | 0.12 J+ | 1210 |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | 489 | < 0.005 U | 1 J | 16.4 | 2830 | < 0.4 U | 0.12 J+ | 1520 |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | 606 | < 0.005 U | 0.76 J | 20.1 | 3080 | < 0.4 U | 0.12 J+ | 504 |
| GNC1-JA04 | 0 | NORM | 8/13/2009 | 512 J | 0.0495 J- | < 2.5 U | 17.6 | 3200 J+ | < 2.5 U | 0.15 J | 608 |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | 493 J | < 0.0353 UJ | 0.69 J | 17.7 | 1780 | < 0.4 U | 0.11 J | 500 |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | 544 J | < 0.0354 UJ | 1.7 J | 15.9 | 2340 | < 0.4 U | 0.12 J | 1570 |

**TABLE B-4**
**SOIL METALS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 6 of 8)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Metals | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Manganese | Mercury | Molybdenum | Nickel | Potassium | Selenium | Silver | Sodium |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | 326 J | < 0.005 U | 0.69 J | 28.2 | 1620 | < 0.4 U | 0.13 J | 1500 |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | 481 J | < 0.005 U | 0.89 J | 16.4 | 1770 | < 0.4 U | < 0.11 U | 834 |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | 587 J | < 0.005 U | 0.79 J | 15.1 | 2480 | < 0.4 U | 0.13 J | 499 J |
| GNC1-JD09 | 0 | FD | 1/30/2009 | 578 J | 0.0421 J+ | 0.9 J | 17.8 | 2540 | < 0.4 U | < 0.11 U | 871 J |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | 517 J | < 0.0356 UJ | 1.3 J | 16.7 | 2290 | < 0.4 U | 0.12 J | 1210 |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | 808 J | < 0.0356 U | 1.7 J | 19 | 2740 J | < 0.4 U | 0.28 J+ | 1480 |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | 530 J | < 0.0354 U | 1.3 J | 18.4 | 1880 J | < 0.4 U | 0.13 J+ | 1040 |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | 692 J | < 0.0367 U | 0.65 J | 17.5 | 2520 J | < 0.4 U | 0.14 J+ | 534 |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | 612 J | < 0.0373 U | 1.1 J | 19.8 | 2240 J | 0.47 J | < 0.11 U | 1330 |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | 661 J | 0.061 J+ | 2.2 J | 19.7 | 2370 | < 0.4 U | 0.23 J | 378 |
| GNC1-JS09 | 0 | FD | 1/30/2009 | 595 J | 0.0412 J+ | 0.69 J | 18.4 | 2310 | < 0.4 U | 0.18 J | 358 |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | 477 J | 0.0484 J+ | 0.93 J | 15.9 | 2710 | < 0.4 U | < 0.11 U | 889 |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | 700 J | 0.0406 J+ | 1 J | 16.8 | 2250 | < 0.4 U | 0.15 J | 342 |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | 397 J | < 0.005 U | 1.1 J | 14.2 | 1840 | < 0.4 U | < 0.11 U | 798 |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | 607 | < 0.0345 U | 0.89 J | 17.4 | 2110 | < 0.4 U | 0.12 J+ | 247 |
| GNC1-JS11 | 0 | FD | 1/29/2009 | 567 | 0.0366 | 0.77 J | 19.5 | 2390 | < 0.4 U | 0.11 J+ | 277 |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | 475 | < 0.005 U | 1.1 J | 17.3 | 1850 | < 0.4 U | 0.12 J+ | 1050 |
| GNC2-BE20C | 0 | NORM | 1/8/2010 | 540 J | 0.0614 J | < 2.6 UJ | 19.7 | 2800 J | < 2.6 UJ | 0.21 J+ | 1080 J+ |
| GNC2-BE20C | 0 | FD | 1/8/2010 | 700 J | 0.122 J | < 2.6 UJ | 17.3 | 2580 J | < 2.6 UJ | 0.18 J+ | 1100 J+ |
| GNC2-JA04 | 0 | NORM | 8/2/2010 | 617 J+ | < 0.0061 U | < 2.5 U | 18.3 | 2970 J+ | < 2.5 U | < 0.04 U | 527 |
| GNC2-JA04 | 0 | FD | 8/2/2010 | 619 J+ | < 0.0061 U | < 2.5 U | 20 | 3090 J+ | < 2.5 U | < 0.04 U | 535 |
| GNC2-JS09C | 0 | NORM | 1/8/2010 | 607 J | 0.0479 | < 2.6 UJ | 19.4 | 2660 J | < 2.6 UJ | 0.11 J+ | 1220 J+ |
| GNC2-JS10C | 0 | NORM | 1/8/2010 | 702 J | 0.0366 | < 2.7 UJ | 17.7 | 1930 J | < 2.7 UJ | 0.091 J+ | 412 J+ |
| GNC2-JS10C | 0 | FD | 1/8/2010 | 553 J | < 0.0353 U | < 2.6 UJ | 16.3 | 1680 J | < 2.6 UJ | 0.083 J+ | 321 J+ |

All units in mg/kg.
-- = no sample data.
= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-4**
**SOIL METALS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Metals | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Strontium | Thallium | Tin | Titanium | Tungsten | Uranium | Vanadium | Zinc |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | 262 | < 0.75 U | < 0.75 U | 664 | < 1.25 UJ | 1.1 | 47.8 | 48 |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | 342 | < 0.75 U | < 0.75 U | 487 | 1.4 J- | 1.6 | 44.8 | 33.6 |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | 202 | < 0.75 U | 1.2 | 765 | < 1.25 UJ | 0.82 | 53.3 | 155 |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | 280 | < 0.75 U | < 0.75 U | 591 | < 1.25 UJ | 1.1 | 42.8 | 40.6 |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | 317 | < 0.75 U | 1 J | 855 | < 1.25 UJ | 0.78 | 52.1 | 67.2 |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | 401 | < 0.75 U | < 0.75 U | 717 | < 1.25 UJ | 1.9 | 49.2 | 41.5 |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | 599 J | < 0.75 U | < 1 U | 925 | < 1.25 U | 0.84 | 58.5 J- | 52.8 |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | 407 J | < 0.75 U | < 0.75 U | 1030 | < 1.25 U | 1 | 62 J- | 53.1 |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | 323 J | < 0.75 U | 1.1 | 628 | < 1.25 UJ | 1.1 | 46.6 J+ | 91.8 J |
| GNC1-BE20 | 0 | FD | 2/6/2009 | 319 J | < 0.75 U | 1.9 | 684 | 1.3 J- | 1.2 | 46.3 J+ | 513 J |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | 623 J | < 0.75 U | < 0.75 U | 608 | < 1.25 UJ | 1.9 | 53.4 J+ | 45 J |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | 319 J | < 0.75 U | < 0.75 U | 598 | < 1.25 UJ | 0.98 | 46.1 J+ | 47.7 J |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | 444 J | < 0.75 U | < 0.75 U | 732 | < 1.25 UJ | 1.2 | 52.2 J+ | 46.3 J |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | 247 J | < 0.75 U | 10.4 | 1050 | < 1.25 U | 0.92 | 70.1 J- | 150 |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | 397 J | < 0.75 U | < 0.75 U | 909 | 2.9 | 1.1 | 61.2 J- | 49 |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | 457 J | < 0.75 U | < 0.75 U | 435 | < 1.25 U | 1.3 | 28.2 J- | 52.6 |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | 516 J | < 0.75 U | < 0.75 U | 1020 | < 1.25 U | 1.3 | 69.7 J- | 56.4 |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | 289 J | < 0.75 U | < 0.75 U | 859 | < 1.25 UJ | 0.7 | 57.5 J+ | 51.8 J |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | 538 J | < 0.75 U | < 0.75 U | 789 | < 1.25 UJ | 1.4 | 58.5 J+ | 43.8 J |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | 226 J | < 0.75 U | < 1.1 U | 875 | < 1.25 U | 0.94 | 67.1 J- | 65.3 |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | 288 J | < 0.75 U | < 0.75 U | 763 | < 1.25 U | 1.2 | 56.7 J- | 43.8 |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | 189 J | < 0.75 U | < 0.75 U | 601 | < 1.25 UJ | 0.59 | 48.2 J+ | 41.4 J |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | 257 J | < 0.75 U | < 0.75 U | 486 | < 1.25 UJ | 1.2 | 41.8 J+ | 37.2 J |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | 401 J | < 0.75 U | < 1.1 U | 1030 | < 1.25 U | 0.98 | 64.8 J- | 81 |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | 305 J | < 0.75 U | < 0.75 U | 1100 | < 1.25 U | 1.2 | 70.7 J- | 53.4 |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | 296 J | < 0.75 U | 1 | 998 | < 1.25 U | 0.85 | 70.7 J- | 62.5 |
| GNC1-BG20 | 0 | FD | 2/5/2009 | 244 J | < 0.75 U | < 1 U | 807 | < 1.25 U | 0.81 | 59.3 J- | 61.5 |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | 443 J | < 0.75 U | < 0.75 U | 556 | < 1.25 U | 1.3 | 48.9 J- | 39.6 |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | 308 J | < 0.75 U | < 1 U | 973 | < 1.25 U | 0.75 | 59.9 J- | 55.8 |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | 293 J | < 0.75 U | < 0.75 U | 838 | < 1.25 U | 1 | 62.7 J- | 52.8 |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | 306 J | < 0.75 U | < 0.75 U | 886 | < 1.25 U | 0.99 | 65.5 J- | 47.7 |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | 226 J | < 0.75 U | 1.2 | 918 | < 1.25 U | 0.74 | 67.2 J- | 52.6 |
| GNC1-JA04 | 0 | NORM | 8/13/2009 | 403 J- | 1.1 | 2.2 | 668 J+ | < 2.5 UJ | 0.92 J+ | 54.1 J+ | 82.2 J+ |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | 303 | < 0.75 U | < 0.75 U | 698 | < 1.25 UJ | 1.2 | 50.4 | 48 |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | 308 | < 0.75 U | < 0.75 U | 800 | < 1.25 UJ | 1.5 | 54.2 | 47.5 |

**TABLE B-4**
**SOIL METALS DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 8 of 8)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Metals | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Strontium | Thallium | Tin | Titanium | Tungsten | Uranium | Vanadium | Zinc |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | 193 | < 0.75 U | < 0.75 U | 791 | < 1.25 UJ | 0.98 | 38.1 | 48 |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | 309 | < 0.75 U | < 0.75 U | 658 | < 1.25 UJ | 1.2 | 50.3 | 44.3 |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | 273 | < 0.75 U | < 0.75 U | 921 | < 1.25 UJ | 1.2 | 54.3 | 49.3 |
| GNC1-JD09 | 0 | FD | 1/30/2009 | 277 | < 0.75 U | < 0.75 U | 789 | < 1.25 UJ | 1 | 55.2 | 52.2 |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | 399 | < 0.75 U | < 0.75 U | 926 | < 1.25 UJ | 1.3 | 62.7 | 47 |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | 347 J | < 0.75 U | < 1.1 U | 1350 J | 3.2 J- | 1.5 J+ | 82.7 | 82.2 J |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | 411 J | < 0.75 U | < 0.75 U | 1200 J | < 1.25 UJ | 1.4 J+ | 60 | 63.5 J |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | 290 J | < 0.75 U | < 0.75 U | 1050 J | < 1.25 UJ | 1.2 J+ | 68.6 | 58.5 J |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | 324 J | < 0.75 U | < 0.75 U | 1120 J | < 1.25 UJ | 2.5 J+ | 59.6 | 67.9 J |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | 262 | < 0.75 U | 314 J | 811 | < 1.25 UJ | 0.97 | 53.2 | 67.8 |
| GNC1-JS09 | 0 | FD | 1/30/2009 | 262 | < 0.75 U | 1 J | 855 | < 1.25 UJ | 0.89 | 54.8 | 67.3 |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | 345 | < 0.75 U | < 0.75 U | 676 | < 1.25 UJ | 1.6 | 51.2 | 38.6 |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | 321 | < 0.75 U | 2 | 803 | 1.8 J- | 1 | 56.9 | 66.1 |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | 358 | < 0.75 U | < 0.75 U | 546 | < 1.25 UJ | 1.4 | 47.5 | 36.9 |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | 249 | < 0.75 U | 4.2 J | 755 | < 1.25 UJ | 0.87 | 54.2 | 59.2 J- |
| GNC1-JS11 | 0 | FD | 1/29/2009 | 245 | < 0.75 U | 2.9 J | 691 | < 1.25 UJ | 0.98 | 51.4 | 51.9 J- |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | 385 | < 0.75 U | < 0.75 U | 882 | < 1.25 UJ | 2 | 57.6 | 44 J- |
| GNC2-BE20C | 0 | NORM | 1/8/2010 | 273 J | < 0.105 U | 1.7 J+ | 815 J | < 0.185 U | 1.2 J+ | 55.5 J+ | 84.5 J+ |
| GNC2-BE20C | 0 | FD | 1/8/2010 | 330 J | < 0.105 U | < 0.75 U | 690 J | < 0.185 U | 1 J+ | 54.7 J+ | 76.5 J+ |
| GNC2-JA04 | 0 | NORM | 8/2/2010 | 285 | < 0.29 U | < 1 U | 971 | < 0.41 UJ | 0.77 | 63.8 | 51.3 |
| GNC2-JA04 | 0 | FD | 8/2/2010 | 285 | < 0.29 U | < 1 U | 1000 | < 0.41 UJ | 0.8 | 67.3 | 52.9 |
| GNC2-JS09C | 0 | NORM | 1/8/2010 | 281 J | < 0.105 U | < 0.75 U | 721 J | < 2.6 U | 1 J+ | 60.6 J+ | 59.3 J+ |
| GNC2-JS10C | 0 | NORM | 1/8/2010 | 216 J | < 0.105 U | < 0.75 U | 583 J | < 0.185 U | 0.66 J+ | 51.6 J+ | 49.3 J+ |
| GNC2-JS10C | 0 | FD | 1/8/2010 | 210 J | < 0.105 U | < 0.75 U | 559 J | < 2.6 U | 0.83 J+ | 49.6 J+ | 55.2 J+ |

All units in mg/kg.
-- = no sample data.
= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-5**
**SOIL ORGANOCHLORINE PESTICIDES DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 6)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Organochlorine Pesticides | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2,4-DDD | 2,4-DDE | 4,4-DDD | 4,4-DDE | 4,4-DDT | Aldrin | alpha-BHC | alpha-Chlordane |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.00034 U | < 0.00022 U | < 0.000098 U | 0.0094 | 0.014 | < 0.0001 U | < 0.00031 U | < 0.00023 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.00033 U | < 0.00021 U | < 0.000095 U | < 0.0002 U | < 0.00022 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.00031 U | 0.0028 | < 0.00009 U | 0.0072 | 0.0024 J | < 0.000096 U | < 0.00028 U | < 0.00021 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.00032 U | < 0.00021 U | < 0.000093 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.00032 U | 0.0047 | < 0.000094 U | 0.011 | 0.0029 J | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.00032 U | < 0.00021 U | < 0.000093 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.00032 U | 0.0038 J+ | < 0.000092 U | 0.0066 J+ | 0.0028 J+ | < 0.000098 U | < 0.00029 U | < 0.00022 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.00032 U | < 0.00021 U | < 0.000094 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.00032 UJ | < 0.00021 UJ | < 0.000093 UJ | 0.012 J | 0.0042 J | < 0.000099 UJ | < 0.0003 UJ | < 0.00022 UJ |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.00032 U | 0.0071 J | 0.0044 J | 0.027 J | 0.016 J | < 0.0001 U | < 0.0003 U | 0.0057 J |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.00033 U | < 0.00022 U | < 0.000097 U | < 0.00021 U | < 0.00022 U | < 0.0001 U | < 0.00031 U | < 0.00023 U |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.00032 U | < 0.00021 U | < 0.000094 U | 0.0019 J+ | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | < 0.00033 U | < 0.00021 U | < 0.000095 U | < 0.00021 U | < 0.00022 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.00032 U | 0.0097 J | < 0.000092 U | 0.0078 J | < 0.00021 U | < 0.000099 U | < 0.00029 U | < 0.00022 U |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.00032 U | < 0.00021 U | < 0.000094 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.00032 U | < 0.00021 U | < 0.000094 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.00032 U | < 0.00021 U | < 0.000094 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.00032 U | < 0.00021 U | < 0.000093 U | 0.0018 J+ | < 0.00021 U | < 0.000099 U | < 0.00029 U | < 0.00022 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.00034 U | < 0.00023 U | < 0.0001 U | < 0.00022 U | < 0.00023 U | < 0.00011 U | < 0.00032 U | < 0.00024 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.00032 U | < 0.00021 U | < 0.000093 U | 0.0031 J+ | 0.0022 J+ | < 0.000099 U | < 0.0003 U | < 0.00022 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.00032 U | < 0.00021 U | < 0.000094 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.00032 U | < 0.00021 U | < 0.000092 U | 0.004 | 0.0022 | < 0.000099 U | < 0.00029 U | < 0.00022 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.00032 U | < 0.00021 U | < 0.000094 U | < 0.0002 U | 0.0031 | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.00032 U | 0.0025 | < 0.000094 U | 0.007 J+ | 0.0027 J+ | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.00032 U | < 0.00021 U | < 0.000094 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.00032 U | 0.002 | < 0.000092 U | 0.0044 J | 0.0041 J+ | < 0.000098 U | < 0.00029 U | < 0.00022 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.00032 U | 0.0034 | < 0.000092 U | 0.0073 J | 0.0042 J | < 0.000098 U | < 0.00029 U | < 0.00022 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.00031 U | < 0.00021 U | < 0.000092 U | < 0.0002 U | < 0.00021 U | < 0.000098 U | < 0.00029 U | < 0.00022 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.00032 U | < 0.00021 U | < 0.000092 U | 0.0022 J+ | 0.0018 J+ | < 0.000098 U | < 0.00029 U | < 0.00022 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.00032 U | < 0.00021 U | < 0.000094 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.00032 U | < 0.00021 U | < 0.000093 U | < 0.0002 U | < 0.00021 U | < 0.000099 U | < 0.00029 U | < 0.00022 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.00032 U | < 0.00021 U | < 0.000093 U | < 0.0002 U | < 0.00021 U | < 0.000099 U | < 0.00029 U | < 0.00022 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.00032 U | < 0.00021 U | < 0.000094 U | 0.0045 | 0.011 | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.00032 U | < 0.00021 U | < 0.000095 U | < 0.0002 U | 0.002 | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.0016 U | < 0.001 U | < 0.00046 U | < 0.00099 U | < 0.001 U | < 0.00049 U | < 0.0014 U | < 0.0011 U |

**TABLE B-5**
**SOIL ORGANOCHLORINE PESTICIDES DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 2 of 6)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Organochlorine Pesticides | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2,4-DDD | 2,4-DDE | 4,4-DDD | 4,4-DDE | 4,4-DDT | Aldrin | alpha-BHC | alpha-Chlordane |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.00032 U | < 0.00021 U | < 0.000094 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.00032 U | < 0.00021 U | < 0.000093 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.00033 U | < 0.00021 U | < 0.000096 U | < 0.00021 U | < 0.00022 U | < 0.0001 U | < 0.0003 U | < 0.00023 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.00033 U | < 0.00021 U | < 0.000095 U | < 0.00021 U | 0.0034 | < 0.0001 U | 0.0022 | < 0.00022 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.00033 U | 0.002 J | < 0.000095 U | 0.0031 J | < 0.00022 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.00032 U | < 0.00021 U | < 0.000095 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.00034 U | < 0.00022 U | < 0.000098 U | < 0.00021 U | < 0.00022 U | < 0.0001 U | < 0.00031 U | < 0.00023 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.00034 U | < 0.00022 U | < 0.0001 U | < 0.00021 U | < 0.00023 UJ | < 0.00011 U | < 0.00032 U | < 0.00023 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.00032 U | < 0.00021 U | < 0.000092 U | 0.0063 | 0.0039 J | < 0.000098 U | < 0.00029 U | 0.0022 J |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.00031 U | 0.0029 | < 0.00009 U | 0.0063 | 0.0026 J | < 0.000096 U | < 0.00028 U | < 0.00021 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.00032 U | < 0.00021 U | < 0.000095 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.00032 U | 0.015 J+ | < 0.000094 U | 0.031 J+ | 0.01 J+ | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.00032 U | < 0.00021 U | < 0.000093 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.00032 U | < 0.00021 U | < 0.000092 U | 0.0031 | 0.0022 | < 0.000098 U | < 0.00029 U | < 0.00022 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.00032 U | < 0.00021 U | < 0.000092 U | 0.0037 | < 0.00021 U | < 0.000098 U | < 0.00029 U | < 0.00022 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.00032 U | < 0.00021 U | < 0.000093 U | < 0.0002 U | < 0.00021 U | < 0.0001 U | < 0.0003 U | < 0.00022 U |

All units in mg/kg.
-- = no sample data.

**TABLE B-5**
**SOIL ORGANOCHLORINE PESTICIDES DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Organochlorine Pesticides | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | beta-BHC | Chlordane | delta-BHC | Dieldrin | Endosulfan I | Endosulfan II | Endosulfan sulfate | Endrin |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.0002 U | < 0.0026 U | < 0.00018 U | < 0.0001 U | < 0.00012 U | < 0.0001 U | < 0.00029 U | < 0.000091 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000097 U | < 0.00011 U | < 0.000099 U | < 0.00028 U | < 0.000088 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | 0.0037 | < 0.0024 U | < 0.00017 U | < 0.000092 U | < 0.00011 U | < 0.000094 U | < 0.00026 U | < 0.000084 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.0002 U | < 0.0024 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000087 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | 0.0095 | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000088 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.0002 U | < 0.0024 U | < 0.00018 U | < 0.000095 U | < 0.00011 U | < 0.000098 U | < 0.00027 U | < 0.000087 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | 0.0043 J+ | < 0.0024 U | < 0.00017 U | < 0.000094 U | < 0.00011 U | < 0.000096 U | < 0.00027 U | < 0.000086 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000097 U | < 0.00011 U | < 0.000099 U | < 0.00028 U | < 0.000088 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | 0.0043 J | < 0.0024 UJ | < 0.00017 UJ | < 0.000095 UJ | < 0.00011 UJ | < 0.000097 UJ | < 0.00027 UJ | < 0.000087 UJ |
| GNC1-BE20 | 0 | FD | 2/6/2009 | 0.013 J | 0.043 J | < 0.00018 U | < 0.000095 U | < 0.00011 U | < 0.000097 U | < 0.00027 U | < 0.000087 U |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000099 U | < 0.00011 U | < 0.0001 U | < 0.00029 U | < 0.000091 U |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000088 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000097 U | < 0.00011 U | < 0.0001 U | < 0.00028 U | < 0.000089 U |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | 0.0047 | < 0.0024 U | < 0.00017 U | < 0.000094 U | < 0.00011 U | < 0.000097 U | 0.019 J | 0.0021 J |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000087 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000087 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000088 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | 0.0048 J+ | < 0.0024 U | < 0.00017 U | < 0.000095 U | < 0.00011 U | < 0.000097 U | < 0.00027 U | < 0.000087 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.00021 U | < 0.0026 U | < 0.00019 U | < 0.0001 U | < 0.00012 U | < 0.00011 U | < 0.0003 U | < 0.000094 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | 0.019 J+ | < 0.0024 U | < 0.00017 U | < 0.000095 U | < 0.00011 U | < 0.000097 U | < 0.00027 U | < 0.000087 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000088 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | 0.0054 | < 0.0024 U | < 0.00017 U | < 0.000094 U | < 0.00011 U | < 0.000097 U | < 0.00027 U | < 0.000086 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000088 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | 0.004 J+ | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000088 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000087 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | 0.011 | < 0.0024 U | < 0.00017 U | < 0.000094 U | < 0.00011 U | < 0.000096 U | < 0.00027 U | < 0.000086 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | 0.014 | < 0.0024 U | < 0.00017 U | < 0.000094 U | < 0.00011 U | < 0.000096 U | < 0.00027 U | < 0.000086 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.0024 U | < 0.00017 U | < 0.000094 U | < 0.00011 U | < 0.000096 U | < 0.00027 U | < 0.000086 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.0024 U | < 0.00017 U | < 0.000094 U | < 0.00011 U | < 0.000096 U | < 0.00027 U | < 0.000086 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000087 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.0024 U | < 0.00017 U | < 0.000095 U | < 0.00011 U | < 0.000097 U | < 0.00027 U | < 0.000087 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.0024 U | < 0.00017 U | < 0.000095 U | < 0.00011 U | < 0.000097 U | < 0.00027 U | < 0.000087 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000088 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000097 U | < 0.00011 U | < 0.000099 U | < 0.00028 U | < 0.000088 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.00096 U | < 0.012 U | < 0.00086 U | < 0.00047 U | < 0.00054 U | < 0.00048 U | < 0.0013 U | < 0.00043 U |

**TABLE B-5**
**SOIL ORGANOCHLORINE PESTICIDES DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Organochlorine Pesticides | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | beta-BHC | Chlordane | delta-BHC | Dieldrin | Endosulfan I | Endosulfan II | Endosulfan sulfate | Endrin |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000099 U | < 0.00028 U | < 0.000088 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.0002 U | < 0.0024 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000087 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000098 U | < 0.00011 U | < 0.0001 U | < 0.00028 U | < 0.000089 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000097 U | < 0.00011 U | < 0.000099 U | < 0.00028 U | < 0.000089 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | 0.0027 J+ | < 0.0025 U | < 0.00018 U | < 0.000097 U | < 0.00011 U | < 0.000099 U | < 0.00028 U | < 0.000089 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000097 U | < 0.00011 U | < 0.000099 U | < 0.00028 U | < 0.000088 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.0002 U | < 0.0026 U | < 0.00018 U | < 0.0001 U | < 0.00012 U | < 0.0001 U | < 0.00029 U | < 0.000091 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.00021 U | < 0.0026 U | < 0.00019 U | < 0.0001 U | < 0.00012 U | < 0.0001 U | < 0.00029 U | < 0.000093 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | 0.0022 | 0.02 | < 0.00017 U | < 0.000094 U | < 0.00011 U | < 0.000096 U | < 0.00027 U | < 0.000086 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | 0.0027 | < 0.0024 U | < 0.00017 U | < 0.000092 U | < 0.00011 U | < 0.000094 U | < 0.00026 U | < 0.000084 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.0002 U | < 0.0025 U | < 0.00018 U | < 0.000097 U | < 0.00011 U | < 0.000099 U | < 0.00028 U | < 0.000088 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | 0.0099 J+ | < 0.0025 U | < 0.00018 U | < 0.000096 U | < 0.00011 U | < 0.000098 U | < 0.00028 U | < 0.000088 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.0024 U | < 0.00018 U | < 0.000095 U | < 0.00011 U | < 0.000097 U | < 0.00027 U | < 0.000087 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | 0.0048 J+ | < 0.0024 U | < 0.00017 U | < 0.000094 U | < 0.00011 U | < 0.000096 U | < 0.00027 U | < 0.000086 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | 0.0031 J+ | < 0.0024 U | < 0.00017 U | < 0.000094 U | < 0.00011 U | < 0.000096 U | < 0.00027 U | < 0.000086 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.00019 U | < 0.0024 U | < 0.00018 U | < 0.000095 U | < 0.00011 U | < 0.000097 U | < 0.00027 U | < 0.000087 U |

All units in mg/kg.
-- = no sample data.

**TABLE B-5**
**SOIL ORGANOCHLORINE PESTICIDES DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Organochlorine Pesticides | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Endrin aldehyde | Endrin ketone | gamma-BHC (Lindane) | gamma-Chlordane | Heptachlor | Heptachlor epoxide | Methoxychlor | Toxaphene |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.0002 U | < 0.00018 U | < 0.00014 U | < 0.000091 U | < 0.00019 U | < 0.00014 U | < 0.00035 UJ | < 0.0064 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 U | < 0.00014 U | < 0.00034 UJ | < 0.0062 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.00018 U | < 0.00016 U | < 0.00012 U | < 0.000084 U | < 0.00017 U | < 0.00013 U | < 0.00032 U | < 0.0059 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000086 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.006 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0062 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.00019 UJ | < 0.00017 UJ | < 0.00013 UJ | < 0.000087 UJ | < 0.00018 UJ | < 0.00014 UJ | < 0.00033 UJ | < 0.0061 UJ |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | 0.007 J | < 0.00018 UJ | < 0.00014 U | 0.0034 J | < 0.0061 U |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.0002 U | < 0.00018 U | < 0.00013 U | < 0.000091 U | < 0.00019 U | < 0.00014 U | < 0.00034 U | < 0.0063 U |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000089 U | < 0.00018 U | < 0.00014 U | < 0.00034 U | < 0.0062 U |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | 0.015 J | < 0.00017 U | < 0.00013 U | < 0.000086 U | < 0.00018 UJ | < 0.00014 U | < 0.00033 U | < 0.006 U |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.0002 U | < 0.00018 U | < 0.00014 U | < 0.000094 U | < 0.00019 U | < 0.00015 U | < 0.00036 U | < 0.0066 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000086 U | < 0.00018 UJ | < 0.00014 U | 0.0086 | < 0.006 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 UJ | < 0.00014 U | 0.015 | < 0.0061 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000086 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.006 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000086 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.006 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.00018 U | < 0.00017 U | < 0.00013 U | < 0.000086 U | < 0.00018 U | < 0.00014 U | < 0.00032 U | < 0.006 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000086 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.006 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 U | < 0.00014 U | 0.016 | < 0.0062 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.00092 U | < 0.00084 U | < 0.00063 U | < 0.00043 U | < 0.00088 U | < 0.00067 U | < 0.0016 U | < 0.03 U |

**TABLE B-5**
**SOIL ORGANOCHLORINE PESTICIDES DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Organochlorine Pesticides | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Endrin aldehyde | Endrin ketone | gamma-BHC (Lindane) | gamma-Chlordane | Heptachlor | Heptachlor epoxide | Methoxychlor | Toxaphene |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.00019 U | < 0.00018 U | < 0.00013 U | < 0.000089 U | < 0.00018 U | < 0.00014 U | < 0.00034 U | < 0.0062 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000089 U | < 0.00018 U | < 0.00014 U | 0.025 | < 0.0062 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000089 U | < 0.00018 UJ | < 0.00014 U | < 0.00034 U | < 0.0062 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 UJ | < 0.00014 U | < 0.00033 U | < 0.0062 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.0002 U | < 0.00018 U | < 0.00014 U | < 0.000091 U | < 0.00019 UJ | < 0.00014 U | < 0.00035 U | < 0.0064 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.0002 U | < 0.00018 U | < 0.00014 U | < 0.000093 U | < 0.00019 UJ | < 0.00015 U | < 0.00035 U | < 0.0065 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | 0.0028 | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.006 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.00018 U | < 0.00016 U | < 0.00012 U | 0.0022 | < 0.00017 U | < 0.00013 U | < 0.00032 U | < 0.0059 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 U | < 0.00014 U | < 0.00034 U | < 0.0062 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000088 U | < 0.00018 U | < 0.00014 U | 0.0023 J | < 0.0061 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000086 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.006 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000086 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.006 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.00019 U | < 0.00017 U | < 0.00013 U | < 0.000087 U | < 0.00018 U | < 0.00014 U | < 0.00033 U | < 0.0061 U |

All units in mg/kg.
-- = no sample data.

**TABLE B-6**
**SOIL POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 2)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Polynuclear Aromatic Hydrocarbons (PAHs) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Acenaphthene | Acenaphthylene | Anthracene | Benzo(a)anthracene | Benzo(a)pyrene | Benzo(b)fluoranthene | Benzo(g,h,i)perylene | Benzo(k)fluoranthene | Chrysene | Dibenzo(a,h)anthracene | Indeno(1,2,3-cd)pyrene | Phenanthrene | Pyrene |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.00178 U | < 0.00178 U | < 0.00178 U | 0.00333 J | < 0.00178 U | 0.0022 J | < 0.00178 U | < 0.00178 U | < 0.00178 U | 0.00287 J | < 0.00178 U | < 0.00178 U | < 0.00178 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.0017 U | < 0.0017 U | < 0.0017 U | < 0.0017 U | < 0.0017 U | < 0.0017 U | < 0.0017 U | < 0.0017 U | < 0.0017 U | < 0.0017 U | < 0.0017 U | < 0.0017 U | < 0.0017 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.00183 U | < 0.00183 U | < 0.00183 U | < 0.00183 U | 0.00185 J | < 0.00183 U | < 0.00183 U | 0.00489 J | 0.00231 J | 0.0587 | < 0.00183 U | < 0.00183 U | 0.00306 J |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.00173 U | < 0.00173 U | 0.00298 J | < 0.00173 U | 0.0162 J | 0.0411 | < 0.00173 U | < 0.00173 U | 0.0319 J | < 0.00173 U | < 0.00173 U | 0.0239 J | 0.0395 |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.00172 U | < 0.00172 U | 0.00271 J | < 0.00172 U | 0.0294 J | 0.0767 | < 0.00172 U | < 0.00172 U | 0.0439 J | < 0.00172 U | < 0.00172 U | 0.0158 J | 0.0499 |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | 0.00763 | 0.00963 | < 0.00179 U | < 0.00179 U | 0.0105 | < 0.00179 U | < 0.00179 U | 0.0123 | 0.0188 |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.00174 U | < 0.00174 U | 0.00599 J | 0.0576 | 0.0585 | 0.129 | 0.0295 | < 0.00174 U | 0.0904 | 0.0135 | 0.0311 | 0.0343 | 0.12 |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.00174 U | < 0.00174 U | < 0.00174 U | 0.00398 J | 0.00282 J | 0.00793 | 0.00327 J | < 0.00174 U | 0.00399 J | < 0.00174 U | 0.00195 J | 0.00402 J | 0.00715 |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.00173 U | < 0.00173 U | 0.0019 J | < 0.00173 U | 0.00285 J | 0.0043 J | < 0.00173 U | 0.00251 J | 0.00445 J | < 0.00173 U | < 0.00173 U | 0.00324 J | 0.00483 J |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.00173 U | < 0.00173 U | < 0.00173 U | < 0.00173 U | < 0.00173 U | < 0.00173 U | < 0.00173 U | < 0.00173 U | < 0.00173 U | < 0.00173 U | < 0.00173 U | < 0.00173 U | < 0.00173 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | 0.00209 J | 0.00206 J | 0.00279 J | < 0.00176 U | 0.00431 J | 0.00714 | < 0.00176 U | 0.00359 J | 0.00609 J | < 0.00176 U | < 0.00176 U | 0.00404 J | 0.00637 J |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.00172 U | < 0.00172 U | 0.00206 J | < 0.00172 U | 0.00412 J | 0.00856 | < 0.00172 U | 0.00296 J | 0.00723 | < 0.00172 U | < 0.00172 U | 0.00398 J | 0.00768 |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.00174 U | < 0.00174 U | < 0.00174 U | 0.00429 J | 0.00342 J | 0.00931 | < 0.00174 U | < 0.00174 U | 0.00646 J | < 0.00174 U | < 0.00174 U | 0.00272 J | 0.0112 |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | 0.0022 J | 0.00248 J |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.00174 U | < 0.00174 U | 0.00213 J | < 0.00174 U | 0.0026 J | 0.0029 J | < 0.00174 U | 0.00229 J | 0.00271 J | < 0.00174 U | < 0.00174 U | 0.00306 J | 0.00384 J |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U | < 0.00175 U |
| GNC1-JA04 | 0 | NORM | 8/13/2009 | < 0.00169 U | < 0.00169 U | < 0.00169 U | 0.00406 J | 0.00911 | 0.00802 | < 0.00169 U | < 0.00169 U | 0.00571 J | < 0.00169 U | 0.00601 J | 0.00263 J | 0.00927 |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | 0.00443 J | 0.0084 | 0.00351 J | < 0.00174 U | 0.00557 J | 0.00208 J | 0.00272 J | 0.00354 J | 0.00783 |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.00169 U | < 0.00169 U | < 0.00169 U | < 0.00169 U | < 0.00169 U | 0.00331 J | 0.0103 | < 0.00169 U | < 0.00169 U | < 0.00169 U | < 0.00169 U | 0.00806 | 0.0156 |

**TABLE B-6**
**SOIL POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Polynuclear Aromatic Hydrocarbons (PAHs) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Acenaphthene | Acenaphthylene | Anthracene | Benzo(a)anthracene | Benzo(a)pyrene | Benzo(b)fluoranthene | Benzo(g,h,i)perylene | Benzo(k)fluoranthene | Chrysene | Dibenzo(a,h)anthracene | Indeno(1,2,3-cd)pyrene | Phenanthrene | Pyrene |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.00174 U | < 0.00174 U | 0.0382 J | 0.188 J | 0.112 J | 0.246 J | 0.0341 J | < 0.00174 U | 0.188 J | < 0.00174 U | 0.0378 J | 0.2 J | 0.412 J |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.00174 U | < 0.00174 U | 0.00963 J | 0.089 J | 0.058 J | 0.136 J | 0.0187 J | < 0.00174 U | 0.111 J | < 0.00174 U | 0.0217 J | 0.0485 J | 0.184 J |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | 0.00199 J | 0.00504 J | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | < 0.00179 U | 0.00279 J | 0.00568 J |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U | < 0.00177 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.00175 U | < 0.00175 U | 0.00338 J | 0.0172 | 0.0101 | 0.0245 | 0.00442 J | < 0.00175 U | 0.0242 | < 0.00175 U | 0.00423 J | 0.019 | 0.0497 |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U | < 0.00178 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U | < 0.00182 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U | < 0.00172 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U | < 0.00176 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.00173 U | < 0.00173 U | < 0.00173 U | < 0.00173 U | < 0.00173 U | 0.00369 J | 0.00224 J | < 0.00173 U | 0.00258 J | < 0.00173 U | < 0.00173 U | < 0.00173 U | 0.004 J |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.00174 U | < 0.00174 U | < 0.00174 U | 0.00225 J | 0.00194 J | 0.00394 J | < 0.00174 U | < 0.00174 U | 0.00291 J | < 0.00174 U | < 0.00174 U | < 0.00174 U | 0.00421 J |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U | < 0.00174 U |
| GNC2-JD09C | 0 | NORM | 1/8/2010 | < 0.00175 U | < 0.00175 U | < 0.00175 U | 0.00642 J | 0.00573 J | 0.0108 | < 0.00175 U | 0.00658 J | 0.0158 | < 0.00175 U | < 0.00175 U | 0.00765 | 0.0138 |

All units in mg/kg.

-- = no sample data.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-7**
**SOIL POLYCHLORINATED BIPHENYLS (PCBs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Polychlorinated Biphenyls (PCBs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Aroclor 1016 | Aroclor 1221 | Aroclor 1232 | Aroclor 1242 | Aroclor 1248 | Aroclor 1254 | Aroclor 1260 | PCB 105 | PCB 114 | PCB 118 |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | -- | -- | -- | -- | -- | -- | -- | 590 | 24 | 1200 |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | -- | -- | -- | -- | -- | -- | -- | 120 | 17 | 260 |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | -- | -- | -- | -- | -- | -- | -- | 68 | 5.9 | 120 |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | -- | -- | -- | -- | -- | -- | -- | 66 | 7.9 | 130 |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | -- | -- | -- | -- | -- | -- | -- | 180 | 17 | 310 |
| GNC1-BE20 | 0 | FD | 2/6/2009 | -- | -- | -- | -- | -- | -- | -- | 180 | 18 | 330 |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | -- | -- | -- | -- | -- | -- | -- | 7.5 | < 2.1 U | 14 |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.0051 U | < 0.0051 U | < 0.0051 U | < 0.0051 U | < 0.0051 U | < 0.0028 U | 3.5 | 2200 J | 130 | 12000 J |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | -- | -- | -- | -- | -- | -- | -- | 78 | 4.4 | 130 |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | -- | -- | -- | -- | -- | -- | -- | 13 | 2.1 | 24 |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | -- | -- | -- | -- | -- | -- | -- | 8.8 | 2.3 | 18 |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | -- | -- | -- | -- | -- | -- | -- | 24 | 4.2 | 47 |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | -- | -- | -- | -- | -- | -- | -- | 14 | 7.5 | 20 |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | -- | -- | -- | -- | -- | -- | -- | 43 | 9.3 | 85 |
| GNC1-BG20 | 0 | FD | 2/5/2009 | -- | -- | -- | -- | -- | -- | -- | 63 | 9.7 | 110 |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | -- | -- | -- | -- | -- | -- | -- | 7.3 | < 2.1 U | 17 |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | -- | -- | -- | -- | -- | -- | -- | 10 | 2.8 | 21 |
| GNC1-JA05 | 0 | NORM | 8/13/2009 | -- | -- | -- | -- | -- | -- | -- | 2.7 | < 2 U | 6.1 |
| GNC1-JA06 | 0 | NORM | 8/13/2009 | -- | -- | -- | -- | -- | -- | -- | 37 | 3.6 | 72 |
| GNC1-JA07 | 0 | NORM | 8/13/2009 | -- | -- | -- | -- | -- | -- | -- | 25 | 3.3 | 57 |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | -- | -- | -- | -- | -- | -- | -- | 310 | 11 | 640 |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | -- | -- | -- | -- | -- | -- | -- | 2.2 | < 2.1 U | 5.2 |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | -- | -- | -- | -- | -- | -- | -- | 13 | < 2.1 U | 24 |
| GNC1-JD09 | 0 | FD | 1/30/2009 | -- | -- | -- | -- | -- | -- | -- | 18 | < 2.1 U | 28 |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | -- | -- | -- | -- | -- | -- | -- | 530 | 23 | 1000 |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | -- | -- | -- | -- | -- | -- | -- | 75 | 3.7 | 120 |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | -- | -- | -- | -- | -- | -- | -- | 360 | 32 | 820 J |
| GNC1-JS09 | 0 | FD | 1/30/2009 | -- | -- | -- | -- | -- | -- | -- | 220 | 23 | 470 J |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | -- | -- | -- | -- | -- | -- | -- | 460 | 65 | 960 |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | -- | -- | -- | -- | -- | -- | -- | 39 J | 8.3 J | 78 J |
| GNC1-JS11 | 0 | FD | 1/29/2009 | -- | -- | -- | -- | -- | -- | -- | 110 J | 18 J | 230 J |
| GNC2-BE20C | 0 | NORM | 1/8/2010 | -- | -- | -- | -- | -- | -- | -- | 48 | 4.5 | 82 |
| GNC2-BE20C | 0 | FD | 1/8/2010 | -- | -- | -- | -- | -- | -- | -- | 43 | 5.4 | 83 |
| GNC2-BE22C | 0 | NORM | 1/6/2010 | -- | -- | -- | -- | -- | -- | -- | 23 | 3.2 | 46 |
| GNC2-JA04 | 0 | NORM | 8/2/2010 | -- | -- | -- | -- | -- | -- | -- | 6.7 | < 1.9 U | 14 |

**TABLE B-7**
**SOIL POLYCHLORINATED BIPHENYLS (PCBs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Polychlorinated Biphenyls (PCBs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Aroclor 1016 | Aroclor 1221 | Aroclor 1232 | Aroclor 1242 | Aroclor 1248 | Aroclor 1254 | Aroclor 1260 | PCB 105 | PCB 114 | PCB 118 |
| GNC2-JA04 | 0 | FD | 8/2/2010 | -- | -- | -- | -- | -- | -- | -- | 5.2 | < 2 U | 10 |
| GNC2-JD07C | 0 | NORM | 1/6/2010 | -- | -- | -- | -- | -- | -- | -- | 200 | < 2 U | 280 |
| GNC2-JE01 | 0 | NORM | 4/26/2010 | -- | -- | -- | -- | -- | -- | -- | 97 | 11 | 190 |
| GNC2-JE02 | 0 | NORM | 4/26/2010 | -- | -- | -- | -- | -- | -- | -- | 170 | 19 | 360 |
| GNC2-JS09C | 0 | NORM | 1/8/2010 | -- | -- | -- | -- | -- | -- | -- | < 2.1 U | < 2.1 U | 4.7 |
| GNC2-JS10C | 0 | NORM | 1/8/2010 | -- | -- | -- | -- | -- | -- | -- | 47 | 6.4 J | 99 |
| GNC2-JS10C | 0 | FD | 1/8/2010 | -- | -- | -- | -- | -- | -- | -- | 30 | 3.9 J | 60 |

Aroclor units in mg/kg; PCB congener units in pg/g.

-- = no sample data.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-7**
**SOIL POLYCHLORINATED BIPHENYLS (PCBs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 3 of 4)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Polychlorinated Biphenyls (PCBs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PCB 123 | PCB 126 | PCB 156 | PCB 157 | PCB 167 | PCB 169 | PCB 189 | PCB 209 | PCB 77 | PCB 81 |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 34 U | 11 | 160 | 35 | 46 | < 2.2 U | 6.7 | 470 | < 39 U | < 23 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 7 U | 8.9 | 39 | 9.1 | 16 | 2.2 | 12 | 3000 J | < 34 U | < 10 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 4.7 U | 4.8 | 23 | 4.9 | 11 | < 2.1 U | 8.9 | 2100 | < 25 U | < 4.4 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 4.3 U | 6.1 | 24 | 5.9 | 12 | < 2.1 U | 9.9 | 2800 J | < 19 U | < 5.9 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 13 U | 11 J | 76 | 19 | 35 | 3.3 | 27 J | 4300 J | < 67 U | < 11 U |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 12 U | 8.3 J | 64 | 15 | 24 | < 2.1 U | 13 J | 1100 J | < 61 U | < 12 U |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 2.1 U | < 2.1 U | 2.8 | < 2.1 U | < 2.1 U | < 2.1 U | < 2.1 U | 370 | 2.1 | < 2.1 U |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 3700 U | 620 | 13000 J | 850 | 4600 J | 24 | 5100 J | 2400 J | < 810 U | < 300 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 5.6 U | < 2.1 U | 24 | 5.3 | 13 | < 2.1 U | 4 | 990 | < 8.9 U | < 4.9 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 2.1 U | < 2.1 U | 5.6 | < 2.1 U | < 2.1 U | < 2.1 U | 3.6 | 1100 | < 5.9 U | < 2.1 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 2.1 U | < 2.1 U | 4 | < 2.1 U | < 2.1 U | < 2.1 U | < 2.1 U | 290 | < 2.9 U | < 2.1 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 2.1 U | 2.8 | 9 | 3.4 | 6.4 | < 2.1 U | 5.8 | 1300 J | 7.4 | 3.4 |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | 6.8 | 7.5 | 10 | 6.9 | 8.8 | 6.2 | 8 | 630 | < 9.7 U | 7.4 |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 2.6 U | 4.8 | 18 | 3.5 | 8.6 | < 2.1 U | 6.5 | 1600 | < 16 U | < 4.4 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 2.6 U | 5.9 | 21 | 5.3 | 12 | < 2.1 U | 4.8 | 1000 | < 21 U | < 6.7 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 2.1 U | < 2.1 U | 3 | < 2.1 U | < 2.1 U | < 2.1 U | < 2.1 U | 180 | < 2.1 U | < 2.1 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 2.1 U | < 2.1 U | 5.1 | < 2.1 U | 2.1 | < 2.1 U | < 2.1 U | 310 | < 3.8 U | < 2.1 U |
| GNC1-JA05 | 0 | NORM | 8/13/2009 | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | 130 | < 2 U | < 2 U |
| GNC1-JA06 | 0 | NORM | 8/13/2009 | < 16 U | 4.2 | 26 | 4.1 | 10 | < 1.9 U | 10 | 460 | < 11 U | < 2.5 U |
| GNC1-JA07 | 0 | NORM | 8/13/2009 | < 33 U | 4.6 | 36 | 5 | 18 | < 2 U | 19 | 660 | < 7.5 U | < 2.2 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 22 U | < 2.1 U | 110 | 24 | 32 | < 2.1 U | 4.8 | 470 | < 16 U | < 9.2 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 2.1 U | < 2.1 U | < 2.1 U | < 2.1 U | < 2.1 U | < 2.1 U | < 2.1 U | 46 | < 2.1 U | < 2.1 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 2.1 U | < 2.1 U | 6.6 | < 2.1 U | 2.4 | < 2.1 U | < 2.1 U | 490 | < 2.5 U | < 2.1 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 2.1 U | < 2.1 U | 7 | < 2.1 U | 2.7 | < 2.1 U | < 2.1 U | 380 | < 3.6 U | < 2.1 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 35 U | 3.3 | 160 | 39 | 65 | < 2.1 U | 18 | 6300 J | < 51 U | < 32 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 5.2 U | 2.5 | 24 | 5.5 | 9.9 | < 2.2 U | 2.8 | 800 | < 10 U | < 4.5 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 19 U | 13 | 99 | 20 | 32 | < 2.1 U | 11 | 1700 | < 59 U | < 16 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 14 U | 14 | 95 | 20 | 33 | < 2 U | 13 | 1500 | < 53 U | < 11 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 27 U | 24 | 180 | 42 | 69 | 6.1 | 46 | 8900 J | < 100 U | < 40 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 3.4 U | 2.8 J | 14 J | 4.1 J | 6.4 J | < 2.1 U | 5.5 J | 940 | < 11 U | < 4.7 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 7 U | 5.8 J | 32 J | 7.5 J | 14 J | < 2.1 U | 10 J | 1500 | < 27 U | < 11 U |
| GNC2-BE20C | 0 | NORM | 1/8/2010 | < 5.4 U | 5.3 | 28 | 7.1 | 13 | 2.3 | 13 | 2900 J | < 13 U | < 3.3 U |
| GNC2-BE20C | 0 | FD | 1/8/2010 | < 4.9 U | 5.4 | 26 | 6.1 | 14 | 2.8 | 13 | 3100 J | < 15 U | < 3.3 U |
| GNC2-BE22C | 0 | NORM | 1/6/2010 | < 18 U | 2.6 | 20 | 2.4 | 7.7 | < 2.1 U | 8.5 | 230 | < 4.6 U | < 2.6 U |
| GNC2-JA04 | 0 | NORM | 8/2/2010 | < 1.9 U | < 1.9 U | 3.4 | < 1.9 U | < 1.9 U | < 1.9 U | < 1.9 U | 130 | < 2.5 U | < 1.9 U |

**TABLE B-7**
**SOIL POLYCHLORINATED BIPHENYLS (PCBs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 4 of 4)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Polychlorinated Biphenyls (PCBs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PCB 123 | PCB 126 | PCB 156 | PCB 157 | PCB 167 | PCB 169 | PCB 189 | PCB 209 | PCB 77 | PCB 81 |
| GNC2-JA04 | 0 | FD | 8/2/2010 | < 2 U | < 2 U | 2.6 | < 2 U | < 2 U | < 2 U | < 2 U | 120 | < 2.3 U | < 2 U |
| GNC2-JD07C | 0 | NORM | 1/6/2010 | < 12 U | < 2 U | 76 | 20 | 28 | < 2 U | 4.2 | 380 | < 12 U | < 8.7 U |
| GNC2-JE01 | 0 | NORM | 4/26/2010 | < 5.8 U | 7.5 | 33 | 8.1 | 13 | < 2.3 U | 13 | 3300 J | < 24 U | < 5.8 U |
| GNC2-JE02 | 0 | NORM | 4/26/2010 | < 10 U | 10 | 54 | 12 | 16 | < 2.2 U | 13 | 2300 J | < 52 U | < 9.3 U |
| GNC2-JS09C | 0 | NORM | 1/8/2010 | < 2.1 U | < 2.1 U | < 2.1 U | < 2.1 U | < 2.1 U | < 2.1 U | < 2.1 U | 30 | < 2.1 U | < 2.1 U |
| GNC2-JS10C | 0 | NORM | 1/8/2010 | < 2.6 U | 4.4 J | 17 J | 4.4 | 9 J | < 2.1 U | 7.7 J | 2700 J | < 13 U | < 3.8 U |
| GNC2-JS10C | 0 | FD | 1/8/2010 | < 2.1 U | 2.2 J | 10 J | 2.4 | 5.4 J | < 2.1 U | 3.9 J | 1300 J | < 8.5 U | < 2.2 U |

Aroclor units in mg/kg; PCB congener units in pg/g.

-- = no sample data.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-8**
**SOIL RADIONUCLIDES DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 2)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Radionuclides | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Radium-226 | Radium-228 | Thorium-228 | Thorium-230 | Thorium-232 | Uranium-233/234 | Uranium-235/236 | Uranium-238 |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | 2.51 | 1.88 | 1.46 | 2.11 | 1.86 | 0.933 | 0.123 U | 0.799 |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | 1.13 | 0.817 | 1.5 | 1.75 | 0.65 | 1.22 | 0.116 U | 1.41 |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | 0.792 | 2.27 | 2.15 | 1.07 | 0.943 | 0.784 | 0.0904 U | 0.821 |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | 1.45 | 1.11 | 2.31 | 1.23 | 1.66 | 1.24 | 0.262 U | 1.23 |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | 0.875 | 1.4 | 1.92 | 1.05 | 1.17 | 0.83 | 0.0462 U | 0.85 |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | 2.2 | 1.31 | 1.48 | 1.65 | 1.52 | 1.23 | 0.107 U | 1.51 |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | 0.643 | 0.508 U | 1.22 | 1.24 | 1.09 | 1 U | 0.0273 U | 1 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | 1.06 | 1.9 | 1.59 | 0.975 | 1.76 | 1 U | 0.0506 U | 1.22 |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | 1.12 | 0.55 U | 1.15 | 1 U | 0.977 | 0.935 | 0.0407 U | 0.937 |
| GNC1-BE20 | 0 | FD | 2/6/2009 | 1.01 | 1.41 | 0.421 U | 0.537 U | 0.509 | 0.556 | 0.0517 U | 0.442 |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | 1.25 | 1.6 | 0.686 | 1.61 | 0.957 | 1.75 | -0.0244 U | 1.3 |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | 1.07 | 1.28 | 0.879 | 1.01 | 1.08 | 0.658 | 0.0533 U | 0.599 |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | 1.57 | 1.31 | 0.968 | 0.881 | 1.48 | 1 U | 0.0655 U | 1.18 |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | 1.79 | 1.15 | 1.26 | 0.687 | 1.01 | 1 U | 0.0705 U | 1.1 |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | 1.01 | 0.737 | 0.728 | 0.757 | 0.608 | 1 U | 0.1 U | 1 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | 1.93 | 0.875 | 1.48 | 1.04 | 1.42 | 1.37 | 0.0201 U | 1.31 |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | 1.09 | 1.33 | 1.3 | 1 U | 1.43 | 0.429 | 0.167 | 0.519 |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | 0.962 | 1.15 | 0.608 | 1.11 | 1.1 | 0.747 | 0.072 U | 0.526 |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | 0.497 | 1.75 | 1.6 | 1.13 | 1.58 | 1 U | 0.0386 U | 1.03 |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | 1.21 | 1.74 | 1.39 | 0.95 | 1.26 | 1 U | 0.0358 U | 1 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | 1.23 | 1.3 | 1.14 | 1 U | 1.28 | 0.688 | 0.00304 U | 0.476 |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | 0.695 | 1.45 | 1.05 | 1.18 | 0.924 | 0.491 | 0.0465 U | 0.879 |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | 1.32 | 0.405 U | 1.76 | 0.869 | 1.16 | 1 U | 0.0381 U | 1 |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | 0.621 | 0.799 | 1.72 | 0.917 | 1.68 | 1.06 | 0.0335 U | 1 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | 0.93 | 0.7 J | 1.46 | 1.22 | 1.06 | 1.23 | -0.0215 U | 1 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | 0.757 | 2.28 J | 1.27 | 0.931 | 1.35 | 1 U | 0.229 | 1 |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | 1.52 | 1.03 | 0.97 | 0.952 | 0.953 | 1.1 | 0.0995 U | 1.15 |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | 0.693 | 0.913 | 1.33 | 0.856 | 1.48 | 1 U | 0.129 | 1 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | 0.997 | 0.628 | 1.57 | 1.13 | 1.68 | 1 U | 0.274 | 1 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | 1.15 | 2.17 | 1.9 | 0.876 | 1.54 | 0.13 U | -0.0272 U | -0.0422 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | 1.03 | 0.943 | 1.59 | 1.05 | 1.08 | 1.02 | 0.117 U | 1 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | 1.03 | 1.41 | 1.43 | 1.66 | 1.24 | 0.809 | -0.0148 U | 1.16 |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | 1.57 | 1.47 | 2.07 | 1.57 | 1.24 | 1.79 | 0.31 | 1.47 |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | 1.31 | 1.06 | 1.68 | 1.04 | 1.48 | 0.971 | 0.0493 U | 1.22 |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | 2.03 | 0.832 U | 1.75 | 0.949 | 2.2 | 0.776 | 0.121 U | 0.955 |

**TABLE B-8**
**SOIL RADIONUCLIDES DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 2 of 2)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Radionuclides | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Radium-226 | Radium-228 | Thorium-228 | Thorium-230 | Thorium-232 | Uranium-233/234 | Uranium-235/236 | Uranium-238 |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | 1.1 | 1.34 | 1.51 | 1.02 | 1.74 | 1.02 | 0.0281 U | 1.07 |
| GNC1-JD09 | 0 | FD | 1/30/2009 | 1.46 | 1.53 | 1.27 | 0.691 | 1.51 | 0.897 | 0.118 U | 0.916 |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | 1.32 | 0.982 | 1.5 | 0.605 | 1.26 | 0.824 | 0.0296 U | 0.774 |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | 0.902 | 1.14 J | 1.17 | 0.837 | 1.3 | 1.45 | 0.098 U | 0.789 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | 1.04 | 1.38 J | 1.31 | 1 | 1.06 | 0.968 | 0.0596 U | 0.964 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | 1.4 | 0.958 J | 1.86 | 1.45 | 2.32 | 1.06 | 0.1 U | 0.989 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | 0.768 | 1.11 J | 1.11 | 0.659 | 1.97 | 0.9 | 0.0492 U | 0.935 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | 1.31 | 2.02 | 1.43 | 0.631 | 1.59 | 0.476 U | -0.0987 U | 0.608 |
| GNC1-JS09 | 0 | FD | 1/30/2009 | 1.5 | 2.41 | 1.94 | 0.977 | 1.6 | 0.937 | 0.135 U | 0.634 |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | 1.89 | 1.51 | 1.39 | 1.1 | 1.47 | 1.63 | 0.132 U | 1.58 |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | 1.21 | 1.45 | 2.2 | 0.94 | 1.61 | 0.773 | 0.0934 U | 0.376 |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | 1.93 | 0.765 | 1.13 | 1.79 | 1.13 | 1.54 | 0.046 U | 1.18 |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | 1 U | 1.3 J | 1.47 | 1.15 | 1.37 | 0.992 | 1 U | 1.2 |
| GNC1-JS11 | 0 | FD | 1/29/2009 | 1.38 | 2.18 J | 1.84 | 1.36 | 1.76 | 1.19 | 0.149 U | 1.09 |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | 1.25 | 1.52 J | 1.51 | 1.33 | 1.9 | 1.29 | 0.121 U | 0.965 |

All units in pCi/g.
-- = no sample data.

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 14)**

| | | | | Aldehydes | | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Acetaldehyde | Formaldehyde | 1,2,4,5-Tetrachloro-benzene | 1,2-Diphenylhydrazine | 1,4-Dioxane | 2,2'-Dichlorobenzil | 2,4,5-Trichlorophenol | 2,4,6-Trichlorophenol | 2,4-Dichlorophenol | 2,4-Dimethylphenol |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.32 U | 0.222 | < 0.0713 U | < 0.0713 U | < 0.0713 U | < 0.118 U | < 0.0713 U | < 0.0713 U | < 0.0713 U | < 0.0713 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.39 U | < 0.26 U | < 0.0726 U | < 0.0726 U | < 0.0726 U | < 0.12 U | < 0.0726 U | < 0.0726 U | < 0.0726 U | < 0.0726 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.313 U | 0.496 J | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.114 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.0688 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.316 U | 0.234 J | < 0.0716 U | < 0.0716 U | < 0.0716 U | < 0.118 U | < 0.0716 U | < 0.0716 U | < 0.0716 U | < 0.0716 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.314 U | 0.285 J | < 0.068 U | < 0.068 U | < 0.068 U | < 0.112 U | < 0.068 U | < 0.068 U | < 0.068 U | < 0.068 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.316 U | < 0.211 U | < 0.071 U | < 0.071 U | < 0.071 U | < 0.117 U | < 0.071 U | < 0.071 U | < 0.071 U | < 0.071 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.503 U | 0.843 J | < 0.0733 U | < 0.0733 U | < 0.0733 U | < 0.121 U | < 0.0733 U | < 0.0733 U | < 0.0733 U | < 0.0733 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.321 U | < 0.258 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.117 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.0708 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.312 U | 0.582 J | < 0.0692 U | < 0.0692 U | < 0.0692 U | < 0.114 U | < 0.0692 U | < 0.0692 U | < 0.0692 U | < 0.0692 U |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.311 U | 0.541 J | < 0.0689 U | < 0.0689 U | < 0.0689 U | < 0.114 U | < 0.0689 U | < 0.0689 U | < 0.0689 U | < 0.0689 U |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.34 U | 0.268 J | < 0.0718 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.118 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.0718 UJ |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.315 U | 0.211 J | < 0.07 U | < 0.07 U | < 0.07 U | < 0.116 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.07 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | < 0.316 U | 0.593 J | -- | -- | -- | -- | -- | -- | -- | -- |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.391 U | < 0.362 U | < 0.0697 U | < 0.0697 U | < 0.0697 U | < 0.115 U | < 0.0697 U | < 0.0697 U | < 0.0697 U | < 0.0697 U |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.344 U | < 0.229 U | < 0.0699 U | < 0.0699 U | < 0.0699 U | < 0.115 U | < 0.0699 U | < 0.0699 U | < 0.0699 U | < 0.0699 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.318 U | < 0.385 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.0695 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.354 U | < 0.236 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.117 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.0708 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.311 U | 0.263 J | < 0.0687 U | < 0.0687 U | < 0.0687 U | < 0.113 U | < 0.0687 U | < 0.0687 U | < 0.0687 U | < 0.0687 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.319 U | < 0.213 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.0704 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.311 U | 0.525 J | < 0.0691 U | < 0.0691 U | < 0.0691 U | < 0.114 U | < 0.0691 U | < 0.0691 U | < 0.0691 U | < 0.0691 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.317 U | 0.487 J | < 0.0703 U | < 0.0703 U | < 0.0703 U | < 0.116 U | < 0.0703 U | < 0.0703 U | < 0.0703 U | < 0.0703 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.312 U | 0.284 J | < 0.0693 U | < 0.0693 U | < 0.0693 U | < 0.114 U | < 0.0693 U | < 0.0693 U | < 0.0693 U | < 0.0693 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.312 U | < 0.208 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.116 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.07 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.369 U | < 0.246 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.116 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.0705 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.317 U | < 0.323 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.118 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.0714 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.306 U | 0.205 J | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.113 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.0688 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.312 U | 0.231 J | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.0695 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.337 U | < 0.225 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.0704 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.311 U | 0.249 J | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.115 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.0698 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.312 U | < 0.208 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.0704 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.315 U | < 0.21 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.0695 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.313 U | < 0.209 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.115 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.0698 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.318 U | 0.215 J | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.0695 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.319 U | < 0.213 U | < 0.0715 U | < 0.0715 U | < 0.0715 U | < 0.118 U | < 0.0715 U | < 0.0715 U | < 0.0715 U | < 0.0715 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.307 U | 0.214 J | < 0.0677 U | < 0.0677 U | < 0.0677 U | < 0.112 U | < 0.0677 U | < 0.0677 U | < 0.0677 U | < 0.0677 U |

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| | | | | Aldehydes | | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Acetaldehyde | Formaldehyde | 1,2,4,5-Tetrachloro-benzene | 1,2-Diphenylhydrazine | 1,4-Dioxane | 2,2'-Dichlorobenzil | 2,4,5-Trichlorophenol | 2,4,6-Trichlorophenol | 2,4-Dichlorophenol | 2,4-Dimethylphenol |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.319 U | 0.22 J | < 0.0706 U | < 0.0706 U | < 0.0706 UJ | < 0.116 U | < 0.0706 U | < 0.0706 U | < 0.0706 U | < 0.0706 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.312 U | < 0.208 U | < 0.0698 U | < 0.0698 U | < 0.0698 UJ | < 0.115 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.0698 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.312 U | 0.238 J | < 0.0697 U | < 0.0697 U | < 0.0697 UJ | < 0.115 U | < 0.0697 U | < 0.0697 U | < 0.0697 U | < 0.0697 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | 0.338 J | < 0.211 U | < 0.0713 U | < 0.0713 U | < 0.0713 UJ | < 0.118 U | < 0.0713 U | < 0.0713 U | < 0.0713 U | < 0.0713 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.317 U | < 0.211 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.118 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.0714 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.312 U | 0.318 J | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.117 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.0708 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.32 U | < 0.213 U | < 0.0702 U | < 0.0702 U | < 0.0702 U | < 0.116 U | < 0.0702 U | < 0.0702 U | < 0.0702 U | < 0.0702 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.317 U | 0.263 J | < 0.0711 U | < 0.0711 U | < 0.0711 U | < 0.117 U | < 0.0711 U | < 0.0711 U | < 0.0711 U | < 0.0711 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.311 U | 0.371 J | < 0.069 U | < 0.069 U | < 0.069 U | < 0.114 U | < 0.069 U | < 0.069 U | < 0.069 U | < 0.069 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.311 U | 0.304 J | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.115 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.0696 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.326 U | 0.405 J | < 0.073 U | < 0.073 U | < 0.073 U | < 0.12 U | < 0.073 U | < 0.073 U | < 0.073 U | < 0.073 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.322 U | 0.887 J | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.114 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.0688 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.318 U | 0.458 J | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.116 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.0705 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.315 U | < 0.21 U | < 0.0694 U | < 0.0694 U | < 0.0694 UJ | < 0.114 U | < 0.0694 U | < 0.0694 U | < 0.0694 U | < 0.0694 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.312 U | 0.293 | < 0.0696 U | < 0.0696 U | < 0.0696 UJ | < 0.115 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.0696 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.316 U | 0.382 | < 0.0696 U | < 0.0696 U | < 0.0696 UJ | < 0.115 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.0696 U |
| GNC2-JD09C | 0 | NORM | 1/8/2010 | -- | -- | < 0.0701 U | < 0.0701 U | < 0.0701 U | < 0.116 U | < 0.0701 U | < 0.0701 U | < 0.0701 U | < 0.0701 U |

All units in mg/kg.

-- = no sample data.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2,4-Dinitrophenol | 2,4-Dinitrotoluene | 2,6-Dinitrotoluene | 2-Chloronaphthalene | 2-Chlorophenol | 2-Methylnaphthalene | 2-Nitroaniline | 2-Nitrophenol | 3,3-Dichlorobenzidine | 3-Nitroaniline |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.136 U | < 0.0357 U | < 0.0357 U | < 0.0125 U | < 0.0713 U | < 0.00713 U | < 0.0713 U | < 0.0357 U | < 0.107 U | < 0.0713 UJ |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.138 U | < 0.0363 U | < 0.0363 U | < 0.0127 U | < 0.0726 U | < 0.00726 U | < 0.0726 U | < 0.0363 U | < 0.109 U | < 0.0726 UJ |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.131 U | < 0.0344 U | < 0.0344 U | < 0.012 U | < 0.0688 U | < 0.00688 U | < 0.0688 U | < 0.0344 U | < 0.103 U | < 0.0688 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.136 U | < 0.0358 U | < 0.0358 U | < 0.0125 U | < 0.0716 U | < 0.00716 U | < 0.0716 U | < 0.0358 U | < 0.107 U | < 0.0716 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.129 U | < 0.034 U | < 0.034 U | < 0.0119 U | < 0.068 U | < 0.0068 U | < 0.068 U | < 0.034 U | < 0.102 U | < 0.068 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.135 U | < 0.0355 U | < 0.0355 U | < 0.0124 U | < 0.071 U | < 0.0071 U | < 0.071 U | < 0.0355 U | < 0.107 U | < 0.071 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.139 U | < 0.0366 U | < 0.0366 U | < 0.0128 U | < 0.0733 U | < 0.00733 U | < 0.0733 U | < 0.0366 U | < 0.11 U | < 0.0733 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.134 U | < 0.0354 U | < 0.0354 U | < 0.0124 U | < 0.0708 U | < 0.00708 U | < 0.0708 U | < 0.0354 U | < 0.106 U | < 0.0708 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.132 U | < 0.0346 U | < 0.0346 U | < 0.0121 U | < 0.0692 U | < 0.00692 U | < 0.0692 U | < 0.0346 U | < 0.104 U | < 0.0692 U |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.131 U | < 0.0345 U | < 0.0345 U | < 0.0121 U | < 0.0689 U | < 0.00689 U | < 0.0689 U | < 0.0345 U | < 0.103 U | < 0.0689 U |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.136 UJ | < 0.0359 UJ | < 0.0359 UJ | < 0.0126 UJ | < 0.0718 UJ | < 0.00718 UJ | < 0.0718 UJ | < 0.0359 UJ | < 0.108 UJ | < 0.0718 UJ |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.133 U | < 0.035 U | < 0.035 U | < 0.0123 U | < 0.07 U | < 0.007 U | < 0.07 U | < 0.035 U | < 0.105 U | < 0.07 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.132 U | < 0.0349 U | < 0.0349 U | < 0.0122 U | < 0.0697 U | < 0.00697 U | < 0.0697 U | < 0.0349 U | < 0.105 U | < 0.0697 UJ |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.133 U | < 0.035 U | < 0.035 U | < 0.0122 U | < 0.0699 U | < 0.00699 U | < 0.0699 U | < 0.035 U | < 0.105 U | < 0.0699 UJ |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.132 U | < 0.0348 U | < 0.0348 U | < 0.0122 U | < 0.0695 U | < 0.00695 U | < 0.0695 U | < 0.0348 U | < 0.104 U | < 0.0695 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.135 U | < 0.0354 U | < 0.0354 U | < 0.0124 U | < 0.0708 U | < 0.00708 U | < 0.0708 U | < 0.0354 U | < 0.106 U | < 0.0708 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.131 U | < 0.0344 U | < 0.0344 U | < 0.012 U | < 0.0687 U | < 0.00687 U | < 0.0687 U | < 0.0344 U | < 0.103 U | < 0.0687 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.134 U | < 0.0352 U | < 0.0352 U | < 0.0123 U | < 0.0704 U | < 0.00704 U | < 0.0704 U | < 0.0352 U | < 0.106 U | < 0.0704 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.131 U | < 0.0345 U | < 0.0345 U | < 0.0121 U | < 0.0691 U | < 0.00691 U | < 0.0691 U | < 0.0345 U | < 0.104 U | < 0.0691 UJ |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.134 U | < 0.0352 U | < 0.0352 U | < 0.0123 U | < 0.0703 U | < 0.00703 U | < 0.0703 U | < 0.0352 U | < 0.105 U | < 0.0703 UJ |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.132 U | < 0.0346 U | < 0.0346 U | < 0.0121 U | < 0.0693 U | < 0.00693 U | < 0.0693 U | < 0.0346 U | < 0.104 U | < 0.0693 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.133 U | < 0.035 U | < 0.035 U | < 0.0123 U | < 0.07 U | < 0.007 U | < 0.07 U | < 0.035 U | < 0.105 U | < 0.07 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.134 U | < 0.0352 U | < 0.0352 U | < 0.0123 U | < 0.0705 U | < 0.00705 U | < 0.0705 U | < 0.0352 U | < 0.106 U | < 0.0705 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.136 U | < 0.0357 U | < 0.0357 U | < 0.0125 U | < 0.0714 U | < 0.00714 U | < 0.0714 U | < 0.0357 U | < 0.107 U | < 0.0714 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.131 U | < 0.0344 U | < 0.0344 U | < 0.012 U | < 0.0688 U | < 0.00688 U | < 0.0688 U | < 0.0344 U | < 0.103 U | < 0.0688 UJ |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.132 U | < 0.0347 U | < 0.0347 U | < 0.0122 U | < 0.0695 U | < 0.00695 U | < 0.0695 U | < 0.0347 U | < 0.104 U | < 0.0695 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.134 U | < 0.0352 U | < 0.0352 U | < 0.0123 U | < 0.0704 U | < 0.00704 U | < 0.0704 U | < 0.0352 U | < 0.106 U | < 0.0704 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.133 U | < 0.0349 U | < 0.0349 U | < 0.0122 U | < 0.0698 U | < 0.00698 U | < 0.0698 U | < 0.0349 U | < 0.105 U | < 0.0698 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.134 U | < 0.0352 U | < 0.0352 U | < 0.0123 U | < 0.0704 U | < 0.00704 U | < 0.0704 U | < 0.0352 U | < 0.106 U | < 0.0704 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.132 U | < 0.0348 U | < 0.0348 U | < 0.0122 U | < 0.0695 U | < 0.00695 U | < 0.0695 U | < 0.0348 U | < 0.104 U | < 0.0695 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.133 U | < 0.0349 U | < 0.0349 U | < 0.0122 U | < 0.0698 U | < 0.00698 U | < 0.0698 U | < 0.0349 U | < 0.105 U | < 0.0698 UJ |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.132 U | < 0.0347 U | < 0.0347 U | < 0.0122 U | < 0.0695 U | < 0.00695 U | < 0.0695 U | < 0.0347 U | < 0.104 U | < 0.0695 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.136 U | < 0.0358 U | < 0.0358 U | < 0.0125 U | < 0.0715 U | < 0.00715 U | < 0.0715 U | < 0.0358 U | < 0.107 U | < 0.0715 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.129 U | < 0.0338 U | < 0.0338 U | < 0.0118 U | < 0.0677 U | < 0.00677 U | < 0.0677 U | < 0.0338 U | < 0.102 U | < 0.0677 U |

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2,4-Dinitrophenol | 2,4-Dinitrotoluene | 2,6-Dinitrotoluene | 2-Chloronaphthalene | 2-Chlorophenol | 2-Methylnaphthalene | 2-Nitroaniline | 2-Nitrophenol | 3,3-Dichlorobenzidine | 3-Nitroaniline |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.134 U | < 0.0353 U | < 0.0353 U | < 0.0123 U | < 0.0706 U | < 0.00706 U | < 0.0706 U | < 0.0353 U | < 0.106 UJ | < 0.0706 UJ |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.133 U | < 0.0349 U | < 0.0349 U | < 0.0122 U | < 0.0698 U | < 0.00698 U | < 0.0698 U | < 0.0349 U | < 0.105 UJ | < 0.0698 UJ |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.132 U | < 0.0349 U | < 0.0349 U | < 0.0122 U | < 0.0697 U | < 0.00697 U | < 0.0697 U | < 0.0349 U | < 0.105 UJ | < 0.0697 UJ |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.135 U | < 0.0356 U | < 0.0356 U | < 0.0125 U | < 0.0713 U | < 0.00713 U | < 0.0713 U | < 0.0356 U | < 0.107 UJ | < 0.0713 UJ |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.136 U | < 0.0357 U | < 0.0357 U | < 0.0125 U | < 0.0714 U | < 0.00714 U | < 0.0714 U | < 0.0357 U | < 0.107 U | < 0.0714 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.134 U | < 0.0354 U | < 0.0354 U | < 0.0124 U | < 0.0708 U | < 0.00708 U | < 0.0708 U | < 0.0354 U | < 0.106 U | < 0.0708 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.133 U | < 0.0351 U | < 0.0351 U | < 0.0123 U | < 0.0702 U | < 0.00702 U | < 0.0702 U | < 0.0351 U | < 0.105 U | < 0.0702 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.135 U | < 0.0355 U | < 0.0355 U | < 0.0124 U | < 0.0711 U | < 0.00711 U | < 0.0711 U | < 0.0355 U | < 0.107 U | < 0.0711 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.131 U | < 0.0345 U | < 0.0345 U | < 0.0121 U | < 0.069 U | < 0.0069 U | < 0.069 U | < 0.0345 U | < 0.103 U | < 0.069 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.132 U | < 0.0348 U | < 0.0348 U | < 0.0122 U | < 0.0696 U | < 0.00696 U | < 0.0696 U | < 0.0348 U | < 0.104 U | < 0.0696 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.139 U | < 0.0365 U | < 0.0365 U | < 0.0128 U | < 0.073 U | < 0.0073 U | < 0.073 U | < 0.0365 U | < 0.109 U | < 0.073 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.131 U | < 0.0344 U | < 0.0344 U | < 0.012 U | < 0.0688 U | < 0.00688 U | < 0.0688 U | < 0.0344 U | < 0.103 U | < 0.0688 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.134 U | < 0.0352 U | < 0.0352 U | < 0.0123 U | < 0.0705 U | < 0.00705 U | < 0.0705 U | < 0.0352 U | < 0.106 U | < 0.0705 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.132 U | < 0.0347 U | < 0.0347 U | < 0.0121 U | < 0.0694 U | < 0.00694 U | < 0.0694 U | < 0.0347 U | < 0.104 UJ | < 0.0694 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.132 U | < 0.0348 U | < 0.0348 U | < 0.0122 U | < 0.0696 U | < 0.00696 U | < 0.0696 U | < 0.0348 U | < 0.104 UJ | < 0.0696 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.132 U | < 0.0348 U | < 0.0348 U | < 0.0122 U | < 0.0696 U | < 0.00696 U | < 0.0696 U | < 0.0348 U | < 0.104 UJ | < 0.0696 U |
| GNC2-JD09C | 0 | NORM | 1/8/2010 | < 0.133 U | < 0.035 U | < 0.035 U | < 0.0123 U | < 0.0701 U | < 0.00701 U | < 0.0701 U | < 0.035 U | < 0.105 U | < 0.0701 U |

All units in mg/kg.

-- = no sample data.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 4-Bromophenyl phenyl ether | 4-Chloro-3-methylphenol | 4-Chlorophenyl phenyl ether | 4-Chlorothioanisole | 4-Nitroaniline | 4-Nitrophenol | Acetophenone | Aniline | Benzenethiol | Benzoic acid |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.0357 U | < 0.0357 U | < 0.0357 U | < 0.118 U | < 0.0713 UJ | < 0.0713 U | < 0.0357 U | < 0.125 U | < 0.118 U | < 0.178 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.0363 U | < 0.0363 U | < 0.0363 U | < 0.12 U | < 0.0726 UJ | < 0.0726 U | < 0.0363 U | < 0.127 U | < 0.12 U | < 0.182 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.0344 U | < 0.0344 U | < 0.0344 U | < 0.114 U | < 0.0688 UJ | < 0.0688 U | < 0.0344 U | < 0.12 U | < 0.114 U | < 0.172 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.0358 U | < 0.0358 U | < 0.0358 U | < 0.118 U | < 0.0716 UJ | < 0.0716 U | < 0.0358 U | < 0.125 U | < 0.118 U | < 0.179 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.034 U | < 0.034 U | < 0.034 U | < 0.112 U | < 0.068 UJ | < 0.068 U | < 0.034 U | < 0.119 U | < 0.112 U | < 0.17 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.0355 U | < 0.0355 U | < 0.0355 U | < 0.117 U | < 0.071 UJ | < 0.071 U | < 0.0355 U | < 0.124 U | < 0.117 U | < 0.178 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.0366 U | < 0.0366 U | < 0.0366 U | < 0.121 U | < 0.0733 U | < 0.0733 U | < 0.0366 U | < 0.128 U | < 0.121 U | < 0.183 UJ |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.0354 U | < 0.0354 U | < 0.0354 U | < 0.117 U | < 0.0708 U | < 0.0708 U | < 0.0354 U | < 0.124 U | < 0.117 U | < 0.177 UJ |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.0346 U | < 0.0346 U | < 0.0346 U | < 0.114 U | < 0.0692 U | < 0.0692 U | < 0.0346 U | < 0.121 U | < 0.114 U | 0.32 J |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.0345 U | < 0.0345 U | < 0.0345 U | < 0.114 U | < 0.0689 U | < 0.0689 U | < 0.0345 U | < 0.121 U | < 0.114 U | < 0.172 U |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.0359 UJ | < 0.0359 UJ | < 0.0359 UJ | < 0.118 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.0359 UJ | < 0.126 UJ | < 0.118 UJ | < 0.179 UJ |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.035 U | < 0.035 U | < 0.035 U | < 0.116 U | < 0.07 U | < 0.07 U | < 0.035 U | < 0.123 U | < 0.116 U | < 0.175 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.0349 U | < 0.0349 U | < 0.0349 U | < 0.115 U | < 0.0697 UJ | < 0.0697 U | < 0.0349 U | < 0.122 U | < 0.115 U | < 0.174 U |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.035 U | < 0.035 U | < 0.035 U | < 0.115 U | < 0.0699 UJ | < 0.0699 U | < 0.035 U | < 0.122 U | < 0.115 U | < 0.175 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.0348 U | < 0.0348 U | < 0.0348 U | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0348 U | < 0.122 U | < 0.115 U | < 0.174 UJ |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.0354 U | < 0.0354 U | < 0.0354 U | < 0.117 U | < 0.0708 U | < 0.0708 U | < 0.0354 U | < 0.124 U | < 0.117 U | < 0.177 UJ |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.0344 U | < 0.0344 U | < 0.0344 U | < 0.113 U | < 0.0687 U | < 0.0687 U | < 0.0344 U | < 0.12 U | < 0.113 U | < 0.172 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.0352 U | < 0.0352 U | < 0.0352 U | < 0.116 U | < 0.0704 U | < 0.0704 U | < 0.0352 U | < 0.123 U | < 0.116 U | < 0.176 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.0345 U | < 0.0345 U | < 0.0345 U | < 0.114 U | < 0.0691 UJ | < 0.0691 U | < 0.0345 U | < 0.121 U | < 0.114 U | < 0.173 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.0352 U | < 0.0352 U | < 0.0352 U | < 0.116 U | < 0.0703 UJ | < 0.0703 U | < 0.0352 U | < 0.123 U | < 0.116 U | < 0.176 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.0346 U | < 0.0346 U | < 0.0346 U | < 0.114 U | < 0.0693 U | < 0.0693 U | < 0.0346 U | < 0.121 U | < 0.114 U | < 0.173 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.035 U | < 0.035 U | < 0.035 U | < 0.116 U | < 0.07 U | < 0.07 U | < 0.035 U | < 0.123 U | < 0.116 U | < 0.175 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.0352 U | < 0.0352 U | < 0.0352 U | < 0.116 U | < 0.0705 U | < 0.0705 U | < 0.0352 U | < 0.123 U | < 0.116 U | < 0.176 UJ |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.0357 U | < 0.0357 U | < 0.0357 U | < 0.118 U | < 0.0714 U | < 0.0714 U | < 0.0357 U | < 0.125 U | < 0.118 U | < 0.178 UJ |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.0344 U | < 0.0344 U | < 0.0344 U | < 0.113 U | < 0.0688 UJ | < 0.0688 U | < 0.0344 U | < 0.12 U | < 0.113 U | < 0.172 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.0347 U | < 0.0347 U | < 0.0347 U | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0347 U | < 0.122 U | < 0.115 U | < 0.174 UJ |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.0352 U | < 0.0352 U | < 0.0352 U | < 0.116 U | < 0.0704 U | < 0.0704 U | < 0.0352 U | < 0.123 U | < 0.116 U | < 0.176 UJ |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.0349 U | < 0.0349 U | < 0.0349 U | < 0.115 U | < 0.0698 U | < 0.0698 U | < 0.0349 U | < 0.122 U | < 0.115 U | < 0.174 UJ |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.0352 U | < 0.0352 U | < 0.0352 U | < 0.116 U | < 0.0704 U | < 0.0704 U | < 0.0352 U | < 0.123 U | < 0.116 U | < 0.176 UJ |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.0348 U | < 0.0348 U | < 0.0348 U | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0348 U | < 0.122 U | < 0.115 U | < 0.174 UJ |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.0349 U | < 0.0349 U | < 0.0349 U | < 0.115 U | < 0.0698 UJ | < 0.0698 U | < 0.0349 U | < 0.122 U | < 0.115 U | < 0.175 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.0347 U | < 0.0347 U | < 0.0347 U | < 0.115 U | < 0.0695 UJ | < 0.0695 U | < 0.0347 U | < 0.122 U | < 0.115 U | < 0.174 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.0358 U | < 0.0358 U | < 0.0358 U | < 0.118 U | < 0.0715 UJ | < 0.0715 U | < 0.0358 U | < 0.125 U | < 0.118 U | < 0.179 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.0338 U | < 0.0338 U | < 0.0338 U | < 0.112 U | < 0.0677 UJ | < 0.0677 U | < 0.0338 U | < 0.118 U | < 0.112 U | < 0.169 U |

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 4-Bromophenyl phenyl ether | 4-Chloro-3-methylphenol | 4-Chlorophenyl phenyl ether | 4-Chlorothioanisole | 4-Nitroaniline | 4-Nitrophenol | Acetophenone | Aniline | Benzenethiol | Benzoic acid |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.0353 U | < 0.0353 U | < 0.0353 U | < 0.116 U | < 0.0706 UJ | < 0.0706 U | < 0.0353 UJ | < 0.123 U | < 0.116 U | < 0.176 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.0349 U | < 0.0349 U | < 0.0349 U | < 0.115 U | < 0.0698 UJ | < 0.0698 U | < 0.0349 UJ | < 0.122 U | < 0.115 U | < 0.174 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.0349 U | < 0.0349 U | < 0.0349 U | < 0.115 U | < 0.0697 UJ | < 0.0697 U | < 0.0349 UJ | < 0.122 U | < 0.115 U | < 0.174 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.0356 U | < 0.0356 U | < 0.0356 U | < 0.118 U | < 0.0713 UJ | < 0.0713 U | < 0.0356 UJ | < 0.125 U | < 0.118 U | < 0.178 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.0357 U | < 0.0357 U | < 0.0357 U | < 0.118 U | < 0.0714 U | < 0.0714 U | < 0.0357 U | < 0.125 U | < 0.118 U | < 0.179 UJ |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.0354 U | < 0.0354 U | < 0.0354 U | < 0.117 U | < 0.0708 U | < 0.0708 U | < 0.0354 U | < 0.124 U | < 0.117 U | < 0.177 UJ |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.0351 U | < 0.0351 U | < 0.0351 U | < 0.116 U | < 0.0702 U | < 0.0702 U | < 0.0351 U | < 0.123 U | < 0.116 U | < 0.175 UJ |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.0355 U | < 0.0355 U | < 0.0355 U | < 0.117 U | < 0.0711 U | < 0.0711 U | < 0.0355 U | < 0.124 U | < 0.117 U | < 0.178 UJ |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.0345 U | < 0.0345 U | < 0.0345 U | < 0.114 U | < 0.069 UJ | < 0.069 U | < 0.0345 U | < 0.121 U | < 0.114 U | < 0.172 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.0348 U | < 0.0348 U | < 0.0348 U | < 0.115 U | < 0.0696 UJ | < 0.0696 U | < 0.0348 U | < 0.122 U | < 0.115 U | < 0.174 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.0365 U | < 0.0365 U | < 0.0365 U | < 0.12 U | < 0.073 UJ | < 0.073 U | < 0.0365 U | < 0.128 U | < 0.12 U | < 0.182 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.0344 U | < 0.0344 U | < 0.0344 U | < 0.114 U | < 0.0688 UJ | < 0.0688 U | < 0.0344 U | < 0.12 U | < 0.114 U | < 0.172 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.0352 U | < 0.0352 U | < 0.0352 U | < 0.116 U | < 0.0705 UJ | < 0.0705 U | < 0.0352 U | < 0.123 U | < 0.116 U | < 0.176 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.0347 U | < 0.0347 U | < 0.0347 U | < 0.114 U | < 0.0694 U | < 0.0694 U | < 0.0347 UJ | < 0.121 U | < 0.114 U | < 0.173 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.0348 U | < 0.0348 U | < 0.0348 U | < 0.115 U | < 0.0696 U | < 0.0696 U | < 0.0348 UJ | < 0.122 U | < 0.115 U | < 0.174 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.0348 U | < 0.0348 U | < 0.0348 U | < 0.115 U | < 0.0696 U | < 0.0696 U | < 0.0348 UJ | < 0.122 U | < 0.115 U | < 0.174 U |
| GNC2-JD09C | 0 | NORM | 1/8/2010 | < 0.035 U | < 0.035 U | < 0.035 U | < 0.116 U | < 0.0701 U | < 0.0701 U | < 0.035 U | < 0.123 U | < 0.116 U | < 0.175 U |

All units in mg/kg.

-- = no sample data.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| | | | | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Depth (ft bgs)** | **Sample Type** | **Sample Date** | Benzyl alcohol | bis(2-Chloroethoxy) methane | bis(2-Chloroethyl) ether | bis(2-Chloroisopropyl) ether | bis(2-Ethylhexyl) phthalate | bis(p-Chlorophenyl) sulfone | bis(p-Chlorophenyl) disulfide | Butylbenzyl phthalate | Carbazole | Dibenzofuran |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.107 U | < 0.0713 U | < 0.0713 U | < 0.0713 U | < 0.11 U | < 0.118 U | < 0.118 UJ | < 0.0713 U | < 0.0107 UJ | < 0.0713 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.109 U | < 0.0726 U | < 0.0726 U | < 0.0726 U | < 0.0997 U | < 0.12 U | < 0.12 UJ | < 0.0726 U | < 0.0109 UJ | < 0.0726 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.103 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.114 U | < 0.114 U | < 0.0688 U | < 0.0103 U | < 0.0688 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.107 U | < 0.0716 U | < 0.0716 U | < 0.0716 U | < 0.0716 U | < 0.118 U | < 0.118 U | < 0.0716 U | < 0.0107 U | < 0.0716 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.102 U | < 0.068 U | < 0.068 U | < 0.068 U | < 0.068 U | < 0.112 U | < 0.112 U | < 0.068 U | < 0.0102 U | < 0.068 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.107 U | < 0.071 U | < 0.071 U | < 0.071 U | < 0.071 U | < 0.117 U | < 0.117 U | < 0.071 U | < 0.0107 U | < 0.071 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.11 U | < 0.0733 U | < 0.0733 U | < 0.0733 U | < 0.0733 U | < 0.121 UJ | < 0.121 U | < 0.0733 U | < 0.011 U | < 0.0733 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.106 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.117 UJ | < 0.117 U | < 0.0708 U | < 0.0106 U | < 0.0708 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.104 U | < 0.0692 U | < 0.0692 U | < 0.0692 U | 1.04 J | < 0.114 U | < 0.114 U | 126 J | < 0.0104 U | < 0.0692 U |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.103 U | < 0.0689 U | < 0.0689 U | < 0.0689 U | < 0.0689 UJ | < 0.114 U | < 0.114 U | < 0.0689 UJ | < 0.0103 U | < 0.0689 U |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.108 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.118 UJ | < 0.118 UJ | < 0.0718 UJ | < 0.0108 UJ | < 0.0718 UJ |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.105 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.116 U | < 0.116 U | < 0.07 U | < 0.0105 U | < 0.07 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.105 U | < 0.0697 U | < 0.0697 U | < 0.0697 U | 0.37 | < 0.115 U | < 0.115 U | < 0.0697 U | < 0.0105 UJ | < 0.0697 U |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.105 U | < 0.0699 U | < 0.0699 U | < 0.0699 U | < 0.0699 U | < 0.115 U | < 0.115 U | < 0.0699 U | < 0.0105 UJ | < 0.0699 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.104 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 UJ | < 0.115 U | < 0.0695 U | < 0.0104 U | < 0.0695 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.106 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.117 UJ | < 0.117 U | < 0.0708 U | < 0.0106 U | < 0.0708 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.103 U | < 0.0687 U | < 0.0687 U | < 0.0687 U | < 0.0687 U | < 0.113 U | < 0.113 U | < 0.0687 U | < 0.0103 U | < 0.0687 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.106 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.116 U | < 0.0704 U | < 0.0106 U | < 0.0704 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.104 U | < 0.0691 U | < 0.0691 U | < 0.0691 U | < 0.0691 U | < 0.114 U | < 0.114 U | < 0.0691 U | < 0.0104 UJ | < 0.0691 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.105 U | < 0.0703 U | < 0.0703 U | < 0.0703 U | < 0.0703 U | < 0.116 U | < 0.116 U | < 0.0703 U | < 0.0105 UJ | < 0.0703 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.104 U | < 0.0693 U | < 0.0693 U | < 0.0693 U | < 0.0693 U | < 0.114 U | < 0.114 U | < 0.0693 U | < 0.0104 U | < 0.0693 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.105 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.116 U | < 0.116 U | < 0.07 U | < 0.0105 U | < 0.07 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.106 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.116 UJ | < 0.116 U | < 0.0705 U | < 0.0106 U | < 0.0705 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.107 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.118 UJ | < 0.118 U | < 0.0714 U | < 0.0107 U | < 0.0714 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.103 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | 0.077 J | < 0.113 U | < 0.113 U | < 0.0688 U | < 0.0103 UJ | < 0.0688 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.104 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | 0.114 J | < 0.115 UJ | < 0.115 U | < 0.0695 U | < 0.0104 U | < 0.0695 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.106 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.116 UJ | < 0.116 U | < 0.0704 U | < 0.0106 U | < 0.0704 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.105 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.115 UJ | < 0.115 U | < 0.0698 U | < 0.0105 U | < 0.0698 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.106 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.116 UJ | < 0.116 U | < 0.0704 U | < 0.0106 U | < 0.0704 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.104 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 UJ | < 0.115 U | < 0.0695 U | < 0.0104 U | < 0.0695 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.105 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.115 U | < 0.115 U | < 0.0698 U | < 0.0105 UJ | < 0.0698 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.104 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.115 U | < 0.0695 U | < 0.0104 U | < 0.0695 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.107 U | < 0.0715 U | < 0.0715 U | < 0.0715 U | < 0.0715 U | < 0.118 U | < 0.118 U | < 0.0715 U | < 0.0107 U | < 0.0715 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.102 U | < 0.0677 U | < 0.0677 U | < 0.0677 U | < 0.0677 U | < 0.112 U | < 0.112 U | < 0.0677 U | < 0.0102 U | < 0.0677 U |

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| | | | | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Depth (ft bgs)** | **Sample Type** | **Sample Date** | Benzyl alcohol | bis(2-Chloroethoxy) methane | bis(2-Chloroethyl) ether | bis(2-Chloroisopropyl) ether | bis(2-Ethylhexyl) phthalate | bis(p-Chlorophenyl) sulfone | bis(p-Chlorophenyl) disulfide | Butylbenzyl phthalate | Carbazole | Dibenzofuran |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.106 U | < 0.0706 U | < 0.0706 U | < 0.0706 U | < 0.0706 U | < 0.116 U | < 0.116 U | < 0.0706 U | < 0.0106 UJ | < 0.0706 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.105 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.115 U | < 0.115 U | < 0.0698 U | 0.0545 J | < 0.0698 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.105 U | < 0.0697 U | < 0.0697 U | < 0.0697 U | 0.225 | < 0.115 U | < 0.115 U | < 0.0697 U | 0.0155 J | < 0.0697 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.107 U | < 0.0713 U | < 0.0713 U | < 0.0713 U | < 0.0713 U | < 0.118 U | < 0.118 U | < 0.0713 U | < 0.0107 UJ | < 0.0713 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.107 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.118 U | < 0.118 U | < 0.0714 U | < 0.0107 U | < 0.0714 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.106 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.117 U | < 0.117 U | < 0.0708 U | < 0.0106 U | < 0.0708 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.105 U | < 0.0702 U | < 0.0702 U | < 0.0702 U | < 0.0702 U | < 0.116 U | < 0.116 U | < 0.0702 U | < 0.0105 U | < 0.0702 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.107 U | < 0.0711 U | < 0.0711 U | < 0.0711 U | < 0.0711 U | < 0.117 U | < 0.117 U | < 0.0711 U | < 0.0107 U | < 0.0711 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.103 U | < 0.069 U | < 0.069 U | < 0.069 U | < 0.069 U | < 0.114 U | < 0.114 U | < 0.069 U | < 0.0103 U | < 0.069 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.104 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.115 U | < 0.115 U | < 0.0696 U | < 0.0104 U | < 0.0696 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.109 U | < 0.073 U | < 0.073 U | < 0.073 U | < 0.073 U | < 0.12 U | < 0.12 U | < 0.073 U | < 0.0109 U | < 0.073 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.103 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.114 U | < 0.114 U | < 0.0688 U | < 0.0103 U | < 0.0688 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.106 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.116 U | < 0.116 U | < 0.0705 U | < 0.0106 U | < 0.0705 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.104 U | < 0.0694 U | < 0.0694 U | < 0.0694 U | < 0.0694 U | < 0.114 U | < 0.114 U | < 0.0694 U | < 0.0104 U | < 0.0694 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.104 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.115 U | < 0.115 U | < 0.0696 U | < 0.0104 U | < 0.0696 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.104 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.115 U | < 0.115 U | < 0.0696 U | < 0.0104 U | < 0.0696 U |
| GNC2-JD09C | 0 | NORM | 1/8/2010 | < 0.105 U | < 0.0701 U | < 0.0701 U | < 0.0701 U | < 0.0701 U | < 0.116 U | < 0.116 U | < 0.0701 U | < 0.0105 U | < 0.0701 U |

All units in mg/kg.

-- = no sample data.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Dichloromethyl ether | Diethyl phthalate | Dimethyl phthalate | Di-n-butyl phthalate | Di-n-octyl phthalate | Diphenyl disulfide | Diphenyl sulfide | Diphenyl sulfone | Diphenylamine | Fluoranthene |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.118 U | < 0.0713 U | < 0.0713 U | < 0.0357 U | < 0.0713 U | < 0.118 U | < 0.118 U | < 0.118 U | < 0.0713 U | < 0.0107 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.12 U | < 0.0726 U | < 0.0726 U | < 0.0363 U | < 0.0726 U | < 0.12 U | < 0.12 U | < 0.12 U | < 0.0726 U | < 0.0109 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.114 U | < 0.0688 U | < 0.0688 U | < 0.0344 U | < 0.0688 U | < 0.114 U | < 0.114 U | < 0.114 U | < 0.0688 U | < 0.0103 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.118 U | < 0.0716 U | < 0.0716 U | < 0.0358 U | < 0.0716 U | < 0.118 U | < 0.118 U | < 0.118 U | < 0.0716 U | < 0.0107 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.112 U | < 0.068 U | < 0.068 U | < 0.034 U | < 0.068 U | < 0.112 U | < 0.112 U | < 0.112 U | < 0.068 U | < 0.0102 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.117 U | < 0.071 U | < 0.071 U | < 0.0355 U | < 0.071 U | < 0.117 U | < 0.117 U | < 0.117 U | < 0.071 U | < 0.0107 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.121 U | < 0.0733 U | < 0.0733 U | < 0.0366 U | < 0.0733 U | < 0.121 U | < 0.121 U | < 0.121 UJ | < 0.0733 U | < 0.011 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.117 U | < 0.0708 U | < 0.0708 U | < 0.0354 U | < 0.0708 U | < 0.117 U | < 0.117 U | < 0.117 UJ | < 0.0708 U | < 0.0106 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.114 U | < 0.0692 U | < 0.0692 U | 0.115 J | < 0.0692 U | < 0.114 U | < 0.114 U | < 0.114 U | < 0.0692 U | 0.0426 |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.114 U | < 0.0689 U | < 0.0689 U | < 0.0345 U | < 0.0689 U | < 0.114 U | < 0.114 U | < 0.114 U | < 0.0689 U | 0.0511 |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.118 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.0359 UJ | < 0.0718 U | < 0.118 UJ | < 0.118 UJ | < 0.118 UJ | < 0.0718 UJ | 0.0127 J |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.116 U | < 0.07 U | < 0.07 U | < 0.035 U | < 0.07 U | < 0.116 U | < 0.116 U | < 0.116 U | < 0.07 U | < 0.0105 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.115 U | < 0.0697 U | < 0.0697 U | < 0.0349 U | < 0.0697 U | < 0.115 U | < 0.115 U | < 0.115 U | < 0.0697 U | 0.127 |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.115 U | < 0.0699 U | < 0.0699 U | < 0.035 U | < 0.0699 U | < 0.115 U | < 0.115 U | < 0.115 U | < 0.0699 U | < 0.0105 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0348 U | < 0.0695 U | < 0.115 U | < 0.115 U | < 0.115 UJ | < 0.0695 U | < 0.0104 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.117 U | < 0.0708 U | < 0.0708 U | < 0.0354 U | < 0.0708 U | < 0.117 U | < 0.117 U | < 0.117 UJ | < 0.0708 U | < 0.0106 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.113 U | < 0.0687 U | < 0.0687 U | < 0.0344 U | < 0.0687 U | < 0.113 U | < 0.113 U | < 0.113 U | < 0.0687 U | < 0.0103 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.116 U | < 0.0704 U | < 0.0704 U | < 0.0352 U | < 0.0704 U | < 0.116 U | < 0.116 U | < 0.116 U | < 0.0704 U | < 0.0106 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.114 U | < 0.0691 U | < 0.0691 U | < 0.0345 U | < 0.0691 U | < 0.114 U | < 0.114 U | < 0.114 U | < 0.0691 U | < 0.0104 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.116 U | < 0.0703 U | < 0.0703 U | < 0.0352 U | < 0.0703 U | < 0.116 U | < 0.116 U | < 0.116 U | < 0.0703 U | < 0.0105 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.114 U | < 0.0693 U | < 0.0693 U | < 0.0346 U | < 0.0693 U | < 0.114 U | < 0.114 U | < 0.114 U | < 0.0693 U | < 0.0104 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.116 U | < 0.07 U | < 0.07 U | < 0.035 U | < 0.07 U | < 0.116 U | < 0.116 U | < 0.116 U | < 0.07 U | < 0.0105 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.116 U | < 0.0705 U | < 0.0705 U | < 0.0352 U | < 0.0705 U | < 0.116 U | < 0.116 U | < 0.116 UJ | < 0.0705 U | < 0.0106 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.118 U | < 0.0714 U | < 0.0714 U | < 0.0357 U | < 0.0714 U | < 0.118 U | < 0.118 U | < 0.118 UJ | < 0.0714 U | < 0.0107 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.113 U | < 0.0688 U | < 0.0688 U | < 0.0344 U | < 0.0688 U | < 0.113 U | < 0.113 U | < 0.113 U | < 0.0688 U | < 0.0103 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0347 U | < 0.0695 U | < 0.115 U | < 0.115 U | < 0.115 UJ | < 0.0695 U | < 0.0104 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.116 U | < 0.0704 U | < 0.0704 U | < 0.0352 U | < 0.0704 U | < 0.116 U | < 0.116 U | < 0.116 UJ | < 0.0704 U | < 0.0106 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.115 U | < 0.0698 U | < 0.0698 U | < 0.0349 U | < 0.0698 U | < 0.115 U | < 0.115 U | < 0.115 UJ | < 0.0698 U | < 0.0105 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.116 U | < 0.0704 U | < 0.0704 U | < 0.0352 U | < 0.0704 U | < 0.116 U | < 0.116 U | < 0.116 UJ | < 0.0704 U | < 0.0106 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0348 U | < 0.0695 U | < 0.115 U | < 0.115 U | < 0.115 UJ | < 0.0695 U | < 0.0104 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.115 U | < 0.0698 U | < 0.0698 U | < 0.0349 U | < 0.0698 U | < 0.115 U | < 0.115 U | < 0.115 U | < 0.0698 U | < 0.0105 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0347 U | < 0.0695 U | < 0.115 U | < 0.115 U | < 0.115 U | < 0.0695 U | < 0.0104 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.118 U | < 0.0715 U | < 0.0715 U | < 0.0358 U | < 0.0715 U | < 0.118 U | < 0.118 U | < 0.118 U | < 0.0715 U | < 0.0107 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.112 U | < 0.0677 U | < 0.0677 U | < 0.0338 U | < 0.0677 U | < 0.112 U | < 0.112 U | < 0.112 U | < 0.0677 U | < 0.0102 U |

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Dichloromethyl ether | Diethyl phthalate | Dimethyl phthalate | Di-n-butyl phthalate | Di-n-octyl phthalate | Diphenyl disulfide | Diphenyl sulfide | Diphenyl sulfone | Diphenylamine | Fluoranthene |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.116 U | < 0.0706 U | < 0.0706 U | < 0.0353 U | < 0.0706 U | < 0.116 U | < 0.116 U | < 0.116 U | < 0.0706 U | < 0.0106 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.115 U | < 0.0698 U | < 0.0698 U | < 0.0349 U | < 0.0698 U | < 0.115 U | < 0.115 U | < 0.115 U | < 0.0698 U | 0.503 J |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.115 U | < 0.0697 U | < 0.0697 U | 0.0372 J | < 0.0697 U | < 0.115 U | < 0.115 U | < 0.115 U | < 0.0697 U | 0.203 J |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.118 U | < 0.0713 U | < 0.0713 U | < 0.0356 U | < 0.0713 U | < 0.118 U | < 0.118 U | < 0.118 U | < 0.0713 U | < 0.0107 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.118 U | < 0.0714 U | < 0.0714 U | < 0.0357 U | < 0.0714 U | < 0.118 U | < 0.118 U | < 0.118 U | < 0.0714 U | < 0.0107 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.117 U | < 0.0708 U | < 0.0708 U | < 0.0354 U | < 0.0708 U | < 0.117 U | < 0.117 U | < 0.117 U | < 0.0708 U | < 0.0106 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.116 U | < 0.0702 U | < 0.0702 U | < 0.0351 U | < 0.0702 U | < 0.116 U | < 0.116 U | < 0.116 U | < 0.0702 U | 0.0527 |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.117 U | < 0.0711 U | < 0.0711 U | < 0.0355 U | < 0.0711 U | < 0.117 U | < 0.117 U | < 0.117 U | < 0.0711 U | < 0.0107 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.114 U | < 0.069 U | < 0.069 U | < 0.0345 U | < 0.069 U | < 0.114 U | < 0.114 U | < 0.114 U | < 0.069 U | < 0.0103 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.115 U | < 0.0696 U | < 0.0696 U | < 0.0348 U | < 0.0696 U | < 0.115 U | < 0.115 U | < 0.115 U | < 0.0696 U | < 0.0104 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.12 U | < 0.073 U | < 0.073 U | < 0.0365 U | < 0.073 U | < 0.12 U | < 0.12 U | < 0.12 U | < 0.073 U | < 0.0109 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.114 U | < 0.0688 U | < 0.0688 U | < 0.0344 U | < 0.0688 U | < 0.114 U | < 0.114 U | < 0.114 U | < 0.0688 U | < 0.0103 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.116 U | < 0.0705 U | < 0.0705 U | < 0.0352 U | < 0.0705 U | < 0.116 U | < 0.116 U | < 0.116 U | < 0.0705 U | < 0.0106 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.114 U | < 0.0694 U | < 0.0694 U | < 0.0347 U | < 0.0694 U | < 0.114 U | < 0.114 U | < 0.114 U | < 0.0694 U | < 0.0104 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.115 U | < 0.0696 U | < 0.0696 U | < 0.0348 U | < 0.0696 U | < 0.115 U | < 0.115 U | < 0.115 U | < 0.0696 U | < 0.0104 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.115 U | < 0.0696 U | < 0.0696 U | < 0.0348 U | < 0.0696 U | < 0.115 U | < 0.115 U | < 0.115 U | < 0.0696 U | < 0.0104 U |
| GNC2-JD09C | 0 | NORM | 1/8/2010 | < 0.116 U | < 0.0701 U | < 0.0701 U | < 0.035 U | < 0.0701 U | < 0.116 U | < 0.116 U | < 0.116 U | < 0.0701 U | 0.0138 J |

All units in mg/kg.

-- = no sample data.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| | | | | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Depth (ft bgs)** | **Sample Type** | **Sample Date** | Fluorene | Hexachlorobenzene | Hexachlorobutadiene | Hexachlorocyclo-pentadiene | Hexachloroethane | Hydroxymethyl phthalimide | Isophorone | m,p-Cresols | Naphthalene | Nitrobenzene |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.0107 U | < 0.0713 U | < 0.0713 U | < 0.0713 UJ | < 0.0713 U | < 0.118 U | < 0.0713 U | < 0.143 U | < 0.0107 U | < 0.0713 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.0109 U | < 0.0726 U | < 0.0726 U | < 0.0726 UJ | < 0.0726 U | < 0.12 U | < 0.0726 U | < 0.145 U | < 0.0109 U | < 0.0726 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.0103 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.114 U | < 0.0688 U | < 0.138 U | < 0.0103 U | < 0.0688 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.0107 U | < 0.0716 U | < 0.0716 U | < 0.0716 U | < 0.0716 U | < 0.118 U | < 0.0716 U | < 0.143 U | < 0.0107 U | < 0.0716 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.0102 U | < 0.068 U | < 0.068 U | < 0.068 U | < 0.068 U | < 0.112 U | < 0.068 U | < 0.136 U | < 0.0102 U | < 0.068 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.0107 U | < 0.071 U | < 0.071 U | < 0.071 U | < 0.071 U | < 0.117 U | < 0.071 U | < 0.142 U | < 0.0107 U | < 0.071 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.011 U | < 0.0733 U | < 0.0733 U | < 0.0733 U | < 0.0733 U | < 0.121 U | < 0.0733 U | < 0.147 U | < 0.011 U | < 0.0733 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.0106 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.117 U | < 0.0708 U | < 0.142 U | < 0.0106 U | < 0.0708 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.0104 U | < 0.0692 U | < 0.0692 U | < 0.0692 U | < 0.0692 U | < 0.114 U | < 0.0692 U | < 0.138 U | < 0.0104 U | < 0.0692 U |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.0103 U | < 0.0689 U | < 0.0689 U | < 0.0689 U | < 0.0689 U | < 0.114 U | < 0.0689 U | < 0.138 U | < 0.0103 U | < 0.0689 U |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.0108 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.118 UJ | < 0.0718 UJ | < 0.144 UJ | < 0.0108 UJ | < 0.0718 UJ |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.0105 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.116 U | < 0.07 U | < 0.14 U | < 0.0105 U | < 0.07 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.0105 U | < 0.0697 U | < 0.0697 U | < 0.0697 U | < 0.0697 U | < 0.115 U | < 0.0697 U | < 0.139 U | < 0.0105 U | < 0.0697 U |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.0105 U | < 0.0699 U | < 0.0699 U | < 0.0699 U | < 0.0699 U | < 0.115 U | < 0.0699 U | < 0.14 U | < 0.0105 U | < 0.0699 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.0104 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.139 U | < 0.0104 U | < 0.0695 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.0106 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.117 U | < 0.0708 U | < 0.142 U | < 0.0106 U | < 0.0708 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.0103 U | < 0.0687 U | < 0.0687 U | < 0.0687 U | < 0.0687 U | < 0.113 U | < 0.0687 U | < 0.137 U | < 0.0103 U | < 0.0687 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.0106 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.0704 U | < 0.141 U | < 0.0106 U | < 0.0704 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.0104 U | < 0.0691 U | < 0.0691 U | < 0.0691 U | < 0.0691 U | < 0.114 U | < 0.0691 U | < 0.138 U | < 0.0104 U | < 0.0691 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.0105 U | < 0.0703 U | < 0.0703 U | < 0.0703 U | < 0.0703 U | < 0.116 U | < 0.0703 U | < 0.141 U | < 0.0105 U | < 0.0703 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.0104 U | < 0.0693 U | < 0.0693 U | < 0.0693 U | < 0.0693 U | < 0.114 U | < 0.0693 U | < 0.139 U | < 0.0104 U | < 0.0693 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.0105 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.116 U | < 0.07 U | < 0.14 U | < 0.0105 U | < 0.07 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.0106 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.116 U | < 0.0705 U | < 0.141 U | < 0.0106 U | < 0.0705 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.0107 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.118 U | < 0.0714 U | < 0.143 U | < 0.0107 U | < 0.0714 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.0103 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.113 U | < 0.0688 U | < 0.138 U | < 0.0103 U | < 0.0688 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.0104 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.139 U | < 0.0104 U | < 0.0695 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.0106 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.0704 U | < 0.141 U | < 0.0106 U | < 0.0704 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.0105 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.115 U | < 0.0698 U | < 0.14 U | < 0.0105 U | < 0.0698 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.0106 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.0704 U | < 0.141 U | < 0.0106 U | < 0.0704 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.0104 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.139 U | < 0.0104 U | < 0.0695 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.0105 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.115 U | < 0.0698 U | < 0.14 U | < 0.0105 U | < 0.0698 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.0104 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.139 U | < 0.0104 U | < 0.0695 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.0107 U | < 0.0715 U | < 0.0715 U | < 0.0715 U | < 0.0715 U | < 0.118 U | < 0.0715 U | < 0.143 U | < 0.0107 U | < 0.0715 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.0102 U | < 0.0677 U | < 0.0677 U | < 0.0677 U | < 0.0677 U | < 0.112 U | < 0.0677 U | < 0.135 U | < 0.0102 U | < 0.0677 U |

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Fluorene | Hexachlorobenzene | Hexachlorobutadiene | Hexachlorocyclo-pentadiene | Hexachloroethane | Hydroxymethyl phthalimide | Isophorone | m,p-Cresols | Naphthalene | Nitrobenzene |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.0106 U | < 0.0706 U | < 0.0706 U | < 0.0706 U | < 0.0706 U | < 0.116 U | < 0.0706 U | < 0.141 U | < 0.0106 U | < 0.0706 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.0105 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.115 U | < 0.0698 U | < 0.14 U | < 0.0105 U | < 0.0698 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.0105 U | < 0.0697 U | < 0.0697 U | < 0.0697 U | < 0.0697 U | < 0.115 U | < 0.0697 U | < 0.139 U | < 0.0105 U | < 0.0697 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.0107 U | < 0.0713 U | < 0.0713 U | < 0.0713 U | < 0.0713 U | < 0.118 U | < 0.0713 U | < 0.143 U | < 0.0107 U | < 0.0713 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.0107 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.118 U | < 0.0714 U | < 0.143 U | < 0.0107 U | < 0.0714 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.0106 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.117 U | < 0.0708 U | < 0.142 U | < 0.0106 U | < 0.0708 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.0105 U | < 0.0702 U | < 0.0702 U | < 0.0702 U | < 0.0702 U | < 0.116 U | < 0.0702 U | < 0.14 U | < 0.0105 U | < 0.0702 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.0107 U | < 0.0711 U | < 0.0711 U | < 0.0711 U | < 0.0711 U | < 0.117 U | < 0.0711 U | < 0.142 U | < 0.0107 U | < 0.0711 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.0103 U | < 0.069 U | < 0.069 U | < 0.069 U | < 0.069 U | < 0.114 U | < 0.069 U | < 0.138 U | < 0.0103 U | < 0.069 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.0104 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.115 U | < 0.0696 U | < 0.139 U | < 0.0104 U | < 0.0696 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.0109 U | < 0.073 U | < 0.073 U | < 0.073 U | < 0.073 U | < 0.12 U | < 0.073 U | < 0.146 U | < 0.0109 U | < 0.073 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.0103 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.114 U | < 0.0688 U | < 0.138 U | < 0.0103 U | < 0.0688 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.0106 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.116 U | < 0.0705 U | < 0.141 U | < 0.0106 U | < 0.0705 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.0104 U | < 0.0694 U | < 0.0694 U | < 0.0694 U | < 0.0694 U | < 0.114 U | < 0.0694 U | < 0.139 U | < 0.0104 U | < 0.0694 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.0104 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.115 U | < 0.0696 U | < 0.139 U | < 0.0104 U | < 0.0696 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.0104 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.115 U | < 0.0696 U | < 0.139 U | < 0.0104 U | < 0.0696 U |
| GNC2-JD09C | 0 | NORM | 1/8/2010 | < 0.0105 U | < 0.0701 U | < 0.0701 U | < 0.0701 UJ | < 0.0701 U | < 0.116 U | < 0.0701 U | < 0.14 U | < 0.0105 U | < 0.0701 U |

All units in mg/kg.

-- = no sample data.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | N-nitrosodi-n-propyl-amine | o-Cresol | Octachlorostyrene | p-Chloroaniline | p-Chlorobenzenethiol | Pentachlorobenzene | Pentachlorophenol | Phenol | Phthalic acid | Pyridine |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.0713 U | < 0.0713 U | < 0.118 U | < 0.0713 U | < 0.118 U | < 0.0713 U | < 0.0713 U | < 0.0713 U | < 0.118 U | < 0.0713 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.0726 U | < 0.0726 U | < 0.12 U | < 0.0726 U | < 0.12 U | < 0.0726 U | < 0.0726 U | < 0.0726 U | < 0.12 U | < 0.0726 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.0688 U | < 0.0688 U | < 0.114 U | < 0.0688 U | < 0.114 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.114 U | < 0.0688 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.0716 U | < 0.0716 U | < 0.118 U | < 0.0716 U | < 0.118 U | < 0.0716 U | < 0.0716 U | < 0.0716 U | < 0.118 U | < 0.0716 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.068 U | < 0.068 U | < 0.112 U | < 0.068 U | < 0.112 U | < 0.068 U | < 0.068 U | < 0.068 U | < 0.112 U | < 0.068 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.071 U | < 0.071 U | < 0.117 U | < 0.071 U | < 0.117 U | < 0.071 U | < 0.071 U | < 0.071 U | < 0.117 U | < 0.071 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.0733 U | < 0.0733 U | < 0.121 U | < 0.0733 U | < 0.121 U | < 0.0733 U | < 0.0733 U | < 0.0733 U | < 0.121 U | < 0.0733 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.0708 U | < 0.0708 U | < 0.117 U | < 0.0708 U | < 0.117 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.117 U | < 0.0708 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.0692 U | < 0.0692 U | < 0.114 U | < 0.0692 U | < 0.114 U | < 0.0692 U | < 0.0692 U | < 0.0692 U | 0.387 | < 0.0692 U |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.0689 U | < 0.0689 U | < 0.114 U | < 0.0689 U | < 0.114 U | < 0.0689 U | < 0.0689 U | < 0.0689 U | < 0.114 U | < 0.0689 U |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.0718 UJ | < 0.0718 UJ | < 0.118 UJ | < 0.0718 UJ | < 0.118 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.0718 UJ | < 0.118 UJ | < 0.0718 UJ |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.07 U | < 0.07 U | < 0.116 U | < 0.07 U | < 0.116 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.116 U | < 0.07 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.0697 U | < 0.0697 U | < 0.115 U | < 0.0697 U | < 0.115 U | < 0.0697 U | < 0.0697 U | < 0.0697 U | < 0.115 UJ | < 0.0697 U |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.0699 U | < 0.0699 U | < 0.115 U | < 0.0699 U | < 0.115 U | < 0.0699 U | < 0.0699 U | < 0.0699 U | < 0.115 UJ | < 0.0699 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.0708 U | < 0.0708 U | < 0.117 U | < 0.0708 U | < 0.117 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.117 U | < 0.0708 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.0687 U | < 0.0687 U | < 0.113 U | < 0.0687 U | < 0.113 U | < 0.0687 U | < 0.0687 U | < 0.0687 U | < 0.113 U | < 0.0687 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.0704 U | < 0.116 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.0704 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.0691 U | < 0.0691 U | < 0.114 U | < 0.0691 U | < 0.114 U | < 0.0691 U | < 0.0691 U | < 0.0691 U | < 0.114 UJ | < 0.0691 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.0703 U | < 0.0703 U | < 0.116 U | < 0.0703 U | < 0.116 U | < 0.0703 U | < 0.0703 U | < 0.0703 U | < 0.116 UJ | < 0.0703 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.0693 U | < 0.0693 U | < 0.114 U | < 0.0693 U | < 0.114 U | < 0.0693 U | < 0.0693 U | < 0.0693 U | < 0.114 U | < 0.0693 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.07 U | < 0.07 U | < 0.116 U | < 0.07 U | < 0.116 U | < 0.07 U | < 0.07 U | < 0.07 U | < 0.116 U | < 0.07 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.0705 U | < 0.0705 U | < 0.116 U | < 0.0705 U | < 0.116 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.116 U | < 0.0705 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.0714 U | < 0.0714 U | < 0.118 U | < 0.0714 U | < 0.118 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.118 U | < 0.0714 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.0688 U | < 0.0688 U | < 0.113 U | < 0.0688 U | < 0.113 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.113 UJ | < 0.0688 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.0704 U | < 0.116 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.0704 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.0698 U | < 0.0698 U | < 0.115 U | < 0.0698 U | < 0.115 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.115 U | < 0.0698 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.0704 U | < 0.116 U | < 0.0704 U | < 0.0704 U | < 0.0704 U | < 0.116 U | < 0.0704 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.0698 U | < 0.0698 U | < 0.115 U | < 0.0698 U | < 0.115 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.115 UJ | < 0.0698 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.115 U | < 0.0695 U | < 0.0695 U | < 0.0695 U | < 0.115 U | < 0.0695 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.0715 U | < 0.0715 U | < 0.118 U | < 0.0715 U | < 0.118 U | < 0.0715 U | < 0.0715 U | < 0.0715 U | < 0.118 U | < 0.0715 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.0677 U | < 0.0677 U | < 0.112 U | < 0.0677 U | < 0.112 U | < 0.0677 U | < 0.0677 U | < 0.0677 U | < 0.112 U | < 0.0677 U |

**TABLE B-9**
**SOIL ALDEHYDES AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | N-nitrosodi-n-propyl-amine | o-Cresol | Octachlorostyrene | p-Chloroaniline | p-Chlorobenzenethiol | Pentachlorobenzene | Pentachlorophenol | Phenol | Phthalic acid | Pyridine |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.0706 U | < 0.0706 U | < 0.116 U | < 0.0706 U | < 0.116 U | < 0.0706 U | < 0.0706 U | < 0.0706 U | < 0.116 U | < 0.0706 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.0698 U | < 0.0698 U | < 0.115 U | < 0.0698 U | < 0.115 U | < 0.0698 U | < 0.0698 U | < 0.0698 U | < 0.115 U | < 0.0698 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.0697 U | < 0.0697 U | < 0.115 U | < 0.0697 U | < 0.115 U | < 0.0697 U | < 0.0697 U | < 0.0697 U | < 0.115 U | < 0.0697 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.0713 U | < 0.0713 U | < 0.118 U | < 0.0713 U | < 0.118 U | < 0.0713 U | < 0.0713 U | < 0.0713 U | < 0.118 U | < 0.0713 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.0714 U | < 0.0714 U | < 0.118 U | < 0.0714 U | < 0.118 U | < 0.0714 U | < 0.0714 U | < 0.0714 U | < 0.118 UJ | < 0.0714 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.0708 U | < 0.0708 U | < 0.117 U | < 0.0708 U | < 0.117 U | < 0.0708 U | < 0.0708 U | < 0.0708 U | < 0.117 UJ | < 0.0708 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.0702 U | < 0.0702 U | < 0.116 U | < 0.0702 U | < 0.116 U | < 0.0702 U | < 0.0702 U | < 0.0702 U | < 0.116 UJ | < 0.0702 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.0711 U | < 0.0711 U | < 0.117 U | < 0.0711 U | < 0.117 U | < 0.0711 U | < 0.0711 U | < 0.0711 U | < 0.117 UJ | < 0.0711 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.069 U | < 0.069 U | < 0.114 U | < 0.069 U | < 0.114 U | < 0.069 U | < 0.069 U | < 0.069 U | < 0.114 U | < 0.069 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.0696 U | < 0.0696 U | < 0.115 U | < 0.0696 U | < 0.115 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.115 U | < 0.0696 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.073 U | < 0.073 U | < 0.12 U | < 0.073 U | < 0.12 U | < 0.073 U | < 0.073 U | < 0.073 U | < 0.12 U | < 0.073 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.0688 U | < 0.0688 U | < 0.114 U | < 0.0688 U | < 0.114 U | < 0.0688 U | < 0.0688 U | < 0.0688 U | < 0.114 U | < 0.0688 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.0705 U | < 0.0705 U | < 0.116 U | < 0.0705 U | < 0.116 U | < 0.0705 U | < 0.0705 U | < 0.0705 U | < 0.116 U | < 0.0705 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.0694 U | < 0.0694 U | < 0.114 UJ | < 0.0694 U | < 0.114 U | < 0.0694 U | < 0.0694 U | < 0.0694 U | < 0.114 U | < 0.0694 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.0696 U | < 0.0696 U | < 0.115 UJ | < 0.0696 U | < 0.115 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.115 U | < 0.0696 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.0696 U | < 0.0696 U | < 0.115 UJ | < 0.0696 U | < 0.115 U | < 0.0696 U | < 0.0696 U | < 0.0696 U | < 0.115 U | < 0.0696 U |
| GNC2-JD09C | 0 | NORM | 1/8/2010 | < 0.0701 U | < 0.0701 U | < 0.116 U | < 0.0701 U | < 0.116 U | < 0.0701 U | < 0.0701 U | < 0.0701 U | < 0.116 UJ | < 0.0701 U |

All units in mg/kg.

-- = no sample data.

= Data not included in risk assessment. Sample location excavated and data replaced with post-excavation data.

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 14)**

| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Volatile Organic Compounds (VOCs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1,1,1,2-Tetrachloroethane | 1,1,1-Trichloroethane | 1,1,2,2-Tetrachloroethane | 1,1,2-Trichloroethane | 1,1-Dichloroethane | 1,1-Dichloroethene | 1,1-Dichloropropene | 1,2,3-Trichlorobenzene | 1,2,3-Trichloropropane | 1,2,4-Trichlorobenzene | 1,2,4-Trimethylbenzene | 1,2-Dichlorobenzene |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.0002 U | < 0.00012 U | < 0.000086 U | < 0.000074 U | < 0.000077 U | < 0.00013 U | < 0.000096 U | < 0.00043 U | < 0.00028 U | < 0.00036 U | < 0.0003 U | < 0.00013 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.00019 U | < 0.00011 U | < 0.000083 U | < 0.000071 U | < 0.000075 U | < 0.00013 U | < 0.000093 U | < 0.00041 U | < 0.00027 U | < 0.00035 U | < 0.00023 U | < 0.00013 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.00018 U | < 0.00011 U | < 0.000079 U | < 0.000068 U | < 0.000071 U | < 0.00012 U | < 0.000088 U | < 0.00039 U | < 0.00025 U | < 0.00033 U | < 0.00055 U | < 0.00012 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.00007 U | < 0.000074 U | < 0.00013 U | < 0.000091 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00048 U | < 0.00013 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00057 U | < 0.00013 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.00007 U | < 0.000073 U | < 0.00013 U | < 0.000091 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.0006 U | < 0.00013 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.000081 U | < 0.000069 U | < 0.000073 U | < 0.00012 U | < 0.00009 U | < 0.0004 UJ | < 0.00026 UJ | < 0.00034 UJ | 0.0011 J | < 0.00013 UJ |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.00011 U | < 0.000083 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00027 U | < 0.00035 U | < 0.00064 U | < 0.00013 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.00007 U | < 0.000073 U | < 0.00013 U | < 0.000091 U | < 0.00041 UJ | < 0.00026 UJ | < 0.00035 UJ | 0.0008 J | < 0.00013 UJ |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.00007 U | < 0.000073 U | < 0.00013 U | < 0.000091 U | < 0.00041 UJ | < 0.00026 UJ | < 0.00035 UJ | 0.0017 J | < 0.00013 UJ |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.00019 U | < 0.00011 U | < 0.000085 U | < 0.000073 U | < 0.000077 U | < 0.00013 U | < 0.000095 U | < 0.00042 U | < 0.00027 U | < 0.00036 U | 0.00072 J | < 0.00013 U |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | 0.00069 J | < 0.00013 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | < 0.00019 U | < 0.00011 U | < 0.000084 U | < 0.000072 U | < 0.000075 U | < 0.00013 U | < 0.000093 U | < 0.00042 U | < 0.00027 U | < 0.00035 U | 0.0007 J | < 0.00013 U |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.000081 U | < 0.00007 U | < 0.000073 U | < 0.00012 U | < 0.00009 U | < 0.0004 UJ | < 0.00026 UJ | < 0.00034 UJ | < 0.00059 UJ | < 0.00013 UJ |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | 0.00069 J | < 0.00013 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00065 U | < 0.00013 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00054 U | < 0.00013 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.00007 U | < 0.000073 U | < 0.00013 U | < 0.000091 U | < 0.00041 U | < 0.00026 U | < 0.00034 U | 0.0007 J | < 0.00013 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.0002 U | < 0.00012 U | < 0.000088 U | < 0.000076 U | < 0.000079 U | < 0.00014 U | < 0.000098 U | < 0.00044 U | < 0.00028 U | < 0.00037 U | 0.00072 J | < 0.00014 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.00007 U | < 0.000073 U | < 0.00013 U | < 0.000091 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00067 U | < 0.00013 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | 0.00069 J | < 0.00013 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.00018 U | < 0.00011 U | < 0.000081 U | < 0.00007 U | < 0.000073 U | < 0.00012 U | < 0.00009 U | < 0.0004 UJ | < 0.00026 UJ | < 0.00034 UJ | 0.001 J | < 0.00013 UJ |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00057 U | < 0.00013 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 UJ | < 0.00026 UJ | < 0.00035 UJ | 0.001 J | < 0.00013 UJ |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.00007 U | < 0.000074 U | < 0.00013 U | < 0.000091 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00056 U | < 0.00013 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.000081 U | < 0.000069 U | < 0.000072 U | < 0.00012 U | < 0.00009 U | < 0.0004 UJ | < 0.00026 UJ | < 0.00034 UJ | 0.001 J | < 0.00013 UJ |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.000081 U | < 0.000069 U | < 0.000072 U | < 0.00012 U | < 0.00009 U | < 0.0004 UJ | < 0.00026 UJ | < 0.00034 UJ | 0.0012 J | < 0.00013 UJ |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.00008 U | < 0.000069 U | < 0.000072 U | < 0.00012 U | < 0.00009 U | < 0.0004 U | < 0.00026 U | < 0.00034 U | 0.00076 J | < 0.00012 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.000081 U | < 0.000069 U | < 0.000072 U | < 0.00012 U | < 0.00009 U | < 0.0004 U | < 0.00026 U | < 0.00034 U | 0.00077 J | < 0.00013 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00036 U | < 0.00013 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.00019 U | < 0.00011 U | < 0.000081 U | < 0.00007 U | < 0.000073 U | < 0.00013 U | < 0.000091 U | < 0.0004 U | < 0.00026 U | < 0.00034 U | < 0.00061 U | < 0.00013 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.00007 U | < 0.000073 U | < 0.00013 U | < 0.000091 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00035 U | < 0.00013 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000083 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00053 U | < 0.00013 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000083 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00027 U | < 0.00035 U | < 0.00055 U | < 0.00013 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.00018 U | < 0.00011 U | < 0.00008 U | < 0.000069 U | < 0.000072 U | < 0.00012 U | < 0.000089 U | < 0.0004 U | < 0.00026 U | < 0.00034 U | < 0.00059 U | < 0.00012 U |

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Volatile Organic Compounds (VOCs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1,1,1,2-Tetrachloroethane | 1,1,1-Trichloroethane | 1,1,2,2-Tetrachloroethane | 1,1,2-Trichloroethane | 1,1-Dichloroethane | 1,1-Dichloroethene | 1,1-Dichloropropene | 1,2,3-Trichlorobenzene | 1,2,3-Trichloropropane | 1,2,4-Trichlorobenzene | 1,2,4-Trimethylbenzene | 1,2-Dichlorobenzene |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000083 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00027 U | < 0.00035 U | < 0.00058 U | < 0.00013 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.00007 U | < 0.000074 U | < 0.00013 U | < 0.000091 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00058 U | < 0.00013 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000084 U | < 0.000072 U | < 0.000075 U | < 0.00013 U | < 0.000093 U | < 0.00042 U | < 0.00027 U | < 0.00035 U | < 0.00052 U | < 0.00013 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000083 U | < 0.000072 U | < 0.000075 U | < 0.00013 U | < 0.000093 U | < 0.00041 U | < 0.00027 U | < 0.00035 U | < 0.00056 U | < 0.00013 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.00019 U | < 0.00011 U | < 0.000083 U | < 0.000072 U | < 0.000075 U | < 0.00013 U | < 0.000093 U | < 0.00041 U | < 0.00027 U | < 0.00035 U | < 0.00043 U | < 0.00013 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.00019 U | < 0.00011 U | < 0.000083 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00027 U | < 0.00035 U | < 0.00042 U | < 0.00013 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.0002 U | < 0.00012 U | < 0.000086 U | < 0.000074 U | < 0.000077 U | < 0.00013 U | < 0.000096 U | < 0.00043 U | < 0.00027 U | < 0.00036 U | < 0.00039 U | < 0.00013 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.0002 U | < 0.00012 U | < 0.000087 U | < 0.000075 U | < 0.000078 U | < 0.00013 U | < 0.000097 U | < 0.00043 U | < 0.00028 U | < 0.00037 U | < 0.00049 U | < 0.00014 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.00018 U | < 0.00011 U | < 0.000081 U | < 0.000069 U | < 0.000073 U | < 0.00012 U | < 0.00009 U | < 0.0004 U | < 0.00026 U | < 0.00034 U | < 0.00064 U | < 0.00013 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.00018 U | < 0.00011 U | < 0.000079 U | < 0.000068 U | < 0.000071 U | < 0.00012 U | < 0.000088 U | < 0.00039 U | < 0.00025 U | < 0.00033 U | < 0.00044 U | < 0.00012 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000083 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000093 U | < 0.00041 U | < 0.00027 U | < 0.00035 U | < 0.00049 U | < 0.00013 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000083 U | < 0.000071 U | < 0.000074 U | < 0.00013 U | < 0.000092 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00073 U | < 0.00013 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.00007 U | < 0.000073 U | < 0.00013 U | < 0.000091 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | 0.00088 J | < 0.00013 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.00018 U | < 0.00011 U | < 0.000081 U | < 0.000069 U | < 0.000072 U | < 0.00012 U | < 0.00009 U | < 0.0004 UJ | < 0.00026 UJ | < 0.00034 UJ | < 0.00037 UJ | < 0.00013 UJ |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.00018 UJ | < 0.00011 U | < 0.000081 U | < 0.000069 U | < 0.000072 U | < 0.00012 U | < 0.00009 U | < 0.0004 UJ | < 0.00026 UJ | < 0.00034 UJ | < 0.00014 UJ | < 0.00013 UJ |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.00019 U | < 0.00011 U | < 0.000082 U | < 0.00007 U | < 0.000073 U | < 0.00013 U | < 0.000091 U | < 0.00041 U | < 0.00026 U | < 0.00035 U | < 0.00025 U | < 0.00013 U |

All units in mg/kg.
-- = no sample data.

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Volatile Organic Compounds (VOCs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1,2-Dichloroethane | 1,2-Dichloroethene | 1,2-Dichloropropane | 1,3,5-Trichlorobenzene | 1,3,5-Trimethylbenzene | 1,3-Dichlorobenzene | 1,3-Dichloropropane | 1,4-Dichlorobenzene | 2,2,3-Trimethylbutane | 2,2-Dichloropropane | 2,2-Dimethylpentane | 2,3-Dimethylpentane |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.000073 U | < 0.00012 U | < 0.00012 U | < 0.00041 U | < 0.00011 U | < 0.00014 U | < 0.000056 U | < 0.00015 U | < 0.00023 U | < 0.00026 U | < 0.0003 U | < 0.00025 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.00007 U | < 0.00012 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.000067 U | < 0.00011 U | < 0.00011 U | < 0.00037 U | < 0.000098 U | < 0.00013 U | < 0.000051 U | < 0.00014 U | < 0.00021 U | < 0.00023 U | < 0.00028 U | < 0.00023 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.000069 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00024 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00024 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.000069 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000053 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00023 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.000068 U | < 0.00011 U | < 0.00011 U | < 0.00038 UJ | < 0.0001 UJ | < 0.00014 UJ | < 0.000053 U | < 0.00014 UJ | < 0.00022 U | < 0.00024 U | < 0.00028 U | < 0.00023 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.000069 U | < 0.00011 U | < 0.00012 U | < 0.00039 UJ | < 0.0001 UJ | < 0.00014 UJ | < 0.000053 U | < 0.00014 UJ | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00023 U |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.000069 U | < 0.00011 U | < 0.00012 U | < 0.00039 UJ | < 0.0001 UJ | < 0.00014 UJ | < 0.000053 U | < 0.00014 UJ | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00023 U |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.000072 U | < 0.00012 U | < 0.00012 U | < 0.0004 U | < 0.00011 U | < 0.00014 U | < 0.000056 U | < 0.00015 U | < 0.00023 U | < 0.00025 U | < 0.0003 U | < 0.00024 U |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00024 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | < 0.000071 U | < 0.00012 U | < 0.00012 U | < 0.0004 U | < 0.0001 U | < 0.00014 U | < 0.000055 U | < 0.00015 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.000069 U | < 0.00011 U | < 0.00011 U | < 0.00038 UJ | < 0.0001 UJ | < 0.00014 UJ | < 0.000053 U | < 0.00014 UJ | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00023 U |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.000069 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00024 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00024 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00024 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.000069 U | < 0.00011 U | < 0.00011 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000053 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00023 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.000075 U | < 0.00012 U | < 0.00012 U | < 0.00042 U | < 0.00011 U | < 0.00015 U | < 0.000058 U | < 0.00015 U | < 0.00024 U | < 0.00026 U | < 0.00031 U | < 0.00025 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.000069 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000053 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00023 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.000069 U | < 0.00011 U | < 0.00011 U | < 0.00038 UJ | < 0.0001 UJ | < 0.00014 UJ | < 0.000053 U | < 0.00014 UJ | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00023 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 UJ | < 0.0001 UJ | < 0.00014 UJ | < 0.000054 U | < 0.00014 UJ | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00024 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.000069 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00024 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.000068 U | < 0.00011 U | < 0.00011 U | < 0.00038 UJ | < 0.0001 UJ | < 0.00014 UJ | < 0.000053 U | < 0.00014 UJ | < 0.00022 U | < 0.00024 U | < 0.00028 U | < 0.00023 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.000068 U | < 0.00011 U | < 0.00011 U | < 0.00038 UJ | < 0.0001 UJ | < 0.00014 UJ | < 0.000053 U | < 0.00014 UJ | < 0.00022 U | < 0.00024 U | < 0.00028 U | < 0.00023 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.000068 U | < 0.00011 U | < 0.00011 U | < 0.00038 U | < 0.0001 U | < 0.00014 U | < 0.000053 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00028 U | < 0.00023 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.000068 U | < 0.00011 U | < 0.00011 U | < 0.00038 U | < 0.0001 U | < 0.00014 U | < 0.000053 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00028 U | < 0.00023 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00024 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.000069 U | < 0.00011 U | < 0.00011 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000053 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00023 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.000069 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000053 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00023 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.000068 U | < 0.00011 U | < 0.00011 U | < 0.00038 U | < 0.0001 U | < 0.00013 U | < 0.000052 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00028 U | < 0.00023 U |

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Volatile Organic Compounds (VOCs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1,2-Dichloroethane | 1,2-Dichloroethene | 1,2-Dichloropropane | 1,3,5-Trichlorobenzene | 1,3,5-Trimethylbenzene | 1,3-Dichlorobenzene | 1,3-Dichloropropane | 1,4-Dichlorobenzene | 2,2,3-Trimethylbutane | 2,2-Dichloropropane | 2,2-Dimethylpentane | 2,3-Dimethylpentane |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.000069 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00024 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.000071 U | < 0.00012 U | < 0.00012 U | < 0.0004 U | < 0.0001 U | < 0.00014 U | < 0.000055 U | < 0.00015 U | < 0.00023 U | < 0.00025 U | < 0.0003 U | < 0.00024 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.00007 U | < 0.00012 U | < 0.00012 U | < 0.0004 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00015 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.000071 U | < 0.00012 U | < 0.00012 U | < 0.0004 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00015 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.000073 U | < 0.00012 U | < 0.00012 U | < 0.00041 U | < 0.00011 U | < 0.00014 U | < 0.000056 U | < 0.00015 U | < 0.00023 U | < 0.00026 U | < 0.0003 U | < 0.00025 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.000074 U | < 0.00012 U | < 0.00012 U | < 0.00041 U | < 0.00011 U | < 0.00015 U | < 0.000057 U | < 0.00015 U | < 0.00023 U | < 0.00026 U | < 0.00031 U | < 0.00025 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.000068 U | < 0.00011 U | < 0.00011 U | < 0.00038 U | < 0.0001 U | < 0.00014 U | < 0.000053 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00023 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.000067 U | < 0.00011 U | < 0.00011 U | < 0.00037 U | < 0.000098 U | < 0.00013 U | < 0.000051 U | < 0.00014 U | < 0.00021 U | < 0.00023 U | < 0.00028 U | < 0.00023 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.00007 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000054 U | < 0.00014 U | < 0.00022 U | < 0.00025 U | < 0.00029 U | < 0.00024 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.000069 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | 0.00012 J | < 0.00014 U | < 0.000053 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00023 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.000068 U | < 0.00011 U | < 0.00011 U | < 0.00038 UJ | < 0.0001 UJ | < 0.00014 UJ | < 0.000053 U | < 0.00014 UJ | < 0.00022 U | < 0.00024 U | < 0.00028 U | < 0.00023 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.000068 U | < 0.00011 U | < 0.00011 U | < 0.00038 UJ | < 0.0001 UJ | < 0.00014 UJ | < 0.000053 U | < 0.00014 UJ | < 0.00022 U | < 0.00024 U | < 0.00028 U | < 0.00023 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.000069 U | < 0.00011 U | < 0.00012 U | < 0.00039 U | < 0.0001 U | < 0.00014 U | < 0.000053 U | < 0.00014 U | < 0.00022 U | < 0.00024 U | < 0.00029 U | < 0.00023 U |

All units in mg/kg.
-- = no sample data.

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Volatile Organic Compounds (VOCs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2,4-Dimethylpentane | 2-Chlorotoluene | 2-Hexanone | 2-Methylhexane | 2-Nitropropane | 3,3-Dimethylpentane | 3-Ethylpentane | 3-Methylhexane | 4-Chlorotoluene | 4-Methyl-2-pentanone (MIBK) | Acetone | Acetonitrile |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.00021 U | < 0.00027 U | < 0.00026 U | < 0.00022 U | < 0.00066 U | < 0.00022 U | < 0.00023 U | < 0.00015 U | < 0.00019 U | < 0.00032 U | < 0.0087 U | < 0.006 UJ |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.00021 U | < 0.00026 U | < 0.00025 U | < 0.00022 U | < 0.00064 U | < 0.00022 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.00031 U | < 0.012 U | < 0.0058 UJ |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.00019 U | < 0.00025 U | < 0.00024 U | < 0.0002 U | < 0.00061 U | < 0.0002 U | < 0.00021 U | < 0.00014 U | < 0.00017 U | < 0.00029 U | < 0.0051 U | < 0.0055 UJ |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.0039 U | < 0.0057 UJ |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00064 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.0018 U | < 0.0057 UJ |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.0045 U | < 0.0057 UJ |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 UJ | < 0.00025 U | < 0.00021 U | < 0.00062 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 UJ | < 0.0003 U | < 0.02 U | < 0.0056 UJ |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00022 U | < 0.00064 U | < 0.00022 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.00031 U | < 0.019 U | < 0.0057 UJ |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.0002 U | < 0.00026 UJ | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 UJ | < 0.0003 U | < 0.018 U | < 0.0057 UJ |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.0002 U | < 0.00026 UJ | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 UJ | < 0.0003 U | < 0.011 UJ | < 0.0057 UJ |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.00021 U | < 0.00027 U | < 0.00026 U | < 0.00022 U | < 0.00066 U | < 0.00022 U | < 0.00023 U | < 0.00015 U | < 0.00019 U | < 0.00031 U | < 0.012 U | < 0.0059 UJ |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00064 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.012 U | < 0.0057 UJ |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | < 0.00021 U | < 0.00026 U | < 0.00025 U | < 0.00022 U | < 0.00064 U | < 0.00022 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.00031 U | < 0.013 U | < 0.0058 UJ |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 UJ | < 0.00025 U | < 0.00021 U | < 0.00062 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 UJ | < 0.0003 U | < 0.018 U | < 0.0056 UJ |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.02 U | < 0.0057 UJ |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.019 U | < 0.0057 UJ |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00064 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.02 U | < 0.0057 UJ |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.011 U | < 0.0057 UJ |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.00022 U | < 0.00028 U | < 0.00027 U | < 0.00023 U | < 0.00068 U | < 0.00023 U | < 0.00024 U | < 0.00016 U | < 0.00019 U | < 0.00033 U | < 0.013 U | < 0.0061 UJ |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.018 U | < 0.0057 UJ |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00064 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.02 U | < 0.0057 UJ |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.0002 U | < 0.00026 UJ | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 UJ | < 0.0003 U | < 0.011 U | < 0.0056 UJ |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00064 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.012 U | < 0.0057 UJ |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 UJ | < 0.00025 U | < 0.00021 U | < 0.00064 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 UJ | < 0.0003 U | < 0.019 UJ | < 0.0057 UJ |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.019 U | < 0.0057 UJ |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 UJ | < 0.00025 U | < 0.00021 U | < 0.00062 U | < 0.00021 U | < 0.00022 U | < 0.00014 U | < 0.00018 UJ | < 0.0003 U | < 0.0095 U | < 0.0056 UJ |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.0002 U | < 0.00026 UJ | < 0.00025 U | < 0.00021 U | < 0.00062 U | < 0.00021 U | < 0.00022 U | < 0.00014 U | < 0.00018 UJ | < 0.0003 U | < 0.01 U | < 0.0056 UJ |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.0002 U | < 0.00025 U | < 0.00024 U | < 0.00021 U | < 0.00062 U | < 0.00021 U | < 0.00022 U | < 0.00014 U | < 0.00018 U | < 0.0003 U | < 0.016 U | < 0.0056 UJ |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00062 U | < 0.00021 U | < 0.00022 U | < 0.00014 U | < 0.00018 U | < 0.0003 U | < 0.01 U | < 0.0056 UJ |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.021 U | < 0.0057 UJ |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.019 U | < 0.0056 UJ |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.021 U | < 0.0057 UJ |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00064 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.00031 U | < 0.011 U | < 0.0057 UJ |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00022 U | < 0.00064 U | < 0.00022 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.00031 U | < 0.0053 U | < 0.0057 UJ |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.0002 U | < 0.00025 U | < 0.00024 U | < 0.00021 U | < 0.00062 U | < 0.00021 U | < 0.00022 U | < 0.00014 U | < 0.00018 U | < 0.0003 U | < 0.0057 U | < 0.0056 UJ |

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Volatile Organic Compounds (VOCs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2,4-Dimethylpentane | 2-Chlorotoluene | 2-Hexanone | 2-Methylhexane | 2-Nitropropane | 3,3-Dimethylpentane | 3-Ethylpentane | 3-Methylhexane | 4-Chlorotoluene | 4-Methyl-2-pentanone (MIBK) | Acetone | Acetonitrile |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00022 U | < 0.00064 U | < 0.00022 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.00031 U | < 0.0062 U | < 0.0057 UJ |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.0077 U | < 0.0057 UJ |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.00021 U | < 0.00027 U | < 0.00025 U | < 0.00022 U | < 0.00065 U | < 0.00022 U | < 0.00023 U | < 0.00015 U | < 0.00018 U | < 0.00031 U | < 0.0082 U | < 0.0058 UJ |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.00021 U | < 0.00026 U | < 0.00025 U | < 0.00022 U | < 0.00064 U | < 0.00022 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.00031 U | < 0.0072 U | < 0.0058 UJ |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.00021 U | < 0.00026 U | < 0.00025 U | < 0.00022 U | < 0.00064 U | < 0.00022 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.00031 U | < 0.0018 U | < 0.0058 UJ |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00022 U | < 0.00064 U | < 0.00022 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.00031 U | < 0.0018 U | < 0.0057 UJ |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.00021 U | < 0.00027 U | < 0.00026 U | < 0.00022 U | < 0.00066 U | < 0.00022 U | < 0.00023 U | < 0.00015 U | < 0.00019 U | < 0.00032 U | < 0.0019 U | < 0.006 UJ |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.00022 U | < 0.00028 U | < 0.00027 U | < 0.00023 U | < 0.00067 U | < 0.00023 U | < 0.00023 U | < 0.00016 U | < 0.00019 U | < 0.00032 U | < 0.01 UJ | < 0.0061 UJ |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00062 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | 0.017 J | < 0.0056 UJ |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.00019 U | < 0.00025 U | < 0.00024 U | < 0.0002 U | < 0.00061 U | < 0.0002 U | < 0.00021 U | < 0.00014 U | < 0.00017 U | < 0.00029 U | < 0.0042 U | < 0.0055 UJ |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.00021 U | < 0.00026 U | < 0.00025 U | < 0.00022 U | < 0.00064 U | < 0.00022 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.00031 U | < 0.0046 U | < 0.0058 UJ |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00064 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.00031 U | < 0.0018 U | < 0.0057 UJ |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.0053 U | < 0.0057 UJ |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.0002 U | < 0.00026 UJ | < 0.00025 U | < 0.00021 U | < 0.00062 U | < 0.00021 U | < 0.00022 U | < 0.00014 U | < 0.00018 UJ | < 0.0003 U | < 0.0018 U | < 0.0056 UJ |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.0002 U | < 0.00026 UJ | < 0.00025 UJ | < 0.00021 U | < 0.00062 UJ | < 0.00021 U | < 0.00022 U | < 0.00014 U | < 0.00018 UJ | < 0.0003 UJ | < 0.0018 U | < 0.0056 UJ |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.0002 U | < 0.00026 U | < 0.00025 U | < 0.00021 U | < 0.00063 U | < 0.00021 U | < 0.00022 U | < 0.00015 U | < 0.00018 U | < 0.0003 U | < 0.012 U | < 0.0057 UJ |

All units in mg/kg.
-- = no sample data.

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Volatile Organic Compounds (VOCs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Benzene | Bromobenzene | Bromodichloromethane | Bromoform | Bromomethane | Carbon disulfide | Carbon tetrachloride | Chlorobenzene | Chlorobromomethane | Chloroethane | Chloroform | Chloromethane |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.000096 U | < 0.00013 U | < 0.00023 U | < 0.000065 U | < 0.00014 U | < 0.00013 U | < 0.00023 U | < 0.00012 U | < 0.00025 U | < 0.00051 U | < 0.00011 U | < 0.0003 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.000093 U | < 0.00013 U | < 0.00023 U | < 0.000063 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00012 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00029 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.000088 U | < 0.00012 U | < 0.00022 U | < 0.00006 U | < 0.00013 U | < 0.00012 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00047 U | < 0.0001 U | < 0.00027 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.000091 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00048 U | < 0.00011 U | < 0.00028 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.000092 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.000091 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00024 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.00009 U | < 0.00013 UJ | < 0.00022 U | < 0.000061 U | < 0.00013 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.000092 U | < 0.00013 U | < 0.00023 U | < 0.000063 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.000091 U | < 0.00013 UJ | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00024 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.000091 U | < 0.00013 UJ | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00024 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.000095 U | < 0.00013 U | < 0.00023 U | < 0.000064 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00012 U | < 0.00025 U | < 0.0005 U | < 0.00011 U | < 0.00029 U |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.000092 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | < 0.000093 U | < 0.00013 U | < 0.00023 U | < 0.000063 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00012 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00029 U |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.00009 U | < 0.00013 UJ | < 0.00022 U | < 0.000061 U | < 0.00013 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.000092 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.000092 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.000092 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.000091 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00024 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.000098 U | < 0.00014 U | < 0.00024 U | < 0.000067 U | < 0.00015 U | < 0.00014 U | < 0.00023 U | < 0.00012 U | < 0.00025 U | < 0.00052 U | < 0.00011 U | < 0.0003 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.000091 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00024 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.000092 U | < 0.00013 U | < 0.00023 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.00009 U | < 0.00013 UJ | < 0.00022 U | < 0.000061 U | < 0.00013 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.000092 U | < 0.00013 U | < 0.00023 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.000092 U | < 0.00013 UJ | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.000091 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00048 U | < 0.00011 U | < 0.00028 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.00009 U | < 0.00013 UJ | < 0.00022 U | < 0.000061 U | < 0.00013 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.00009 U | < 0.00013 UJ | < 0.00022 U | < 0.000061 U | < 0.00013 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.00009 U | < 0.00012 U | < 0.00022 U | < 0.000061 U | < 0.00013 U | < 0.00012 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.00009 U | < 0.00013 U | < 0.00022 U | < 0.000061 U | < 0.00013 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.000092 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.000091 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.000091 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00024 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.000092 U | < 0.00013 U | < 0.00023 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.000092 U | < 0.00013 U | < 0.00023 U | < 0.000063 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.000089 U | < 0.00012 U | < 0.00022 U | < 0.000061 U | < 0.00013 U | < 0.00012 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00047 U | < 0.0001 U | < 0.00028 U |

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Volatile Organic Compounds (VOCs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Benzene | Bromobenzene | Bromodichloromethane | Bromoform | Bromomethane | Carbon disulfide | Carbon tetrachloride | Chlorobenzene | Chlorobromomethane | Chloroethane | Chloroform | Chloromethane |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.000092 U | < 0.00013 U | < 0.00023 U | < 0.000063 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.000091 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00048 U | < 0.00011 U | < 0.00028 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.000093 U | < 0.00013 U | < 0.00023 U | < 0.000063 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00012 U | < 0.00024 U | < 0.0005 U | < 0.00011 U | < 0.00029 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.000093 U | < 0.00013 U | < 0.00023 U | < 0.000063 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00012 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00029 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.000093 U | < 0.00013 U | < 0.00023 U | < 0.000063 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00012 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00029 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.000092 U | < 0.00013 U | < 0.00023 U | < 0.000063 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.000096 U | < 0.00013 U | < 0.00023 U | < 0.000065 U | < 0.00014 U | < 0.00013 U | < 0.00023 U | < 0.00012 U | < 0.00025 U | < 0.00051 U | < 0.00011 U | < 0.00029 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.000097 U | < 0.00014 U | < 0.00024 U | < 0.000066 U | < 0.00015 U | < 0.00014 U | < 0.00023 U | < 0.00012 U | < 0.00025 U | < 0.00052 U | < 0.00011 U | < 0.0003 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.00009 U | < 0.00013 U | < 0.00022 U | < 0.000061 U | < 0.00013 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.000088 U | < 0.00012 U | < 0.00021 U | < 0.00006 U | < 0.00013 U | < 0.00012 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00047 U | < 0.0001 U | < 0.00027 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.000093 U | < 0.00013 U | < 0.00023 U | < 0.000063 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00029 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.000092 U | < 0.00013 U | < 0.00023 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00022 U | < 0.00011 U | < 0.00024 U | < 0.00049 U | < 0.00011 U | < 0.00028 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.000091 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00024 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.00009 U | < 0.00013 UJ | < 0.00022 U | < 0.000061 U | < 0.00013 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00023 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.00009 U | < 0.00013 UJ | < 0.00022 U | < 0.000061 UJ | < 0.00013 U | < 0.00013 U | < 0.00021 U | < 0.00011 UJ | < 0.00023 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.000091 U | < 0.00013 U | < 0.00022 U | < 0.000062 U | < 0.00014 U | < 0.00013 U | < 0.00021 U | < 0.00011 U | < 0.00024 U | < 0.00048 U | < 0.0001 U | < 0.00028 U |

All units in mg/kg.
-- = no sample data.

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| | | | | Volatile Organic Compounds (VOCs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | cis-1,2-Dichloroethene | cis-1,3-Dichloropropene | Cymene (Isopropyltoluene) | Dibromochloromethane | Dibromochloropropane | Dibromomethane | Dichloromethane (Methylene chloride) | Dimethyldisulfide | Ethanol | Ethylbenzene | Freon-11 (Trichlorofluoromethane) | Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane) |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.000059 U | < 0.00011 U | < 0.00014 U | < 0.00013 U | < 0.00023 U | < 0.00018 U | 0.0099 | < 0.00019 U | < 0.052 UJ | < 0.000064 U | < 0.00024 U | < 0.00016 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.000058 U | < 0.00011 U | < 0.00013 U | < 0.00013 U | < 0.00022 U | < 0.00018 U | 0.0083 | < 0.00019 U | < 0.05 UJ | < 0.000062 U | < 0.00023 U | < 0.00015 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.000055 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00021 U | < 0.00017 U | 0.0032 J | < 0.00018 U | < 0.048 UJ | < 0.000059 U | < 0.00022 U | < 0.00015 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | 0.0039 J | < 0.00018 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00018 U | 0.0051 J | < 0.00019 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.000057 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | 0.015 | < 0.00018 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 UJ | < 0.00012 U | < 0.00022 UJ | < 0.00017 U | 0.019 | < 0.00018 U | < 0.049 UJ | < 0.00006 U | < 0.00023 U | < 0.00015 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00013 U | < 0.00022 U | < 0.00018 U | < 0.0026 U | < 0.00019 U | < 0.05 UJ | < 0.000062 U | < 0.00023 U | < 0.00015 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.000057 U | < 0.0001 U | < 0.00013 UJ | < 0.00012 U | < 0.00022 UJ | < 0.00017 U | 0.011 J | < 0.00018 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.000057 U | < 0.0001 U | < 0.00013 UJ | < 0.00012 U | < 0.00022 UJ | < 0.00017 U | 0.0014 J | < 0.00018 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.000059 U | < 0.00011 U | < 0.00014 U | < 0.00013 U | < 0.00023 U | < 0.00018 U | < 0.00075 U | < 0.00019 U | < 0.052 UJ | < 0.000063 U | < 0.00024 U | < 0.00016 U |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00018 U | < 0.00073 U | < 0.00019 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | < 0.000058 U | < 0.00011 U | < 0.00013 U | < 0.00013 U | < 0.00023 U | < 0.00018 U | < 0.00074 U | < 0.00019 U | < 0.051 UJ | < 0.000062 U | < 0.00023 U | < 0.00016 U |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 UJ | < 0.00012 U | < 0.00022 UJ | < 0.00017 U | < 0.006 U | < 0.00018 U | < 0.049 UJ | < 0.00006 U | < 0.00023 U | < 0.00015 U |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | < 0.0041 U | < 0.00019 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | < 0.0045 U | < 0.00019 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00018 U | < 0.0039 U | < 0.00019 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | < 0.00072 U | < 0.00018 U | < 0.049 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.000061 U | < 0.00011 U | < 0.00014 U | < 0.00013 U | < 0.00024 U | < 0.00019 U | < 0.00078 U | < 0.0002 U | < 0.053 UJ | < 0.000066 U | < 0.00025 U | < 0.00016 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | < 0.0042 U | < 0.00018 U | < 0.049 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00018 U | < 0.0038 U | < 0.00019 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 UJ | < 0.00012 U | < 0.00022 UJ | < 0.00017 U | < 0.00071 U | < 0.00018 U | < 0.049 UJ | < 0.00006 U | < 0.00023 U | < 0.00015 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00018 U | < 0.00073 U | < 0.00019 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 UJ | < 0.00012 U | < 0.00022 UJ | < 0.00018 U | < 0.0077 UJ | < 0.00019 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | < 0.0035 U | < 0.00019 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 UJ | < 0.00012 U | < 0.00022 UJ | < 0.00017 U | < 0.0018 U | < 0.00018 U | < 0.049 UJ | < 0.00006 U | < 0.00023 U | < 0.00015 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 UJ | < 0.00012 U | < 0.00022 UJ | < 0.00017 U | < 0.0022 U | < 0.00018 U | < 0.049 UJ | 0.000077 J | < 0.00023 U | < 0.00015 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | < 0.00071 U | < 0.00018 U | < 0.049 UJ | < 0.00006 U | < 0.00022 U | < 0.00015 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | < 0.00071 U | < 0.00018 U | < 0.049 UJ | < 0.00006 U | < 0.00023 U | < 0.00015 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | 0.017 | < 0.00019 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | 0.018 | < 0.00018 U | < 0.049 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | 0.018 | < 0.00018 U | < 0.049 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00018 U | 0.0031 J | < 0.00019 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00013 U | < 0.00022 U | < 0.00018 U | 0.0028 J | < 0.00019 U | < 0.05 UJ | < 0.000062 U | < 0.00023 U | < 0.00015 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.000055 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | 0.016 | < 0.00018 U | < 0.049 UJ | < 0.00006 U | < 0.00022 U | < 0.00015 U |

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Volatile Organic Compounds (VOCs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | cis-1,2-Dichloroethene | cis-1,3-Dichloropropene | Cymene (Isopropyltoluene) | Dibromochloromethane | Dibromochloropropane | Dibromomethane | Dichloromethane (Methylene chloride) | Dimethyldisulfide | Ethanol | Ethylbenzene | Freon-11 (Trichlorofluoromethane) | Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane) |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00013 U | < 0.00022 U | < 0.00018 U | 0.015 | < 0.00019 U | < 0.05 UJ | 0.000062 J | < 0.00023 U | < 0.00015 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | 0.017 | < 0.00018 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.000058 U | < 0.00011 U | < 0.00013 U | < 0.00013 U | < 0.00023 U | < 0.00018 U | 0.016 | < 0.00019 U | < 0.051 UJ | < 0.000062 U | < 0.00023 U | < 0.00016 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.000058 U | < 0.00011 U | < 0.00013 U | < 0.00013 U | < 0.00023 U | < 0.00018 U | 0.014 | < 0.00019 U | < 0.051 UJ | < 0.000062 U | < 0.00023 U | < 0.00015 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.000058 U | < 0.00011 U | < 0.00013 U | < 0.00013 U | < 0.00023 U | < 0.00018 U | < 0.0026 U | < 0.00019 U | < 0.051 UJ | < 0.000062 U | < 0.00023 U | < 0.00015 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00013 U | < 0.00022 U | < 0.00018 U | < 0.0036 U | < 0.00019 U | < 0.05 UJ | < 0.000062 U | < 0.00023 U | < 0.00015 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.000059 U | < 0.00011 U | < 0.00014 U | < 0.00013 U | < 0.00023 U | < 0.00018 U | < 0.0038 U | < 0.00019 U | < 0.052 UJ | < 0.000064 U | < 0.00024 U | < 0.00016 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.00006 U | < 0.00011 U | < 0.00014 U | < 0.00013 U | < 0.00024 U | < 0.00019 U | < 0.0053 U | < 0.0002 U | < 0.053 UJ | < 0.000065 U | < 0.00024 U | < 0.00016 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | 0.028 J | < 0.00018 U | < 0.049 UJ | < 0.00006 U | < 0.00023 U | < 0.00015 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.000055 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00021 U | < 0.00017 U | 0.0027 J | < 0.00018 U | < 0.048 UJ | < 0.000059 U | < 0.00022 U | < 0.00015 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00013 U | < 0.00022 U | < 0.00018 U | 0.0033 J | < 0.00019 U | < 0.05 UJ | < 0.000062 U | < 0.00023 U | < 0.00015 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.000057 U | < 0.00011 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00018 U | 0.0041 J | < 0.00019 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.000057 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | 0.0046 J | < 0.00018 U | < 0.05 UJ | 0.000062 J | < 0.00023 U | < 0.00015 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 UJ | < 0.00012 U | < 0.00022 UJ | < 0.00017 U | < 0.0016 U | < 0.00018 U | < 0.049 UJ | < 0.00006 U | < 0.00023 U | < 0.00015 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.000056 U | < 0.0001 U | < 0.00013 UJ | < 0.00012 UJ | < 0.00022 UJ | < 0.00017 U | < 0.003 U | < 0.00018 UJ | < 0.049 UJ | < 0.00006 UJ | < 0.00023 U | < 0.00015 U |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.000057 U | < 0.0001 U | < 0.00013 U | < 0.00012 U | < 0.00022 U | < 0.00017 U | < 0.0025 U | < 0.00018 U | < 0.05 UJ | < 0.000061 U | < 0.00023 U | < 0.00015 U |

All units in mg/kg.
-- = no sample data.

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| | | | | Volatile Organic Compounds (VOCs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Depth (ft bgs)** | **Sample Type** | **Sample Date** | Freon-12 (Dichloro-difluoromethane) | Heptane | Isopropylbenzene | m,p-Xylene | Methyl ethyl ketone (2-Butanone) | Methyl iodide | MTBE (Methyl tert-butyl ether) | n-Butylbenzene | Nonanal | n-Propylbenzene | o-Xylene | sec-Butylbenzene |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.00032 U | < 0.00018 U | < 0.00011 U | < 0.00018 U | < 0.00096 U | < 0.00014 UJ | < 0.000098 U | < 0.0002 U | < 0.00052 U | < 0.00012 U | < 0.000084 U | < 0.00012 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.00031 U | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 U | < 0.00013 UJ | < 0.000095 U | < 0.00019 U | < 0.0005 U | < 0.00012 U | < 0.000081 U | < 0.00011 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.00029 UJ | < 0.00016 U | < 0.0001 U | < 0.00017 U | < 0.00088 U | < 0.00013 U | < 0.00009 U | < 0.00018 U | < 0.00047 U | < 0.00011 U | < 0.000077 U | < 0.00011 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.0003 UJ | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000093 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.00008 U | < 0.00011 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.00031 UJ | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.00049 U | < 0.00012 U | < 0.00008 U | < 0.00011 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.0003 UJ | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000093 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.00008 U | < 0.00011 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.0009 U | < 0.00013 U | < 0.000092 U | < 0.00019 UJ | < 0.00048 UJ | < 0.00011 UJ | < 0.000079 U | < 0.00011 UJ |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.00031 U | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.0005 U | < 0.00012 U | < 0.000081 U | < 0.00011 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000093 U | < 0.00019 UJ | < 0.00049 UJ | < 0.00011 UJ | < 0.00008 U | < 0.00011 UJ |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000093 U | < 0.00019 UJ | < 0.00049 UJ | < 0.00011 UJ | < 0.00008 U | < 0.00011 UJ |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.00032 U | < 0.00018 U | < 0.00011 U | < 0.00018 U | < 0.00095 U | < 0.00014 U | < 0.000097 U | < 0.0002 U | 0.0008 J | < 0.00012 U | < 0.000083 U | < 0.00012 U |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00091 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.00049 U | < 0.00012 U | < 0.00008 U | < 0.00011 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | < 0.00031 U | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00093 U | < 0.00013 U | < 0.000095 U | < 0.00019 U | 0.00098 J | < 0.00012 U | < 0.000081 U | < 0.00011 U |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.0009 U | < 0.00013 U | < 0.000092 U | < 0.00019 UJ | < 0.00049 UJ | < 0.00011 UJ | < 0.000079 U | < 0.00011 UJ |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.00008 U | < 0.00011 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.00008 U | < 0.00011 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.00031 U | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.00049 U | < 0.00012 U | < 0.00008 U | < 0.00011 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000093 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.000079 U | < 0.00011 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.00033 U | < 0.00018 U | < 0.00012 U | < 0.00019 U | < 0.00098 U | < 0.00014 U | < 0.0001 U | < 0.0002 U | < 0.00053 U | < 0.00012 U | < 0.000086 U | < 0.00012 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000093 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.00008 U | < 0.00011 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.00031 U | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.00049 U | < 0.00012 U | < 0.00008 U | < 0.00011 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.0009 U | < 0.00013 U | < 0.000092 U | < 0.00019 UJ | < 0.00049 UJ | < 0.00011 UJ | < 0.000079 U | < 0.00011 UJ |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.00031 U | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.00049 U | < 0.00012 U | < 0.00008 U | < 0.00011 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.00031 U | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 U | < 0.00013 U | < 0.000094 U | < 0.00019 UJ | < 0.00049 UJ | < 0.00012 UJ | < 0.00008 U | < 0.00011 UJ |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.00008 U | < 0.00011 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.0009 U | < 0.00013 U | < 0.000092 U | < 0.00019 UJ | < 0.00048 UJ | < 0.00011 UJ | < 0.000079 U | < 0.00011 UJ |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.0009 U | < 0.00013 U | < 0.000092 U | < 0.00019 UJ | < 0.00048 UJ | < 0.00011 UJ | < 0.000079 U | < 0.00011 UJ |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00089 U | < 0.00013 U | < 0.000092 U | < 0.00019 U | < 0.00048 U | < 0.00011 U | < 0.000078 U | < 0.00011 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.0009 U | < 0.00013 U | < 0.000092 U | < 0.00019 U | < 0.00048 U | < 0.00011 U | < 0.000079 U | < 0.00011 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.00008 U | < 0.00011 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.0009 U | < 0.00013 U | < 0.000093 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.000079 U | < 0.00011 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000093 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.000079 U | < 0.00011 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.00031 UJ | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.0005 U | < 0.00012 U | < 0.00008 U | < 0.00011 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.00031 UJ | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 U | < 0.00013 U | < 0.000095 U | < 0.00019 U | < 0.0005 U | < 0.00012 U | < 0.000081 U | < 0.00011 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.0003 UJ | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00089 U | < 0.00013 U | < 0.000091 U | < 0.00018 U | < 0.00048 U | < 0.00011 U | < 0.000078 U | < 0.00011 U |

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Volatile Organic Compounds (VOCs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Freon-12 (Dichloro-difluoromethane) | Heptane | Isopropylbenzene | m,p-Xylene | Methyl ethyl ketone (2-Butanone) | Methyl iodide | MTBE (Methyl tert-butyl ether) | n-Butylbenzene | Nonanal | n-Propylbenzene | o-Xylene | sec-Butylbenzene |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.00031 UJ | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.0005 U | < 0.00012 U | < 0.000081 U | < 0.00011 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.0003 UJ | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000093 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.00008 U | < 0.00011 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.00031 UJ | < 0.00018 U | < 0.00011 U | < 0.00018 U | < 0.00093 U | < 0.00013 U | < 0.000096 U | < 0.00019 U | < 0.0005 U | < 0.00012 U | < 0.000082 U | < 0.00011 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.00031 UJ | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00093 U | < 0.00013 U | < 0.000095 U | < 0.00019 U | < 0.0005 U | < 0.00012 U | < 0.000081 U | < 0.00011 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.00031 U | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00093 UJ | < 0.00013 U | < 0.000095 U | < 0.00019 U | < 0.0005 U | < 0.00012 U | < 0.000081 U | < 0.00011 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.00031 U | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 UJ | < 0.00013 U | < 0.000095 U | < 0.00019 U | < 0.0005 U | < 0.00012 U | < 0.000081 U | < 0.00011 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.00032 U | < 0.00018 U | < 0.00011 U | < 0.00018 U | < 0.00095 UJ | < 0.00014 U | < 0.000098 U | < 0.0002 U | < 0.00051 U | < 0.00012 U | < 0.000084 U | < 0.00012 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.00032 U | < 0.00018 U | < 0.00012 U | < 0.00019 U | < 0.00097 UJ | < 0.00014 U | < 0.0001 U | < 0.0002 U | < 0.00052 U | < 0.00012 U | < 0.000085 U | < 0.00012 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.0003 UJ | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.0009 U | < 0.00013 U | < 0.000092 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.000079 U | < 0.00011 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.00029 UJ | < 0.00016 U | < 0.0001 U | < 0.00017 U | < 0.00088 U | < 0.00013 U | < 0.00009 U | < 0.00018 U | < 0.00047 U | < 0.00011 U | < 0.000077 U | < 0.00011 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.00031 UJ | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 U | < 0.00013 U | < 0.000095 U | < 0.00019 U | < 0.0005 U | < 0.00012 U | < 0.000081 U | < 0.00011 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.00031 UJ | < 0.00017 U | < 0.00011 U | < 0.00018 U | < 0.00092 U | < 0.00013 U | < 0.000094 U | < 0.00019 U | < 0.0005 U | < 0.00012 U | < 0.00008 U | < 0.00011 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.0003 UJ | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 U | < 0.000093 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.00008 U | < 0.00011 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.0009 U | < 0.00013 UJ | < 0.000092 U | < 0.00019 UJ | < 0.00048 UJ | < 0.00011 UJ | < 0.000079 U | < 0.00011 UJ |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 UJ | < 0.00017 UJ | < 0.0009 U | < 0.00013 UJ | < 0.000092 U | < 0.00019 UJ | < 0.00048 UJ | < 0.00011 UJ | < 0.000079 U | < 0.00011 UJ |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.0003 U | < 0.00017 U | < 0.00011 U | < 0.00017 U | < 0.00091 U | < 0.00013 UJ | < 0.000093 U | < 0.00019 U | < 0.00049 U | < 0.00011 U | < 0.00008 U | < 0.00011 U |

All units in mg/kg.
-- = no sample data.

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Volatile Organic Compounds (VOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Styrene | tert-Butylbenzene | Tetrachloroethene | Toluene | trans-1,2-Dichloroethene | trans-1,3-Dichloro-propene | Trichloroethene | Vinyl acetate | Vinyl chloride | Xylenes (total) |
| GNC1-BD19 | 0 | NORM | 1/28/2009 | < 0.00019 U | < 0.00011 U | < 0.000096 U | < 0.00035 U | < 0.000099 U | < 0.00011 U | < 0.00011 U | < 0.00026 U | < 0.00012 U | < 0.00025 U |
| GNC1-BD19 | 10 | NORM | 1/28/2009 | < 0.00018 U | < 0.00011 U | < 0.000093 U | < 0.00034 U | < 0.000096 U | < 0.00011 U | < 0.00011 U | < 0.00026 U | < 0.00012 U | < 0.00025 U |
| GNC1-BD20 | 0 | NORM | 1/30/2009 | < 0.00021 U | < 0.0001 U | < 0.000088 U | < 0.00033 U | < 0.000091 U | < 0.0001 U | < 0.00011 U | < 0.00024 U | < 0.00011 U | < 0.00023 U |
| GNC1-BD20 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000091 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BD21 | 0 | NORM | 1/30/2009 | < 0.0002 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BD21 | 10 | NORM | 1/30/2009 | < 0.0002 U | < 0.0001 U | < 0.000091 U | < 0.00034 U | < 0.000094 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BE19 | 0 | NORM | 2/5/2009 | < 0.00018 U | < 0.0001 UJ | < 0.00009 U | < 0.00033 U | < 0.000093 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BE19 | 10 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000096 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00025 U |
| GNC1-BE20 | 0 | NORM | 2/6/2009 | < 0.00018 U | < 0.0001 UJ | < 0.000091 U | < 0.00034 U | < 0.000094 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BE20 | 0 | FD | 2/6/2009 | < 0.00018 U | < 0.0001 UJ | < 0.000091 U | 0.00036 J+ | < 0.000094 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BE20 | 10 | NORM | 2/6/2009 | < 0.00019 U | < 0.00011 U | < 0.000095 U | < 0.00035 U | < 0.000098 U | < 0.00011 U | < 0.00011 U | < 0.00026 U | < 0.00012 U | < 0.00025 U |
| GNC1-BE21 | 0 | NORM | 2/6/2009 | < 0.00018 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BE21 | 10 | NORM | 2/6/2009 | < 0.00019 U | < 0.00011 U | < 0.000093 U | < 0.00034 U | < 0.000096 U | < 0.00011 U | < 0.00011 U | < 0.00026 U | < 0.00012 U | < 0.00025 U |
| GNC1-BE22 | 0 | NORM | 2/5/2009 | < 0.00018 U | < 0.0001 UJ | < 0.00009 U | < 0.00033 U | < 0.000093 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BE22 | 10 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BF19 | 0 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BF19 | 11 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BF20 | 0 | NORM | 2/6/2009 | < 0.00018 U | < 0.0001 U | < 0.000091 U | < 0.00034 U | < 0.000094 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BF20 | 10 | NORM | 2/6/2009 | < 0.0002 U | < 0.00011 U | < 0.000098 U | < 0.00036 U | < 0.0001 U | < 0.00011 U | < 0.00012 U | < 0.00027 U | < 0.00013 U | < 0.00026 U |
| GNC1-BF21 | 0 | NORM | 2/5/2009 | < 0.00018 U | < 0.0001 U | < 0.000091 U | < 0.00034 U | < 0.000094 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BF21 | 10 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BF22 | 0 | NORM | 2/6/2009 | < 0.00018 U | < 0.0001 UJ | < 0.00009 U | < 0.00033 U | < 0.000093 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BF22 | 10 | NORM | 2/6/2009 | < 0.00018 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BG19 | 0 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 UJ | < 0.000092 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BG19 | 10 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.000091 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BG20 | 0 | NORM | 2/5/2009 | < 0.0002 U | < 0.0001 UJ | < 0.00009 U | < 0.00033 U | < 0.000093 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BG20 | 0 | FD | 2/5/2009 | < 0.00021 U | < 0.0001 UJ | < 0.00009 U | < 0.00033 U | < 0.000093 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BG20 | 10 | NORM | 2/5/2009 | < 0.00018 U | < 0.0001 U | < 0.00009 U | < 0.00033 U | < 0.000093 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BG21 | 0 | NORM | 2/5/2009 | < 0.00018 U | < 0.0001 U | < 0.00009 U | < 0.00033 U | < 0.000093 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BG21 | 10 | NORM | 2/5/2009 | < 0.00018 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BG22 | 0 | NORM | 2/5/2009 | < 0.00018 U | < 0.0001 U | < 0.000091 U | < 0.00034 U | < 0.000094 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-BG22 | 10 | NORM | 2/5/2009 | < 0.00018 U | < 0.0001 U | < 0.000091 U | < 0.00034 U | < 0.000094 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-JD07 | 0 | NORM | 1/30/2009 | < 0.00027 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-JD07 | 10 | NORM | 1/30/2009 | < 0.00022 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000096 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00025 U |
| GNC1-JD08 | 0 | NORM | 1/30/2009 | < 0.00019 U | < 0.0001 U | < 0.000089 U | < 0.00033 U | < 0.000092 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |

**TABLE B-10**
**SOIL VOLATILE ORGANIC COMPOUNDS (VOCS) DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Depth (ft bgs) | Sample Type | Sample Date | Volatile Organic Compounds (VOCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Styrene | tert-Butylbenzene | Tetrachloroethene | Toluene | trans-1,2-Dichloroethene | trans-1,3-Dichloro-propene | Trichloroethene | Vinyl acetate | Vinyl chloride | Xylenes (total) |
| GNC1-JD08 | 10 | NORM | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-JD09 | 0 | NORM | 1/30/2009 | < 0.00021 U | < 0.00011 U | < 0.000091 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-JD09 | 0 | FD | 1/30/2009 | < 0.00019 U | < 0.00011 U | < 0.000093 U | < 0.00035 U | < 0.000097 U | < 0.00011 U | < 0.00011 U | < 0.00026 U | < 0.00012 U | < 0.00025 U |
| GNC1-JD09 | 10 | NORM | 1/30/2009 | < 0.00018 U | < 0.00011 U | < 0.000093 U | < 0.00034 U | < 0.000096 U | < 0.00011 U | < 0.00011 U | < 0.00026 U | < 0.00012 U | < 0.00025 U |
| GNC1-JD10 | 0 | NORM | 2/9/2009 | < 0.00018 U | < 0.00011 U | < 0.000093 U | < 0.00034 U | < 0.000096 U | < 0.00011 U | < 0.00011 U | < 0.00026 U | < 0.00012 U | < 0.00025 U |
| GNC1-JD10 | 11 | NORM | 2/9/2009 | < 0.00018 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000096 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00025 U |
| GNC1-JD11 | 0 | NORM | 2/9/2009 | < 0.00019 U | < 0.00011 U | < 0.000096 U | < 0.00035 U | < 0.000099 U | < 0.00011 U | < 0.00011 U | < 0.00026 U | < 0.00012 U | < 0.00025 U |
| GNC1-JD11 | 11 | NORM | 2/9/2009 | < 0.00019 U | < 0.00011 U | < 0.000097 U | < 0.00036 U | < 0.0001 U | < 0.00011 U | < 0.00012 U | < 0.00027 U | < 0.00013 U | < 0.00026 U |
| GNC1-JS09 | 0 | NORM | 1/30/2009 | < 0.00019 U | < 0.0001 U | < 0.00009 U | < 0.00033 U | < 0.000093 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-JS09 | 0 | FD | 1/30/2009 | < 0.00026 U | < 0.0001 U | < 0.000088 U | < 0.00033 U | < 0.000091 U | < 0.0001 U | < 0.0001 U | < 0.00024 U | < 0.00011 U | < 0.00023 U |
| GNC1-JS09 | 10 | NORM | 1/30/2009 | < 0.00021 U | < 0.00011 U | < 0.000093 U | < 0.00034 U | < 0.000096 U | < 0.00011 U | < 0.00011 U | < 0.00026 U | < 0.00012 U | < 0.00025 U |
| GNC1-JS10 | 0 | NORM | 1/30/2009 | < 0.00025 U | < 0.00011 U | < 0.000092 U | < 0.00034 U | < 0.000095 U | < 0.00011 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-JS10 | 10 | NORM | 1/30/2009 | < 0.00025 U | < 0.0001 U | < 0.000091 U | < 0.00034 U | < 0.000094 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-JS11 | 0 | NORM | 1/29/2009 | < 0.00018 U | < 0.0001 UJ | < 0.00009 U | < 0.00033 U | < 0.000093 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |
| GNC1-JS11 | 0 | FD | 1/29/2009 | < 0.00018 UJ | < 0.0001 UJ | < 0.00009 UJ | < 0.00033 UJ | < 0.000093 U | < 0.0001 UJ | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 UJ |
| GNC1-JS11 | 10 | NORM | 1/29/2009 | < 0.00018 U | < 0.0001 U | < 0.000091 U | < 0.00034 U | < 0.000094 U | < 0.0001 U | < 0.00011 U | < 0.00025 U | < 0.00012 U | < 0.00024 U |

All units in mg/kg.
-- = no sample data.

**TABLE B-11**
**SURFACE FLUX DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Sample Type | Sample Date | Analytical Method | Surface Flux | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1,1,1,2-Tetrachloroethane | 1,1,1-Trichloroethane | 1,1,2,2-Tetrachloroethane | 1,1,2-Trichloroethane | 1,1-Dichloroethane | 1,1-Dichloroethene | 1,1-Dichloropropene | 1,2,3-Trichloropropane | 1,2,4-Trichlorobenzene | 1,2,4-Trimethylbenzene | 1,2-Dibromoethane | 1,2-Dichlorobenzene |
| GNC1-BE20 | NORM | 2/11/2009 | TO-15 | < 0.0158 U | < 0.0142 U | < 0.0181 UJ | < 0.0142 U | < 0.0104 U | < 0.0104 U | < 0.00962 U | < 0.0135 U | < 0.0392 UJ | < 0.0258 U | < 0.0204 U | < 0.0308 UJ |
| GNC1-BE20 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00181 UJ | < 0.00142 U | -- | -- | -- | < 0.00123 UJ | -- | -- | < 0.00204 U | < 0.00154 UJ |
| GNC1-BE21 | NORM | 2/11/2009 | TO-15 | < 0.0154 U | < 0.0138 U | < 0.0177 UJ | < 0.0138 U | < 0.0104 U | < 0.01 U | < 0.00962 U | < 0.0131 U | < 0.0385 UJ | 0.0254 J | < 0.02 U | < 0.0304 UJ |
| GNC1-BE21 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00177 UJ | < 0.00138 U | -- | -- | -- | < 0.00123 UJ | -- | -- | 0.00885 J | < 0.00273 UJ |
| GNC1-BE22 | NORM | 2/11/2009 | TO-15 | < 0.0158 U | < 0.0142 U | < 0.0181 UJ | < 0.0142 U | < 0.0104 U | < 0.0104 U | < 0.00962 U | < 0.0135 U | < 0.0392 UJ | < 0.0258 U | < 0.0204 U | < 0.0308 UJ |
| GNC1-BE22 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00181 UJ | < 0.00142 UJ | -- | -- | -- | < 0.00123 UJ | -- | -- | < 0.00408 UJ | 0.00165 J |
| GNC1-BF19 | NORM | 2/11/2009 | TO-15 | < 0.0158 U | < 0.0142 U | < 0.0181 UJ | < 0.0142 U | < 0.0104 U | < 0.0104 U | < 0.00962 U | < 0.0135 UJ | < 0.0392 UJ | < 0.0258 U | < 0.0204 UJ | < 0.0308 UJ |
| GNC1-BF19 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00181 UJ | < 0.00142 UJ | -- | -- | -- | < 0.00123 UJ | -- | -- | < 0.00204 UJ | 0.00319 J |
| GNC1-BF20 | NORM | 2/11/2009 | TO-15 | < 0.0162 U | < 0.0146 U | < 0.0185 UJ | < 0.0146 U | < 0.0108 U | < 0.0108 U | < 0.01 U | < 0.0138 U | < 0.0408 UJ | < 0.0265 U | < 0.0212 U | < 0.0319 UJ |
| GNC1-BF20 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00185 UJ | < 0.00146 UJ | -- | -- | -- | < 0.00127 UJ | -- | -- | < 0.00212 UJ | < 0.00162 UJ |
| GNC1-BF21 | NORM | 2/11/2009 | TO-15 | < 0.0158 U | < 0.0142 U | < 0.0181 UJ | < 0.0142 U | < 0.0104 U | < 0.0104 U | < 0.01 U | < 0.0135 U | < 0.0396 UJ | < 0.0258 U | < 0.0208 U | < 0.0312 UJ |
| GNC1-BF21 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00181 UJ | < 0.00142 UJ | -- | -- | -- | < 0.00123 UJ | -- | -- | < 0.00208 UJ | < 0.00154 UJ |
| GNC1-BF22 | NORM | 2/11/2009 | TO-15 | < 0.0162 U | < 0.0146 U | < 0.0185 UJ | < 0.0146 U | < 0.0108 U | < 0.0104 U | < 0.01 U | < 0.0138 U | < 0.0404 UJ | < 0.0265 U | < 0.0212 U | < 0.0319 UJ |
| GNC1-BF22 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00185 UJ | < 0.00146 U | -- | -- | -- | < 0.00127 UJ | -- | -- | < 0.00212 U | < 0.00158 UJ |
| GNC1-BG19 | NORM | 2/11/2009 | TO-15 | < 0.0154 UJ | < 0.0142 UJ | < 0.0177 UJ | < 0.0142 UJ | < 0.0104 UJ | < 0.01 UJ | < 0.00962 UJ | < 0.0131 UJ | < 0.0388 UJ | < 0.0254 UJ | < 0.0204 UJ | < 0.0304 UJ |
| GNC1-BG19 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00177 UJ | < 0.00142 U | -- | -- | -- | < 0.00123 UJ | -- | -- | < 0.00204 U | < 0.00154 UJ |
| GNC1-BG20 | NORM | 2/11/2009 | TO-15 | < 0.0158 UJ | < 0.0146 UJ | < 0.0181 UJ | < 0.0146 UJ | < 0.0108 UJ | < 0.0104 UJ | < 0.01 UJ | < 0.0135 UJ | < 0.0396 UJ | < 0.0262 UJ | < 0.0208 UJ | < 0.0312 UJ |
| GNC1-BG20 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00181 UJ | < 0.00146 U | -- | -- | -- | < 0.00127 UJ | -- | -- | < 0.00208 U | < 0.00158 UJ |
| GNC1-BG21 | NORM | 2/11/2009 | TO-15 | < 0.015 UJ | < 0.0138 UJ | < 0.0173 UJ | < 0.0138 UJ | < 0.01 UJ | < 0.01 UJ | < 0.00962 UJ | < 0.0127 UJ | < 0.0381 UJ | < 0.025 UJ | < 0.02 UJ | < 0.03 UJ |
| GNC1-BG21 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00173 UJ | < 0.00138 U | -- | -- | -- | < 0.00119 UJ | -- | -- | < 0.002 U | < 0.0015 UJ |
| GNC1-BG22 | NORM | 2/11/2009 | TO-15 | < 0.0154 UJ | < 0.0138 UJ | < 0.0177 UJ | < 0.0138 UJ | < 0.0104 UJ | < 0.01 UJ | < 0.00962 UJ | < 0.0131 UJ | < 0.0385 UJ | < 0.0254 UJ | < 0.02 UJ | < 0.0304 UJ |
| GNC1-BG22 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00177 UJ | < 0.00138 U | -- | -- | -- | < 0.00123 UJ | -- | -- | < 0.002 U | < 0.0015 UJ |
| GNC1-JD09 | NORM | 2/11/2009 | TO-15 | < 0.0154 U | < 0.0138 U | < 0.0177 UJ | < 0.0138 U | < 0.0104 U | < 0.01 U | < 0.00962 U | < 0.0131 U | < 0.0385 UJ | < 0.0254 U | < 0.02 U | < 0.0304 UJ |
| GNC1-JD09 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00177 UJ | < 0.00138 UJ | -- | -- | -- | < 0.00123 UJ | -- | -- | < 0.002 UJ | < 0.0015 UJ |
| GNC1-JS09 | NORM | 2/12/2009 | TO-15 | < 0.0231 U | < 0.0212 U | < 0.0265 UJ | < 0.0212 U | < 0.0154 U | < 0.0154 U | < 0.0146 U | < 0.0196 U | < 0.0581 UJ | < 0.0381 U | < 0.0304 U | < 0.0458 U |
| GNC1-JS09 | NORM | 2/12/2009 | TO-15 SIM | -- | -- | < 0.00185 UJ | < 0.00146 UJ | -- | -- | -- | < 0.00127 UJ | -- | -- | < 0.00212 UJ | < 0.00162 UJ |
| GNC1-JS10 | NORM | 2/12/2009 | TO-15 | < 0.0154 U | < 0.0142 U | < 0.0177 UJ | < 0.0142 U | < 0.0104 U | < 0.01 U | < 0.00962 U | < 0.0131 U | < 0.0388 UJ | 0.0562 J- | < 0.0204 U | < 0.0304 UJ |
| GNC1-JS10 | NORM | 2/12/2009 | TO-15 SIM | -- | -- | < 0.00177 UJ | < 0.00142 UJ | -- | -- | -- | < 0.00123 UJ | -- | -- | < 0.00204 UJ | < 0.00154 UJ |
| GNC1-JS11 | NORM | 2/12/2009 | TO-15 | < 0.0158 U | < 0.0142 U | < 0.0181 UJ | < 0.0142 U | < 0.0104 U | < 0.0104 U | < 0.00962 U | < 0.0135 U | < 0.0392 UJ | 0.0527 J- | < 0.0204 U | < 0.0308 UJ |
| GNC1-JS11 | NORM | 2/12/2009 | TO-15 SIM | -- | -- | < 0.00181 UJ | < 0.00142 U | -- | -- | -- | < 0.00123 UJ | -- | -- | < 0.00204 U | < 0.00154 UJ |
| GNC1-JS11R | FD | 2/12/2009 | TO-15 | < 0.0154 U | < 0.0142 U | < 0.0177 UJ | < 0.0142 U | < 0.0104 U | < 0.01 U | < 0.00962 U | < 0.0131 U | < 0.0388 UJ | 0.0742 J- | < 0.0204 U | < 0.0304 UJ |
| GNC1-JS11R | FD | 2/12/2009 | TO-15 SIM | -- | -- | < 0.00465 UJ | < 0.00442 U | -- | -- | -- | < 0.00123 UJ | -- | -- | < 0.00969 U | < 0.00231 UJ |

All units in $\mu g/m^2,min^{-1}$.
-- = no sample data.

**TABLE B-11**
**SURFACE FLUX DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Sample Type | Sample Date | Analytical Method | Surface Flux | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1,2-Dichloroethane | 1,2-Dichloropropane | 1,3,5-Trimethylbenzene | 1,3-Dichlorobenzene | 1,3-Dichloropropane | 1,4-Dichlorobenzene | 1,4-Dioxane | 2,2-Dichloropropane | 2-Hexanone | 2-Methyl-1-propanol | 4-Methyl-2-pentanone (MIBK) | Acetone |
| GNC1-BE20 | NORM | 2/11/2009 | TO-15 | < 0.0108 U | < 0.0123 U | < 0.0265 U | < 0.0315 U | < 0.01 U | < 0.0315 U | 0.0177 J | < 0.0108 U | 0.01 J | < 0.0192 UJ | < 0.00962 U | 0.247 J |
| GNC1-BE20 | NORM | 2/11/2009 | TO-15 SIM | < 0.00108 U | < 0.00123 U | -- | < 0.00158 UJ | -- | < 0.00158 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-BE21 | NORM | 2/11/2009 | TO-15 | < 0.0104 U | < 0.0119 U | < 0.0262 U | < 0.0308 U | < 0.00962 U | < 0.0308 U | < 0.00808 U | < 0.0108 U | < 0.00923 U | < 0.0188 UJ | < 0.00962 U | 0.206 J |
| GNC1-BE21 | NORM | 2/11/2009 | TO-15 SIM | < 0.00108 U | < 0.00123 U | -- | < 0.00331 UJ | -- | < 0.00315 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-BE22 | NORM | 2/11/2009 | TO-15 | < 0.0108 U | < 0.0123 U | < 0.0265 U | < 0.0315 U | < 0.01 U | < 0.0315 U | < 0.00808 U | < 0.0108 U | < 0.00923 U | < 0.0192 UJ | < 0.00962 U | 0.0273 J |
| GNC1-BE22 | NORM | 2/11/2009 | TO-15 SIM | 0.00196 J | 0.00135 J | -- | 0.00208 J | -- | 0.00235 J | -- | -- | -- | -- | -- | -- |
| GNC1-BF19 | NORM | 2/11/2009 | TO-15 | < 0.0108 U | < 0.0123 U | < 0.0265 U | < 0.0315 U | < 0.01 U | < 0.0315 U | < 0.00808 U | < 0.0108 UJ | 0.0288 J | < 0.0192 UJ | 0.0131 J | 0.123 J |
| GNC1-BF19 | NORM | 2/11/2009 | TO-15 SIM | < 0.00108 UJ | < 0.00123 UJ | -- | < 0.00158 UJ | -- | < 0.00158 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-BF20 | NORM | 2/11/2009 | TO-15 | < 0.0112 U | < 0.0127 U | < 0.0277 U | < 0.0327 U | < 0.0104 U | < 0.0327 U | < 0.00846 U | < 0.0112 U | < 0.00962 U | < 0.02 UJ | < 0.01 U | < 0.00577 UJ |
| GNC1-BF20 | NORM | 2/11/2009 | TO-15 SIM | < 0.00112 UJ | < 0.00127 UJ | -- | < 0.00162 UJ | -- | < 0.00162 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-BF21 | NORM | 2/11/2009 | TO-15 | < 0.0108 U | < 0.0123 U | < 0.0269 U | < 0.0315 U | < 0.01 U | < 0.0315 U | < 0.00808 U | < 0.0108 U | < 0.00923 U | < 0.0192 UJ | < 0.00962 U | 0.111 J |
| GNC1-BF21 | NORM | 2/11/2009 | TO-15 SIM | < 0.00108 UJ | < 0.00123 UJ | -- | < 0.00158 UJ | -- | < 0.00158 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-BF22 | NORM | 2/11/2009 | TO-15 | < 0.0112 U | < 0.0127 U | < 0.0277 U | < 0.0323 U | < 0.01 U | < 0.0323 U | < 0.00846 U | < 0.0112 U | 0.0131 J | < 0.0196 UJ | < 0.01 U | 0.181 J |
| GNC1-BF22 | NORM | 2/11/2009 | TO-15 SIM | < 0.00112 U | < 0.00127 U | -- | < 0.00162 UJ | -- | < 0.00162 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-BG19 | NORM | 2/11/2009 | TO-15 | < 0.0108 UJ | < 0.0119 UJ | < 0.0265 UJ | < 0.0312 UJ | < 0.00962 UJ | < 0.0312 UJ | < 0.00808 UJ | < 0.0108 UJ | < 0.00923 UJ | < 0.0188 UJ | < 0.00962 UJ | 0.0477 J |
| GNC1-BG19 | NORM | 2/11/2009 | TO-15 SIM | < 0.00108 U | < 0.00123 U | -- | < 0.00158 UJ | -- | < 0.00158 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-BG20 | NORM | 2/11/2009 | TO-15 | < 0.0108 UJ | < 0.0123 UJ | < 0.0269 UJ | < 0.0319 UJ | < 0.01 UJ | < 0.0319 UJ | < 0.00808 UJ | < 0.0108 UJ | < 0.00923 UJ | < 0.0192 UJ | < 0.00962 UJ | < 0.0469 UJ |
| GNC1-BG20 | NORM | 2/11/2009 | TO-15 SIM | < 0.00108 U | < 0.00127 U | -- | < 0.00158 UJ | -- | < 0.00158 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-BG21 | NORM | 2/11/2009 | TO-15 | < 0.0104 UJ | < 0.0119 UJ | < 0.0258 UJ | < 0.0304 UJ | < 0.00962 UJ | < 0.0304 UJ | < 0.00769 UJ | < 0.0104 UJ | < 0.00885 UJ | < 0.0185 UJ | < 0.00923 UJ | < 0.0265 UJ |
| GNC1-BG21 | NORM | 2/11/2009 | TO-15 SIM | < 0.00104 U | < 0.00119 U | -- | < 0.00154 UJ | -- | < 0.00154 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-BG22 | NORM | 2/11/2009 | TO-15 | < 0.0104 UJ | < 0.0119 UJ | < 0.0262 UJ | < 0.0308 UJ | < 0.00962 UJ | < 0.0308 UJ | < 0.00808 UJ | < 0.0108 UJ | < 0.00923 UJ | < 0.0188 UJ | < 0.00962 UJ | 0.0627 J |
| GNC1-BG22 | NORM | 2/11/2009 | TO-15 SIM | < 0.00108 U | < 0.00123 U | -- | < 0.00154 UJ | -- | < 0.00154 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-JD09 | NORM | 2/11/2009 | TO-15 | < 0.0104 U | < 0.0119 U | < 0.0262 U | < 0.0308 U | < 0.00962 U | < 0.0308 U | < 0.00808 U | < 0.0108 U | < 0.00923 U | < 0.0188 UJ | < 0.00962 U | < 0.00538 UJ |
| GNC1-JD09 | NORM | 2/11/2009 | TO-15 SIM | < 0.00108 UJ | < 0.00123 UJ | -- | < 0.00154 UJ | -- | < 0.00154 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-JS09 | NORM | 2/12/2009 | TO-15 | < 0.0158 U | < 0.0181 U | < 0.0396 U | < 0.0465 U | < 0.0146 U | < 0.0465 U | < 0.0119 U | < 0.0162 U | < 0.0138 U | < 0.0285 UJ | < 0.0142 U | < 0.00808 UJ |
| GNC1-JS09 | NORM | 2/12/2009 | TO-15 SIM | < 0.00112 UJ | < 0.00127 UJ | -- | < 0.00162 UJ | -- | < 0.00162 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-JS10 | NORM | 2/12/2009 | TO-15 | < 0.0108 U | < 0.0119 U | < 0.0265 U | < 0.0312 UJ | < 0.00962 U | < 0.0312 UJ | < 0.00808 U | < 0.0108 U | < 0.00923 U | 0.0488 J- | < 0.00962 U | < 0.00538 UJ |
| GNC1-JS10 | NORM | 2/12/2009 | TO-15 SIM | < 0.00108 UJ | < 0.00123 UJ | -- | < 0.00158 UJ | -- | < 0.00158 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-JS11 | NORM | 2/12/2009 | TO-15 | < 0.0108 U | < 0.0123 U | < 0.0265 U | < 0.0315 UJ | < 0.01 U | < 0.0315 UJ | < 0.00808 U | < 0.0108 U | < 0.00923 U | < 0.0192 UJ | < 0.00962 U | < 0.0858 UJ |
| GNC1-JS11 | NORM | 2/12/2009 | TO-15 SIM | < 0.00108 U | < 0.00123 U | -- | < 0.00158 UJ | -- | < 0.00158 UJ | -- | -- | -- | -- | -- | -- |
| GNC1-JS11R | FD | 2/12/2009 | TO-15 | < 0.0108 U | < 0.0119 U | < 0.0265 U | < 0.0312 UJ | < 0.00962 U | < 0.0312 UJ | < 0.00808 U | < 0.0108 U | < 0.00923 U | < 0.0188 UJ | < 0.00962 U | < 0.00538 UJ |
| GNC1-JS11R | FD | 2/12/2009 | TO-15 SIM | < 0.00108 U | < 0.00123 U | -- | < 0.00281 UJ | -- | < 0.00319 UJ | -- | -- | -- | -- | -- | -- |

All units in $\mu g/m^2,min^{-1}$.
-- = no sample data.

**TABLE B-11**
**SURFACE FLUX DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 3 of 6)**

| Sample ID | Sample Type | Sample Date | Analytical Method | Surface Flux | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Acetonitrile | Benzene | Benzyl chloride | Bromodichloromethane | Bromoform | Bromomethane | Carbon disulfide | Carbon tetrachloride | Chlorobenzene | Chlorobromomethane | Chloroethane | Chloroform |
| GNC1-BE20 | NORM | 2/11/2009 | TO-15 | 0.0577 | < 0.055 U | < 0.0238 UJ | < 0.0138 U | < 0.0246 U | < 0.0104 U | 0.0385 J | < 0.0165 U | < 0.0119 U | < 0.0115 U | 0.112 J+ | < 0.0127 U |
| GNC1-BE20 | NORM | 2/11/2009 | TO-15 SIM | -- | 0.00581 | < 0.001 UJ | < 0.00115 U | -- | -- | -- | 0.0055 J | -- | -- | -- | 0.0207 |
| GNC1-BE21 | NORM | 2/11/2009 | TO-15 | < 0.0104 U | < 0.0677 UJ | < 0.0235 U | < 0.0135 U | < 0.0242 U | < 0.01 U | < 0.00692 UJ | < 0.0162 U | < 0.0119 U | < 0.0115 U | < 0.00692 U | < 0.0127 U |
| GNC1-BE21 | NORM | 2/11/2009 | TO-15 SIM | -- | 0.00912 | < 0.001 UJ | < 0.00115 U | -- | -- | -- | 0.00881 | -- | -- | -- | 0.0155 |
| GNC1-BE22 | NORM | 2/11/2009 | TO-15 | < 0.0104 U | < 0.0154 UJ | < 0.0238 U | < 0.0138 U | < 0.0246 U | < 0.0104 U | < 0.00692 UJ | < 0.0165 U | < 0.0119 U | < 0.0115 U | < 0.00692 U | < 0.0127 U |
| GNC1-BE22 | NORM | 2/11/2009 | TO-15 SIM | -- | 0.00331 J | < 0.001 UJ | < 0.00115 UJ | -- | -- | -- | 0.00323 J | -- | -- | -- | 0.00773 J |
| GNC1-BF19 | NORM | 2/11/2009 | TO-15 | 0.015 J | < 0.0412 U | < 0.0238 UJ | < 0.0138 U | < 0.0246 UJ | < 0.0104 UJ | 0.0269 J | < 0.0165 U | < 0.0119 U | < 0.0115 U | < 0.00692 UJ | 0.0177 J |
| GNC1-BF19 | NORM | 2/11/2009 | TO-15 SIM | -- | 0.00612 J | < 0.001 UJ | < 0.00115 UJ | -- | -- | -- | 0.00838 J | -- | -- | -- | 0.029 J |
| GNC1-BF20 | NORM | 2/11/2009 | TO-15 | < 0.0108 U | < 0.0569 U | < 0.0246 UJ | < 0.0142 U | < 0.0254 U | < 0.0108 U | < 0.00731 UJ | < 0.0169 U | < 0.0123 U | < 0.0119 U | < 0.00731 U | < 0.0131 U |
| GNC1-BF20 | NORM | 2/11/2009 | TO-15 SIM | -- | 0.00431 J | < 0.00104 UJ | < 0.00123 UJ | -- | -- | -- | 0.00542 J | -- | -- | -- | 0.0275 J |
| GNC1-BF21 | NORM | 2/11/2009 | TO-15 | < 0.0108 U | < 0.0369 U | < 0.0242 UJ | < 0.0138 U | < 0.025 U | < 0.0104 U | < 0.00731 UJ | < 0.0165 U | < 0.0123 U | < 0.0119 U | < 0.00692 U | < 0.0127 U |
| GNC1-BF21 | NORM | 2/11/2009 | TO-15 SIM | -- | 0.0162 J | < 0.001 UJ | < 0.00119 UJ | -- | -- | -- | 0.00554 J | -- | -- | -- | 0.00519 J |
| GNC1-BF22 | NORM | 2/11/2009 | TO-15 | 0.0419 J | < 0.0769 U | < 0.0246 UJ | < 0.0142 U | < 0.0254 U | < 0.0108 U | 0.0319 J | < 0.0169 U | < 0.0123 U | < 0.0119 U | 0.132 J+ | < 0.0131 U |
| GNC1-BF22 | NORM | 2/11/2009 | TO-15 SIM | -- | 0.0117 | < 0.00104 UJ | < 0.00119 U | -- | -- | -- | 0.00962 | -- | -- | -- | 0.0283 |
| GNC1-BG19 | NORM | 2/11/2009 | TO-15 | < 0.0104 UJ | < 0.00923 UJ | < 0.0238 UJ | < 0.0135 UJ | < 0.0246 UJ | < 0.0104 UJ | < 0.00692 UJ | < 0.0162 UJ | < 0.0119 UJ | < 0.0115 UJ | < 0.00692 UJ | < 0.0127 UJ |
| GNC1-BG19 | NORM | 2/11/2009 | TO-15 SIM | -- | 0.0115 | < 0.001 UJ | < 0.00115 U | -- | -- | -- | 0.00892 | -- | -- | -- | 0.0215 |
| GNC1-BG20 | NORM | 2/11/2009 | TO-15 | < 0.0108 UJ | < 0.01 UJ | < 0.0242 UJ | < 0.0138 UJ | < 0.025 UJ | < 0.0104 UJ | < 0.00731 UJ | < 0.0165 UJ | < 0.0123 UJ | < 0.0119 UJ | < 0.00731 UJ | < 0.0131 UJ |
| GNC1-BG20 | NORM | 2/11/2009 | TO-15 SIM | -- | 0.0105 | < 0.00104 UJ | < 0.00119 U | -- | -- | -- | 0.0167 | -- | -- | -- | 0.0204 |
| GNC1-BG21 | NORM | 2/11/2009 | TO-15 | < 0.01 UJ | < 0.00962 UJ | < 0.0231 UJ | < 0.0135 UJ | < 0.0238 UJ | < 0.01 UJ | 0.00846 J | < 0.0158 UJ | < 0.0115 UJ | < 0.0112 UJ | < 0.00692 UJ | < 0.0123 UJ |
| GNC1-BG21 | NORM | 2/11/2009 | TO-15 SIM | -- | 0.00954 | < 0.000962 UJ | < 0.00112 U | -- | -- | -- | 0.00908 | -- | -- | -- | 0.0287 |
| GNC1-BG22 | NORM | 2/11/2009 | TO-15 | < 0.0104 UJ | < 0.00846 UJ | < 0.0235 UJ | < 0.0135 UJ | < 0.0242 UJ | < 0.01 UJ | 0.0131 J | < 0.0162 UJ | < 0.0119 UJ | < 0.0115 UJ | < 0.00692 UJ | < 0.0127 UJ |
| GNC1-BG22 | NORM | 2/11/2009 | TO-15 SIM | -- | < 0.000846 U | < 0.001 UJ | < 0.00115 U | -- | -- | -- | 0.00604 J | -- | -- | -- | 0.017 |
| GNC1-JD09 | NORM | 2/11/2009 | TO-15 | < 0.0104 U | < 0.03 UJ | < 0.0235 U | < 0.0135 U | < 0.0242 U | < 0.01 U | < 0.00692 UJ | < 0.0162 U | < 0.0119 U | < 0.0115 U | < 0.00692 U | < 0.0127 U |
| GNC1-JD09 | NORM | 2/11/2009 | TO-15 SIM | -- | 0.00365 J | < 0.001 UJ | < 0.00115 UJ | -- | -- | -- | 0.00827 J | -- | -- | -- | 0.00412 J |
| GNC1-JS09 | NORM | 2/12/2009 | TO-15 | < 0.0158 U | < 0.0381 U | < 0.0354 UJ | < 0.0204 U | < 0.0365 U | < 0.0154 U | 0.0123 J | < 0.0242 U | < 0.0177 U | < 0.0173 U | < 0.0104 U | 0.02 J |
| GNC1-JS09 | NORM | 2/12/2009 | TO-15 SIM | -- | 0.00477 J | < 0.00104 UJ | < 0.00123 UJ | -- | -- | -- | 0.0108 J | -- | -- | -- | 0.0333 J |
| GNC1-JS10 | NORM | 2/12/2009 | TO-15 | < 0.0104 U | < 0.00846 U | < 0.0238 UJ | < 0.0135 U | < 0.0246 U | < 0.0104 U | < 0.00692 UJ | < 0.0162 U | < 0.0119 U | < 0.0115 U | < 0.00692 U | < 0.0127 U |
| GNC1-JS10 | NORM | 2/12/2009 | TO-15 SIM | -- | 0.00412 J | < 0.001 UJ | < 0.00115 UJ | -- | -- | -- | 0.00269 J | -- | -- | -- | 0.00985 J |
| GNC1-JS11 | NORM | 2/12/2009 | TO-15 | < 0.015 U | < 0.13 UJ | < 0.0238 UJ | < 0.0138 U | < 0.0246 U | < 0.0104 U | 0.0281 J | < 0.0165 U | < 0.0119 U | < 0.0115 U | 0.0338 J | < 0.0127 U |
| GNC1-JS11 | NORM | 2/12/2009 | TO-15 SIM | -- | 0.00412 J | < 0.001 UJ | < 0.00115 U | -- | -- | -- | 0.00527 J | -- | -- | -- | 0.00781 |
| GNC1-JS11R | FD | 2/12/2009 | TO-15 | < 0.0104 U | < 0.0923 UJ | < 0.0238 UJ | < 0.0135 U | < 0.0246 U | < 0.0104 U | < 0.00692 UJ | 0.0188 J | < 0.0119 U | < 0.0115 U | < 0.00692 U | < 0.0127 U |
| GNC1-JS11R | FD | 2/12/2009 | TO-15 SIM | -- | 0.0065 | < 0.001 UJ | < 0.00115 U | -- | -- | -- | 0.00419 J | -- | -- | -- | 0.00885 |

All units in $\mu g/m^2,min^{-1}$.
-- = no sample data.

**TABLE B-11**
**SURFACE FLUX DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Sample Type | Sample Date | Analytical Method | Surface Flux | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Chloromethane | cis-1,2-Dichloroethene | cis-1,3-Dichloropropene | Cymene (Isopropyltoluene) | Dibromochloromethane | Dibromochloropropane | Dibromomethane | Dichloromethane (Methylene chloride) | Ethanol | Ethylbenzene | Freon-11 (Trichlorofluoromethane) | Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane) |
| GNC1-BE20 | NORM | 2/11/2009 | TO-15 | < 0.00538 U | < 0.0104 U | < 0.0123 U | < 0.0258 UJ | < 0.0192 U | < 0.119 UJ | < 0.0162 U | 0.0162 J | 0.17 J | < 0.0115 U | 0.0265 J | < 0.02 U |
| GNC1-BE20 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00162 U | < 0.00531 UJ | -- | < 0.000923 U | -- | -- | -- | -- |
| GNC1-BE21 | NORM | 2/11/2009 | TO-15 | < 0.00538 U | < 0.0104 U | < 0.0123 U | < 0.025 U | < 0.0192 U | < 0.117 UJ | < 0.0158 U | 0.239 | < 0.0115 UJ | 0.0196 J | < 0.0146 U | < 0.0196 U |
| GNC1-BE21 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00158 U | < 0.00523 UJ | -- | < 0.000923 U | -- | -- | -- | -- |
| GNC1-BE22 | NORM | 2/11/2009 | TO-15 | < 0.00538 U | < 0.0104 U | < 0.0123 U | < 0.0258 U | < 0.0192 U | < 0.119 UJ | < 0.0162 U | < 0.00923 U | < 0.0119 UJ | < 0.0115 U | < 0.015 U | < 0.02 U |
| GNC1-BE22 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00162 UJ | < 0.00531 UJ | -- | < 0.000923 UJ | -- | -- | -- | -- |
| GNC1-BF19 | NORM | 2/11/2009 | TO-15 | < 0.00538 U | < 0.0104 U | < 0.0123 UJ | < 0.0258 UJ | < 0.0192 U | < 0.119 UJ | < 0.0162 U | < 0.00923 U | 0.0304 J | < 0.0115 U | < 0.015 U | < 0.02 U |
| GNC1-BF19 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00162 UJ | < 0.00531 UJ | -- | < 0.000923 UJ | -- | -- | -- | -- |
| GNC1-BF20 | NORM | 2/11/2009 | TO-15 | < 0.00577 U | < 0.0108 U | < 0.0127 U | < 0.0265 UJ | < 0.02 U | < 0.123 UJ | < 0.0165 U | < 0.00962 U | < 0.0123 UJ | < 0.0119 U | < 0.0154 U | < 0.0208 U |
| GNC1-BF20 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00169 UJ | < 0.0055 UJ | -- | < 0.000962 UJ | -- | -- | -- | -- |
| GNC1-BF21 | NORM | 2/11/2009 | TO-15 | < 0.00538 U | < 0.0104 U | < 0.0123 U | < 0.0258 UJ | < 0.0196 U | < 0.12 UJ | < 0.0162 U | < 0.00923 U | < 0.0119 UJ | < 0.0115 U | < 0.015 U | < 0.02 U |
| GNC1-BF21 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00162 UJ | < 0.00535 UJ | -- | < 0.000923 UJ | -- | -- | -- | -- |
| GNC1-BF22 | NORM | 2/11/2009 | TO-15 | < 0.00538 U | < 0.0108 U | < 0.0127 U | < 0.0265 UJ | < 0.02 U | < 0.123 UJ | < 0.0165 U | < 0.00962 U | 0.0646 J | < 0.0119 U | 0.0304 J | < 0.0208 U |
| GNC1-BF22 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00165 U | < 0.00546 UJ | -- | < 0.000962 U | -- | -- | -- | -- |
| GNC1-BG19 | NORM | 2/11/2009 | TO-15 | < 0.00538 UJ | < 0.0104 UJ | < 0.0123 UJ | < 0.0254 UJ | < 0.0192 UJ | < 0.118 UJ | < 0.0158 UJ | < 0.00923 UJ | < 0.0115 UJ | < 0.0115 UJ | < 0.015 UJ | < 0.02 UJ |
| GNC1-BG19 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00162 U | < 0.00527 UJ | -- | < 0.000923 U | -- | -- | -- | -- |
| GNC1-BG20 | NORM | 2/11/2009 | TO-15 | < 0.00538 UJ | < 0.0108 UJ | < 0.0127 UJ | < 0.0262 UJ | < 0.0196 UJ | < 0.121 UJ | < 0.0162 UJ | < 0.00923 UJ | < 0.0119 UJ | < 0.0119 UJ | < 0.0154 UJ | < 0.0204 UJ |
| GNC1-BG20 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00165 U | < 0.00538 UJ | -- | < 0.000923 U | -- | -- | -- | -- |
| GNC1-BG21 | NORM | 2/11/2009 | TO-15 | < 0.00538 UJ | < 0.01 UJ | < 0.0119 UJ | < 0.0246 UJ | < 0.0188 UJ | < 0.115 UJ | < 0.0154 UJ | < 0.00885 UJ | < 0.0115 UJ | < 0.0112 UJ | < 0.0146 UJ | < 0.0192 UJ |
| GNC1-BG21 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00158 U | < 0.00512 UJ | -- | < 0.000885 U | -- | -- | -- | -- |
| GNC1-BG22 | NORM | 2/11/2009 | TO-15 | < 0.00538 UJ | < 0.0104 UJ | < 0.0123 UJ | < 0.025 UJ | < 0.0192 UJ | < 0.117 UJ | < 0.0158 UJ | < 0.00923 UJ | < 0.0115 UJ | < 0.0115 UJ | < 0.0146 UJ | < 0.0196 UJ |
| GNC1-BG22 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00158 U | < 0.00523 UJ | -- | < 0.000923 U | -- | -- | -- | -- |
| GNC1-JD09 | NORM | 2/11/2009 | TO-15 | < 0.00538 U | < 0.0104 U | < 0.0123 U | < 0.025 U | < 0.0192 U | < 0.117 UJ | < 0.0158 U | < 0.00923 U | < 0.0115 UJ | < 0.0115 U | < 0.0146 U | < 0.0196 U |
| GNC1-JD09 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00158 UJ | < 0.00523 UJ | -- | < 0.000923 UJ | -- | -- | -- | -- |
| GNC1-JS09 | NORM | 2/12/2009 | TO-15 | < 0.00808 U | < 0.0154 U | < 0.0185 U | < 0.0381 U | < 0.0288 U | < 0.176 UJ | < 0.0238 U | < 0.0138 U | < 0.0173 UJ | < 0.0173 U | < 0.0223 U | < 0.0296 U |
| GNC1-JS09 | NORM | 2/12/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00169 UJ | < 0.0055 UJ | -- | < 0.000962 UJ | -- | -- | -- | -- |
| GNC1-JS10 | NORM | 2/12/2009 | TO-15 | < 0.00538 U | < 0.0104 U | < 0.0123 U | < 0.0254 U | < 0.0192 U | < 0.118 UJ | < 0.0158 U | < 0.00923 U | < 0.0115 UJ | 0.0154 J | < 0.015 U | < 0.02 U |
| GNC1-JS10 | NORM | 2/12/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00162 UJ | < 0.00527 UJ | -- | < 0.000923 UJ | -- | -- | -- | -- |
| GNC1-JS11 | NORM | 2/12/2009 | TO-15 | 0.0169 J | < 0.0104 U | < 0.0123 U | < 0.0258 U | < 0.0192 U | < 0.119 UJ | < 0.0162 U | < 0.00923 U | < 0.0119 UJ | 0.0177 J | 0.0196 J | < 0.02 U |
| GNC1-JS11 | NORM | 2/12/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00162 U | < 0.00531 UJ | -- | < 0.000923 U | -- | -- | -- | -- |
| GNC1-JS11R | FD | 2/12/2009 | TO-15 | < 0.00538 U | < 0.0104 U | < 0.0123 U | < 0.0254 U | < 0.0192 U | < 0.118 UJ | < 0.0158 U | < 0.00923 U | < 0.0115 UJ | 0.0269 J | < 0.015 U | < 0.02 U |
| GNC1-JS11R | FD | 2/12/2009 | TO-15 SIM | -- | -- | -- | -- | < 0.00162 U | < 0.00527 UJ | -- | 0.00408 J | -- | -- | -- | -- |

All units in $\mu g/m^2,min^{-1}$.
-- = no sample data.

**TABLE B-11**
**SURFACE FLUX DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Sample ID | Sample Type | Sample Date | Analytical Method | Surface Flux | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Freon-12 (Dichloro-difluoromethane) | Heptane | Hexachlorobutadiene | Isopropylbenzene | m & p-Xylenes | Methyl ethyl ketone (2-Butanone) | Methyl iodide | MTBE (Methyl tert-butyl ether) | Naphthalene | n-Butylbenzene | n-Propylbenzene | o-Xylene |
| GNC1-BE20 | NORM | 2/11/2009 | TO-15 | 0.04 J | < 0.00885 U | < 0.0562 UJ | < 0.0119 U | 0.0246 J | 0.085 | < 0.0304 U | < 0.00731 U | -- | < 0.0258 UJ | < 0.0108 U | < 0.0115 U |
| GNC1-BE20 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00285 UJ | -- | -- | -- | -- | -- | < 0.00288 UJ | -- | -- | -- |
| GNC1-BE21 | NORM | 2/11/2009 | TO-15 | < 0.0131 U | < 0.00885 U | < 0.0554 UJ | < 0.0119 U | 0.0708 J | < 0.00654 U | < 0.03 U | < 0.00692 U | -- | < 0.0254 U | < 0.0104 U | 0.0281 J |
| GNC1-BE21 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00281 UJ | -- | -- | -- | -- | -- | < 0.00285 UJ | -- | -- | -- |
| GNC1-BE22 | NORM | 2/11/2009 | TO-15 | < 0.0135 U | < 0.00885 U | < 0.0562 UJ | < 0.0119 U | < 0.0231 U | < 0.00654 U | < 0.0304 U | < 0.00731 U | -- | < 0.0258 U | < 0.0108 U | < 0.0115 U |
| GNC1-BE22 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00285 UJ | -- | -- | -- | -- | -- | < 0.00288 UJ | -- | -- | -- |
| GNC1-BF19 | NORM | 2/11/2009 | TO-15 | < 0.0135 U | < 0.00885 U | < 0.0562 UJ | < 0.0119 U | < 0.0231 U | 0.101 J- | < 0.0304 UJ | < 0.00731 U | -- | < 0.0258 UJ | < 0.0108 U | 0.0146 J |
| GNC1-BF19 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00285 UJ | -- | -- | -- | -- | -- | < 0.00288 UJ | -- | -- | -- |
| GNC1-BF20 | NORM | 2/11/2009 | TO-15 | < 0.0138 U | < 0.00923 U | < 0.0585 UJ | < 0.0123 U | 0.0277 J | < 0.00692 U | < 0.0315 U | < 0.00731 U | -- | < 0.0269 UJ | < 0.0112 U | < 0.0119 U |
| GNC1-BF20 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00296 UJ | -- | -- | -- | -- | -- | < 0.003 UJ | -- | -- | -- |
| GNC1-BF21 | NORM | 2/11/2009 | TO-15 | < 0.0135 U | < 0.00885 U | < 0.0565 UJ | < 0.0119 U | < 0.0231 U | < 0.00654 U | < 0.0308 U | < 0.00731 U | -- | < 0.0262 UJ | < 0.0108 U | < 0.0115 U |
| GNC1-BF21 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00285 UJ | -- | -- | -- | -- | -- | < 0.00288 UJ | -- | -- | -- |
| GNC1-BF22 | NORM | 2/11/2009 | TO-15 | 0.0608 J | < 0.00923 U | < 0.0581 UJ | 0.0515 J | 0.0246 J | 0.02 J | < 0.0315 U | < 0.00731 U | -- | < 0.0265 UJ | < 0.0108 U | < 0.0115 U |
| GNC1-BF22 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00292 UJ | -- | -- | -- | -- | -- | < 0.00296 UJ | -- | -- | -- |
| GNC1-BG19 | NORM | 2/11/2009 | TO-15 | < 0.0131 UJ | < 0.00885 UJ | < 0.0558 UJ | < 0.0119 UJ | < 0.0227 UJ | 0.00923 J | < 0.0304 UJ | < 0.00731 UJ | -- | < 0.0258 UJ | < 0.0104 UJ | < 0.0112 UJ |
| GNC1-BG19 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00281 UJ | -- | -- | -- | -- | -- | < 0.00285 UJ | -- | -- | -- |
| GNC1-BG20 | NORM | 2/11/2009 | TO-15 | < 0.0135 UJ | < 0.00885 UJ | < 0.0573 UJ | < 0.0123 UJ | < 0.0235 UJ | 0.0112 J | < 0.0312 UJ | < 0.00731 UJ | -- | < 0.0262 UJ | < 0.0108 UJ | < 0.0115 UJ |
| GNC1-BG20 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00288 UJ | -- | -- | -- | -- | -- | < 0.00292 UJ | -- | -- | -- |
| GNC1-BG21 | NORM | 2/11/2009 | TO-15 | < 0.0131 UJ | < 0.00846 UJ | < 0.0546 UJ | < 0.0115 UJ | < 0.0223 UJ | 0.0196 J | < 0.0296 UJ | < 0.00692 UJ | -- | < 0.025 UJ | < 0.0104 UJ | < 0.0112 UJ |
| GNC1-BG21 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00277 UJ | -- | -- | -- | -- | -- | < 0.00277 UJ | -- | -- | -- |
| GNC1-BG22 | NORM | 2/11/2009 | TO-15 | < 0.0131 UJ | < 0.00885 UJ | < 0.0554 UJ | < 0.0119 UJ | < 0.0227 UJ | 0.0158 J | < 0.03 UJ | < 0.00692 UJ | -- | < 0.0254 UJ | < 0.0104 UJ | < 0.0112 UJ |
| GNC1-BG22 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00281 UJ | -- | -- | -- | -- | -- | < 0.00285 UJ | -- | -- | -- |
| GNC1-JD09 | NORM | 2/11/2009 | TO-15 | < 0.0131 U | < 0.00885 U | < 0.0554 UJ | < 0.0119 U | < 0.0227 U | < 0.00654 U | < 0.03 U | < 0.00692 U | -- | < 0.0254 U | < 0.0104 U | < 0.0112 U |
| GNC1-JD09 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | < 0.00281 UJ | -- | -- | -- | -- | -- | < 0.00285 UJ | -- | -- | -- |
| GNC1-JS09 | NORM | 2/12/2009 | TO-15 | < 0.0196 U | < 0.0131 U | < 0.0835 U | < 0.0177 U | < 0.0338 U | < 0.00962 U | < 0.0454 U | < 0.0108 U | -- | < 0.0385 U | < 0.0158 U | < 0.0169 U |
| GNC1-JS09 | NORM | 2/12/2009 | TO-15 SIM | -- | -- | < 0.00296 UJ | -- | -- | -- | -- | -- | < 0.003 UJ | -- | -- | -- |
| GNC1-JS10 | NORM | 2/12/2009 | TO-15 | < 0.0131 U | < 0.00885 U | < 0.0558 UJ | < 0.0131 U | < 0.0427 U | < 0.00654 U | < 0.0304 U | < 0.00731 U | -- | < 0.0258 UJ | 0.0131 J | < 0.0223 U |
| GNC1-JS10 | NORM | 2/12/2009 | TO-15 SIM | -- | -- | < 0.00281 UJ | -- | -- | -- | -- | -- | < 0.00285 UJ | -- | -- | -- |
| GNC1-JS11 | NORM | 2/12/2009 | TO-15 | 0.0473 J | 0.0119 J | < 0.0562 UJ | 0.0473 J | 0.0654 J | < 0.0196 U | < 0.0304 U | < 0.00731 U | -- | < 0.0258 UJ | 0.0115 J | < 0.0288 U |
| GNC1-JS11 | NORM | 2/12/2009 | TO-15 SIM | -- | -- | < 0.00285 UJ | -- | -- | -- | -- | -- | < 0.00288 UJ | -- | -- | -- |
| GNC1-JS11R | FD | 2/12/2009 | TO-15 | < 0.0131 U | 0.0162 J | < 0.0558 UJ | 0.0608 | 0.0896 J | < 0.00654 U | < 0.0304 U | < 0.00731 U | -- | < 0.0258 UJ | 0.0158 J | 0.0427 J |
| GNC1-JS11R | FD | 2/12/2009 | TO-15 SIM | -- | -- | < 0.00281 UJ | -- | -- | -- | -- | -- | < 0.00285 UJ | -- | -- | -- |

All units in $\mu g/m^2,min^{-1}$.
-- = no sample data.

**TABLE B-11**
**SURFACE FLUX DATA**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 6 of 6)**

| Sample ID | Sample Type | Sample Date | Analytical Method | Surface Flux | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | sec-Butylbenzene | Styrene | tert-Butylbenzene | Tetrachloroethene | Toluene | Total Xylenes | trans-1,2-Dichloroethene | trans-1,3-Dichloro-propene | Trichloroethene | Vinyl acetate | Vinyl chloride |
| GNC1-BE20 | NORM | 2/11/2009 | TO-15 | < 0.0258 U | < 0.0112 U | < 0.0254 UJ | < 0.0177 U | 0.0412 J | 0.0304 | < 0.00885 U | < 0.0119 U | < 0.0142 U | < 0.00769 U | < 0.00692 U |
| GNC1-BE20 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | 0.013 | -- | -- | -- | -- | < 0.00142 UJ | -- | < 0.000692 U |
| GNC1-BE21 | NORM | 2/11/2009 | TO-15 | < 0.025 U | < 0.0112 U | < 0.025 U | < 0.0173 U | 0.121 | 0.0989 | < 0.00885 U | < 0.0119 U | < 0.0538 UJ | < 0.00769 U | < 0.00654 U |
| GNC1-BE21 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | 0.00765 J | -- | -- | -- | -- | < 0.00242 U | -- | < 0.000654 U |
| GNC1-BE22 | NORM | 2/11/2009 | TO-15 | < 0.0258 U | < 0.0112 U | < 0.0254 U | < 0.0177 U | < 0.01 U | < 0.0173 U | < 0.00885 U | < 0.0119 U | < 0.0142 U | < 0.00769 U | < 0.00692 U |
| GNC1-BE22 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | 0.00254 J | -- | -- | -- | -- | < 0.00269 UJ | -- | < 0.000692 UJ |
| GNC1-BF19 | NORM | 2/11/2009 | TO-15 | < 0.0258 U | < 0.0112 U | < 0.0254 UJ | < 0.0177 U | < 0.0154 U | 0.0262 | < 0.00885 U | < 0.0119 UJ | < 0.0142 U | < 0.00769 UJ | < 0.00692 UJ |
| GNC1-BF19 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | 0.00623 J | -- | -- | -- | -- | < 0.00142 UJ | -- | < 0.000692 UJ |
| GNC1-BF20 | NORM | 2/11/2009 | TO-15 | < 0.0265 U | < 0.0115 U | < 0.0262 UJ | < 0.0185 U | 0.05 J | 0.0337 | < 0.00923 U | < 0.0127 U | < 0.0146 U | < 0.00808 U | < 0.00692 U |
| GNC1-BF20 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | 0.00881 J | -- | -- | -- | -- | < 0.00185 UJ | -- | < 0.000692 UJ |
| GNC1-BF21 | NORM | 2/11/2009 | TO-15 | < 0.0258 U | < 0.0112 U | < 0.0254 UJ | < 0.0177 U | < 0.01 U | < 0.0173 U | < 0.00885 U | < 0.0123 U | < 0.0142 U | < 0.00769 U | < 0.00692 U |
| GNC1-BF21 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | < 0.00177 UJ | -- | -- | -- | -- | < 0.00146 UJ | -- | < 0.000692 UJ |
| GNC1-BF22 | NORM | 2/11/2009 | TO-15 | < 0.0265 U | < 0.0115 U | < 0.0262 UJ | < 0.0181 U | 0.0312 J | 0.0304 | < 0.00923 U | < 0.0123 U | < 0.0146 U | < 0.00808 U | < 0.00692 U |
| GNC1-BF22 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | 0.00446 J | -- | -- | -- | -- | < 0.00146 U | -- | < 0.000692 U |
| GNC1-BG19 | NORM | 2/11/2009 | TO-15 | < 0.0254 UJ | < 0.0112 UJ | < 0.025 UJ | < 0.0177 UJ | < 0.01 UJ | < 0.0167 U | < 0.00885 UJ | < 0.0119 UJ | < 0.0142 UJ | < 0.00769 UJ | < 0.00692 UJ |
| GNC1-BG19 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | 0.0045 J | -- | -- | -- | -- | < 0.00142 U | -- | < 0.000692 U |
| GNC1-BG20 | NORM | 2/11/2009 | TO-15 | < 0.0262 UJ | < 0.0115 UJ | < 0.0258 UJ | < 0.0181 UJ | < 0.01 UJ | < 0.0175 U | < 0.00885 UJ | < 0.0123 UJ | < 0.0142 UJ | < 0.00769 UJ | < 0.00692 UJ |
| GNC1-BG20 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | 0.018 | -- | -- | -- | -- | < 0.00146 UJ | -- | < 0.000692 U |
| GNC1-BG21 | NORM | 2/11/2009 | TO-15 | < 0.0246 UJ | < 0.0108 UJ | < 0.0246 UJ | < 0.0173 UJ | < 0.01 UJ | < 0.0168 U | < 0.00846 UJ | < 0.0115 UJ | 0.114 J | < 0.00769 UJ | < 0.00654 UJ |
| GNC1-BG21 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | 0.00615 J | -- | -- | -- | -- | < 0.00138 U | -- | < 0.000654 U |
| GNC1-BG22 | NORM | 2/11/2009 | TO-15 | < 0.025 UJ | < 0.0112 UJ | < 0.025 UJ | < 0.0173 UJ | < 0.00962 UJ | < 0.0169 U | < 0.00885 UJ | < 0.0119 UJ | < 0.0627 UJ | < 0.00769 UJ | < 0.00654 UJ |
| GNC1-BG22 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | 0.00388 J | -- | -- | -- | -- | < 0.00142 UJ | -- | < 0.000654 U |
| GNC1-JD09 | NORM | 2/11/2009 | TO-15 | < 0.025 U | < 0.0112 U | < 0.025 U | < 0.0173 U | < 0.00962 U | < 0.0169 U | < 0.00885 U | < 0.0119 U | < 0.0138 U | < 0.00769 U | < 0.00654 U |
| GNC1-JD09 | NORM | 2/11/2009 | TO-15 SIM | -- | -- | -- | 0.00365 J | -- | -- | -- | -- | < 0.00154 UJ | -- | < 0.000654 UJ |
| GNC1-JS09 | NORM | 2/12/2009 | TO-15 | < 0.0381 U | < 0.0165 U | < 0.0377 U | < 0.0262 U | < 0.0146 U | < 0.0254 U | < 0.0131 U | < 0.0181 U | < 0.0212 U | < 0.0115 U | < 0.01 U |
| GNC1-JS09 | NORM | 2/12/2009 | TO-15 SIM | -- | -- | -- | 0.0145 J | -- | -- | -- | -- | < 0.00312 UJ | -- | < 0.000692 UJ |
| GNC1-JS10 | NORM | 2/12/2009 | TO-15 | < 0.0254 U | < 0.0112 U | < 0.025 UJ | 0.02 J | < 0.02 U | < 0.0325 U | < 0.00885 U | < 0.0119 U | < 0.0142 U | < 0.00769 U | < 0.00692 U |
| GNC1-JS10 | NORM | 2/12/2009 | TO-15 SIM | -- | -- | -- | 0.015 J | -- | -- | -- | -- | 0.00281 J | -- | < 0.000692 UJ |
| GNC1-JS11 | NORM | 2/12/2009 | TO-15 | < 0.0258 U | < 0.0112 U | < 0.0254 UJ | < 0.0177 U | 0.0585 | 0.0798 | < 0.00885 U | < 0.0119 U | < 0.0142 U | < 0.00769 U | < 0.00692 U |
| GNC1-JS11 | NORM | 2/12/2009 | TO-15 SIM | -- | -- | -- | 0.00281 J | -- | -- | -- | -- | < 0.00142 UJ | -- | < 0.000692 U |
| GNC1-JS11R | FD | 2/12/2009 | TO-15 | 0.0265 J | < 0.0112 U | < 0.025 UJ | < 0.0177 U | 0.0742 | 0.132 | < 0.00885 U | < 0.0119 U | < 0.0142 U | < 0.00769 U | < 0.00692 U |
| GNC1-JS11R | FD | 2/12/2009 | TO-15 SIM | -- | -- | -- | < 0.00562 U | -- | -- | -- | -- | < 0.00346 UJ | -- | < 0.000692 U |

All units in $\mu g/m^2,min^{-1}$.
-- = no sample data.

**TABLE B-12**
**SPLP DATA SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 1 of 4)**

| Parameter of Interest | Compound List | Units | Total Count | GNC1-BE21 Result | Residential Water BCL[c] | Count of Detects > BCL | MCL | Count of Detects > MCL |
|---|---|---|---|---|---|---|---|---|
| **Aldehydes** | Acetaldehyde | mg/L | 1 | < 0.0082 U | 0.066 | -- | -- | -- |
| | Formaldehyde | mg/L | 1 | < 0.021 U | 0.0015 | -- | -- | -- |
| **General Chemistry** | Ammonia (as N) | mg/L | 1 | 0.0896 | 0.73 | 0 | -- | -- |
| | Bromide | mg/L | 1 | < 0.026 U | -- | -- | -- | -- |
| | Chlorate | mg/L | 1 | 0.22 J | -- | -- | -- | -- |
| | Chloride | mg/L | 1 | 22.2 | -- | -- | -- | -- |
| | Fluoride | mg/L | 1 | 0.23 | 2.2 | 0 | 4 | 0 |
| | Nitrate | mg/L | -- | -- | 10 | -- | 10 | -- |
| | Nitrite | mg/L | 1 | < 0.003 U | 1 | -- | 1 | -- |
| | Orthophosphate as P | mg/L | 1 | 0.5 U | -- | -- | -- | -- |
| | Perchlorate | mg/L | 1 | 0.148 | 0.026 | 1 | 0.018/0.0245(1) | 1 |
| | Total Kjeldahl Nitrogen (TKN) | mg/L | 1 | 0.5 U | -- | -- | -- | -- |
| **Metals** | Aluminum | mg/L | 1 | < 0.00991 U | 37 | -- | -- | -- |
| | Antimony | mg/L | 1 | 0.005 U | 0.015 | 0 | 0.006 | 0 |
| | Arsenic | mg/L | 1 | 0.0034 J | 0.000045 | 1 | 0.01 | 0 |
| | Barium | mg/L | 1 | 0.0561 | 7.3 | 0 | 2 | 0 |
| | Beryllium | mg/L | 1 | < 0.000128 U | 0.073 | -- | 0.004 | -- |
| | Boron | mg/L | 1 | 0.0656 | 7.3 | 0 | -- | -- |
| | Cadmium | mg/L | 1 | < 0.000042 U | 0.018 | -- | 0.005 | -- |
| | Calcium | mg/L | 1 | 190 | -- | -- | -- | -- |
| | Chromium | mg/L | 1 | < 0.003 U | -- | -- | 0.1 | -- |
| | Chromium (VI) | mg/L | 1 | < 0.002 UJ | 0.11 | -- | 0.1 | -- |
| | Cobalt | mg/L | 1 | 0.00036 J | 0.011 | 0 | -- | -- |
| | Copper | mg/L | 1 | 0.0022 | 1.4 | 0 | 1.3 | 0 |
| | Iron | mg/L | 1 | 0.264 | 26 | 0 | -- | -- |
| | Lead | mg/L | 1 | < 0.000492 U | 0.015 | -- | 0.015 | -- |
| | Lithium | mg/L | 1 | 0.0138 | 0.073 | 0 | -- | -- |
| | Magnesium | mg/L | 1 | 12.5 | 210 | 0 | -- | -- |
| | Manganese | mg/L | 1 | 0.0057 | 0.51 | 0 | -- | -- |
| | Mercury | mg/L | 1 | 0.0002 U | 0.0058 | 0 | 0.002 | 0 |
| | Molybdenum | mg/L | 1 | 0.0088 | 0.18 | 0 | -- | -- |
| | Nickel | mg/L | 1 | 0.0049 J | 0.73 | 0 | -- | -- |
| | Potassium | mg/L | 1 | 5.25 | -- | -- | -- | -- |
| | Selenium | mg/L | 1 | 0.005 U | 0.18 | 0 | 0.05 | 0 |
| | Silver | mg/L | 1 | < 0.0002028 U | 0.18 | -- | -- | -- |
| | Sodium | mg/L | 1 | 21.9 | -- | -- | -- | -- |
| | Strontium | mg/L | 1 | 6.01 | 22 | 0 | -- | -- |
| | Thallium | mg/L | 1 | < 0.00006 U | 0.0026 | -- | 0.002 | -- |
| | Tin | mg/L | 1 | < 0.00068 U | 22 | -- | -- | -- |
| | Titanium | mg/L | 1 | < 0.00151 U | 150 | -- | -- | -- |
| | Tungsten | mg/L | 1 | 0.0273 | 0.27 | 0 | -- | -- |
| | Uranium | mg/L | 1 | 0.00042 J | 0.11 | 0 | 0.03 | 0 |
| | Vanadium | mg/L | 1 | 0.0043 J | 0.18 | 0 | -- | -- |
| | Zinc | mg/L | 1 | < 0.0009 U | 11 | -- | -- | -- |

**TABLE B-12**
**SPLP DATA SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 2 of 4)**

| Parameter of Interest | Compound List | Units | Total Count | GNC1-BE21 Result | Residential Water BCL[c] | Count of Detects > BCL | MCL | Count of Detects > MCL |
|---|---|---|---|---|---|---|---|---|
| **OCPs** | 2,4-DDD | mg/L | 1 | < 0.000011 U | -- | -- | -- | -- |
| | 2,4-DDE | mg/L | 1 | < 0.000009 U | -- | -- | -- | -- |
| | 4,4-DDD | mg/L | 1 | < 0.0000038 U | 0.00028 | -- | -- | -- |
| | 4,4-DDE | mg/L | 1 | < 0.0000027 U | 0.0002 | -- | -- | -- |
| | 4,4-DDT | mg/L | 1 | < 0.0000056 U | 0.0002 | -- | -- | -- |
| | Aldrin | mg/L | 1 | < 0.000004 U | 0.000004 | -- | -- | -- |
| | alpha-BHC | mg/L | 1 | < 0.0000025 U | 0.000011 | -- | -- | -- |
| | alpha-Chlordane | mg/L | 1 | < 0.000003 U | -- | -- | -- | -- |
| | beta-BHC | mg/L | 1 | < 0.000013 U | 0.000037 | -- | -- | -- |
| | Chlordane | mg/L | 1 | < 0.00018 U | 0.00019 | -- | 0.002 | -- |
| | delta-BHC | mg/L | 1 | < 0.000006 U | -- | -- | -- | -- |
| | Dieldrin | mg/L | 1 | < 0.0000023 U | 0.0000042 | -- | -- | -- |
| | Endosulfan I | mg/L | 1 | < 0.0000025 U | -- | -- | -- | -- |
| | Endosulfan II | mg/L | 1 | < 0.00001 U | -- | -- | -- | -- |
| | Endosulfan sulfate | mg/L | 1 | < 0.000017 U | -- | -- | -- | -- |
| | Endrin | mg/L | 1 | < 0.0000028 U | 0.011 | -- | 0.002 | -- |
| | Endrin aldehyde | mg/L | 1 | < 0.0000032 U | -- | -- | -- | -- |
| | Endrin ketone | mg/L | 1 | < 0.000016 U | -- | -- | -- | -- |
| | gamma-BHC (Lindane) | mg/L | 1 | < 0.0000025 U | 0.000052 | -- | 0.0002 | -- |
| | gamma-Chlordane | mg/L | 1 | < 0.0000027 U | -- | -- | -- | -- |
| | Heptachlor | mg/L | 1 | < 0.0000025 U | 0.000015 | -- | 0.0004 | -- |
| | Heptachlor epoxide | mg/L | 1 | < 0.0000032 U | 0.0000074 | -- | 0.0002 | -- |
| | Methoxychlor | mg/L | 1 | < 0.000005 U | 0.18 | -- | 0.04 | -- |
| | Toxaphene | mg/L | 1 | < 0.00033 U | 0.000061 | -- | 0.003 | -- |
| **PAHs** | Acenaphthene | mg/L | 1 | < 0.00025 U | 2.2 | -- | -- | -- |
| | Acenaphthylene | mg/L | 1 | < 0.00025 U | 1.1 | -- | -- | -- |
| | Anthracene | mg/L | 1 | < 0.00025 U | 11 | -- | -- | -- |
| | Benzo(a)anthracene | mg/L | 1 | < 0.00025 U | 0.000092 | -- | -- | -- |
| | Benzo(a)pyrene | mg/L | 1 | < 0.00025 U | 0.0000092 | -- | 0.0002 | -- |
| | Benzo(b)fluoranthene | mg/L | 1 | < 0.00025 U | 0.000092 | -- | -- | -- |
| | Benzo(g,h,i)perylene | mg/L | 1 | < 0.00025 U | 1.1 | -- | -- | -- |
| | Benzo(k)fluoranthene | mg/L | 1 | < 0.00025 U | 0.00092 | -- | -- | -- |
| | Chrysene | mg/L | 1 | < 0.00025 U | 0.0092 | -- | -- | -- |
| | Dibenzo(a,h)anthracene | mg/L | 1 | < 0.00025 U | 0.0000092 | -- | -- | -- |
| | Indeno(1,2,3-cd)pyrene | mg/L | 1 | < 0.00025 U | 0.000092 | -- | -- | -- |
| | Phenanthrene | mg/L | 1 | < 0.00025 U | 1.1 | -- | -- | -- |
| | Pyrene | mg/L | 1 | < 0.00025 U | 1.1 | -- | -- | -- |
| **Radionuclides** | Radium-226 | pCi/L | 1 | 0.692 | 5 | 0 | -- | -- |
| | Radium-228 | pCi/L | 1 | 0.0538 U | 5 | 0 | -- | -- |
| | Thorium-228 | pCi/L | 1 | -0.212 U | 0.11 | 0 | -- | -- |
| | Thorium-230 | pCi/L | 1 | -0.06 U | 0.042 | 0 | -- | -- |
| | Thorium-232 | pCi/L | 1 | -0.019 U | 0.14 | 0 | -- | -- |
| | Uranium-233/234 | pCi/L | 1 | 0.246 U | -- | -- | -- | -- |
| | Uranium-235/236 | pCi/L | 1 | 0.164 U | -- | -- | -- | -- |
| | Uranium-238 | pCi/L | 1 | 0.12 U | -- | -- | -- | -- |

**TABLE B-12**
**SPLP DATA SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**
**(Page 3 of 4)**

| Parameter of Interest | Compound List | Units | Total Count | GNC1-BE21 Result | Residential Water BCL[c] | Count of Detects > BCL | MCL | Count of Detects > MCL |
|---|---|---|---|---|---|---|---|---|
| SVOCs | 1,2,4,5-Tetrachlorobenzene | mg/L | 1 | < 0.01 U | 0.011 | -- | -- | -- |
| | 1,2-Diphenylhydrazine | mg/L | 1 | < 0.01 U | 0.000084 | -- | -- | -- |
| | 1,4-Dioxane | mg/L | 1 | < 0.005 U | 0.0061 | -- | -- | -- |
| | 2,2'-Dichlorobenzil | mg/L | 1 | < 0.0165 U | 0.011 | -- | -- | -- |
| | 2,4,5-Trichlorophenol | mg/L | 1 | < 0.005 U | 3.7 | -- | -- | -- |
| | 2,4,6-Trichlorophenol | mg/L | 1 | < 0.01 U | 0.0061 | -- | -- | -- |
| | 2,4-Dichlorophenol | mg/L | 1 | < 0.01 U | 0.11 | -- | -- | -- |
| | 2,4-Dimethylphenol | mg/L | 1 | < 0.01 U | 0.73 | -- | -- | -- |
| | 2,4-Dinitrophenol | mg/L | 1 | < 0.05 U | 0.073 | -- | -- | -- |
| | 2,4-Dinitrotoluene | mg/L | 1 | < 0.01 U | 0.00022 | -- | -- | -- |
| | 2,6-Dinitrotoluene | mg/L | 1 | < 0.01 U | 0.037 | -- | -- | -- |
| | 2-Chloronaphthalene | mg/L | 1 | < 0.00175 U | 2.9 | -- | -- | -- |
| | 2-Chlorophenol | mg/L | 1 | < 0.01 U | 0.18 | -- | -- | -- |
| | 2-Methylnaphthalene | mg/L | 1 | < 0.0015 U | -- | -- | -- | -- |
| | 2-Nitroaniline | mg/L | 1 | < 0.01 U | 0.11 | -- | -- | -- |
| | 2-Nitrophenol | mg/L | 1 | < 0.01 U | -- | -- | -- | -- |
| | 3,3-Dichlorobenzidine | mg/L | 1 | < 0.005 U | 0.00015 | -- | -- | -- |
| | 3-Nitroaniline | mg/L | 1 | < 0.01 U | -- | -- | -- | -- |
| | 4-Bromophenyl phenyl ether | mg/L | 1 | < 0.01 U | -- | -- | -- | -- |
| | 4-Chloro-3-methylphenol | mg/L | 1 | < 0.01 U | -- | -- | -- | -- |
| | 4-Chlorophenyl phenyl ether | mg/L | 1 | < 0.01 U | -- | -- | -- | -- |
| | 4-Chlorothioanisole | mg/L | 1 | < 0.0165 U | -- | -- | -- | -- |
| | 4-Nitroaniline | mg/L | 1 | < 0.015 U | -- | -- | -- | -- |
| | 4-Nitrophenol | mg/L | 1 | < 0.01 U | 0.29 | -- | -- | -- |
| | Acetophenone | mg/L | 1 | < 0.01 U | 3.7 | -- | -- | -- |
| | Aniline | mg/L | 1 | < 0.0125 U | 0.012 | -- | -- | -- |
| | Benzenethiol | mg/L | 1 | < 0.033 U | -- | -- | -- | -- |
| | Benzoic acid | mg/L | 1 | < 0.03 U | 150 | -- | -- | -- |
| | Benzyl alcohol | mg/L | 1 | < 0.01 U | 18 | -- | -- | -- |
| | bis(2-Chloroethoxy)methane | mg/L | 1 | < 0.015 U | -- | -- | -- | -- |
| | bis(2-Chloroethyl) ether | mg/L | 1 | < 0.01 U | 0.000054 | -- | -- | -- |
| | bis(2-Chloroisopropyl) ether | mg/L | 1 | < 0.01 U | 0.0009 | -- | -- | -- |
| | bis(2-Ethylhexyl) phthalate | mg/L | 1 | < 0.01 U | 0.0048 | -- | 0.006 | -- |
| | bis(p-Chlorophenyl) sulfone | mg/L | 1 | < 0.0165 U | -- | -- | -- | -- |
| | bis(p-Chlorophenyl)disulfide | mg/L | 1 | < 0.0165 U | -- | -- | -- | -- |
| | Butylbenzyl phthalate | mg/L | 1 | < 0.01 U | 7.3 | -- | -- | -- |
| | Carbazole | mg/L | 1 | < 0.001 U | 0.0034 | -- | -- | -- |
| | Dibenzofuran | mg/L | 1 | < 0.01 U | 0.073 | -- | -- | -- |
| | Diethyl phthalate | mg/L | 1 | < 0.01 U | 29 | -- | -- | -- |
| | Dimethyl phthalate | mg/L | 1 | < 0.01 U | 370 | -- | -- | -- |
| | Di-n-butyl phthalate | mg/L | 1 | < 0.01 U | 3.7 | -- | -- | -- |
| | Di-n-octyl phthalate | mg/L | 1 | < 0.015 U | -- | -- | -- | -- |
| | Diphenyl disulfide | mg/L | 1 | < 0.0165 U | -- | -- | -- | -- |
| | Diphenyl sulfide | mg/L | 1 | < 0.0165 U | -- | -- | -- | -- |
| | Diphenyl sulfone | mg/L | 1 | < 0.0165 U | 0.11 | -- | -- | -- |

**TABLE B-12**
**SPLP DATA SUMMARY**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH-SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | Compound List | Units | Total Count | GNC1-BE21 Result | Residential Water BCL[c] | Count of Detects > BCL | MCL | Count of Detects > MCL |
|---|---|---|---|---|---|---|---|---|
| **SVOCs** | Diphenylamine | mg/L | 1 | < 0.015 U | 0.91 | -- | -- | -- |
| | Fluoranthene | mg/L | 1 | < 0.001 U | 1.5 | -- | -- | -- |
| | Fluorene | mg/L | 1 | < 0.001 U | 1.5 | -- | -- | -- |
| | Hexachlorobenzene | mg/L | 1 | < 0.01 U | 0.000042 | -- | 0.001 | -- |
| | Hexachlorobutadiene | mg/L | 1 | < 0.01 U | 0.00086 | -- | -- | -- |
| | Hexachlorocyclopentadiene | mg/L | 1 | < 0.01 U | 0.22 | -- | 0.05 | -- |
| | Hexachloroethane | mg/L | 1 | < 0.01 U | 0.0048 | -- | -- | -- |
| | Hydroxymethyl phthalimide | mg/L | 1 | < 0.0165 U | -- | -- | -- | -- |
| | Isophorone | mg/L | 1 | < 0.01 U | 0.071 | -- | -- | -- |
| | m,p-Cresols | mg/L | 1 | < 0.015 U | 0.18 | -- | -- | -- |
| | Naphthalene | mg/L | 1 | < 0.0015 U | 0.0043 | -- | -- | -- |
| | Nitrobenzene | mg/L | 1 | < 0.015 U | 0.0037 | -- | -- | -- |
| | N-nitrosodi-n-propylamine | mg/L | 1 | < 0.01 U | 0.0000096 | -- | -- | -- |
| | o-Cresol | mg/L | 1 | < 0.01 U | 1.8 | -- | -- | -- |
| | Octachlorostyrene | mg/L | 1 | < 0.0165 U | -- | -- | -- | -- |
| | p-Chloroaniline | mg/L | 1 | < 0.01 U | 0.15 | -- | -- | -- |
| | p-Chlorobenzenethiol | mg/L | 1 | < 0.0165 U | -- | -- | -- | -- |
| | Pentachlorobenzene | mg/L | 1 | < 0.01 U | 0.029 | -- | -- | -- |
| | Pentachlorophenol | mg/L | 1 | < 0.01 U | 0.00056 | -- | 0.001 | -- |
| | Phenol | mg/L | 1 | < 0.005 U | 11 | -- | -- | -- |
| | Pyridine | mg/L | 1 | < 0.005 U | 0.037 | -- | -- | -- |

BCL = Basic Comparison Levels (BCLs) from NDEP 2011a. Values used are residential water BCLs.

MCL = USEPA Maximum Contaminant Level.

[(1)]A MCL for perchlorate has not been promulgated. The USEPA Drinking Water Equivalent Level of 24.5 ug/L was used.

# APPENDIX C

GES FIELD REPORTS
(on the report CD in Appendix B)

# APPENDIX D

# SURFACE FLUX CHAMBER TESTING INVESTIGATOR'S REPORT
(on the report CD in Appendix B)

# APPENDIX E

# DATA USABILITY TABLES
(on the report CD in Appendix B)

## LIST OF TABLES (APPENDIX E)


Table E-1 Data Usability Evaluation for Semi-Volatile Organic Compounds

Table E-2 Data Usability Evaluation for Dioxins/Furans

Table E-3 Data Usability Evaluation for Aldehydes

Table E-4 Data Usability Evaluation for Radionuclides

Table E-5 Data Usability Evaluation for Polychlorinated Biphenyls

Table E-6 Data Usability Evaluation for Organochlorine Pesticides

Table E-7 Data Usability Evaluation for General Chemistry Parameters

Table E-8 Data Usability Evaluation for Volatile Organic Compounds in Soil

Table E-9 Data Usability Evaluation for Metals

Table E-10 Data Usability Evaluation for Volatile Organic Compounds in Flux

Table E-11 Data Usability Evaluation for Low MS and LCS Recoveries

Table E-12 Data Usability Evaluation for Field Duplicate RPD Exceedences

Table E-13 Data Usability Evaluation for Surrogate Recoveries

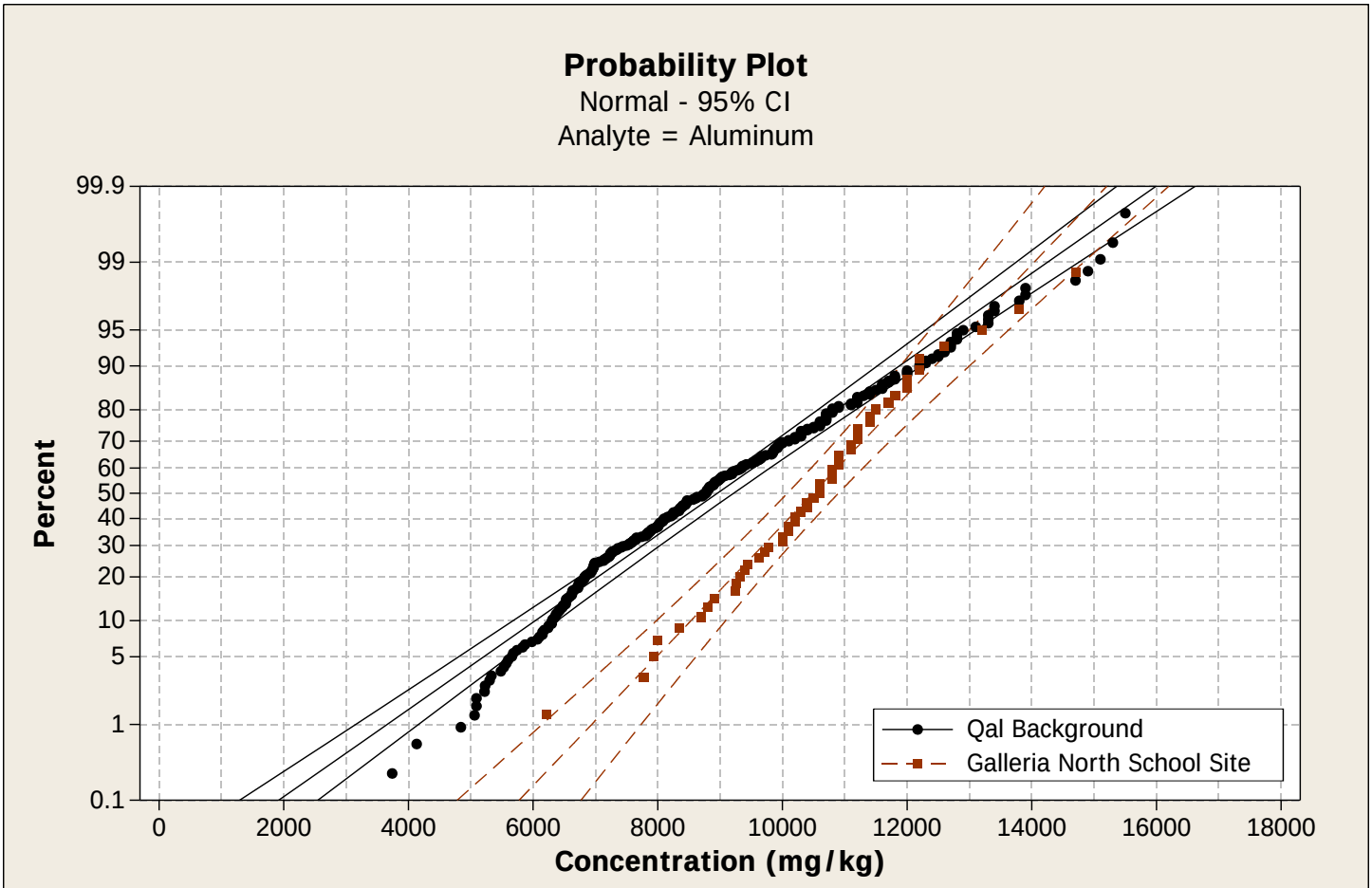
Table E-14 Data Censored Due to Lab or Field Blank Contamination

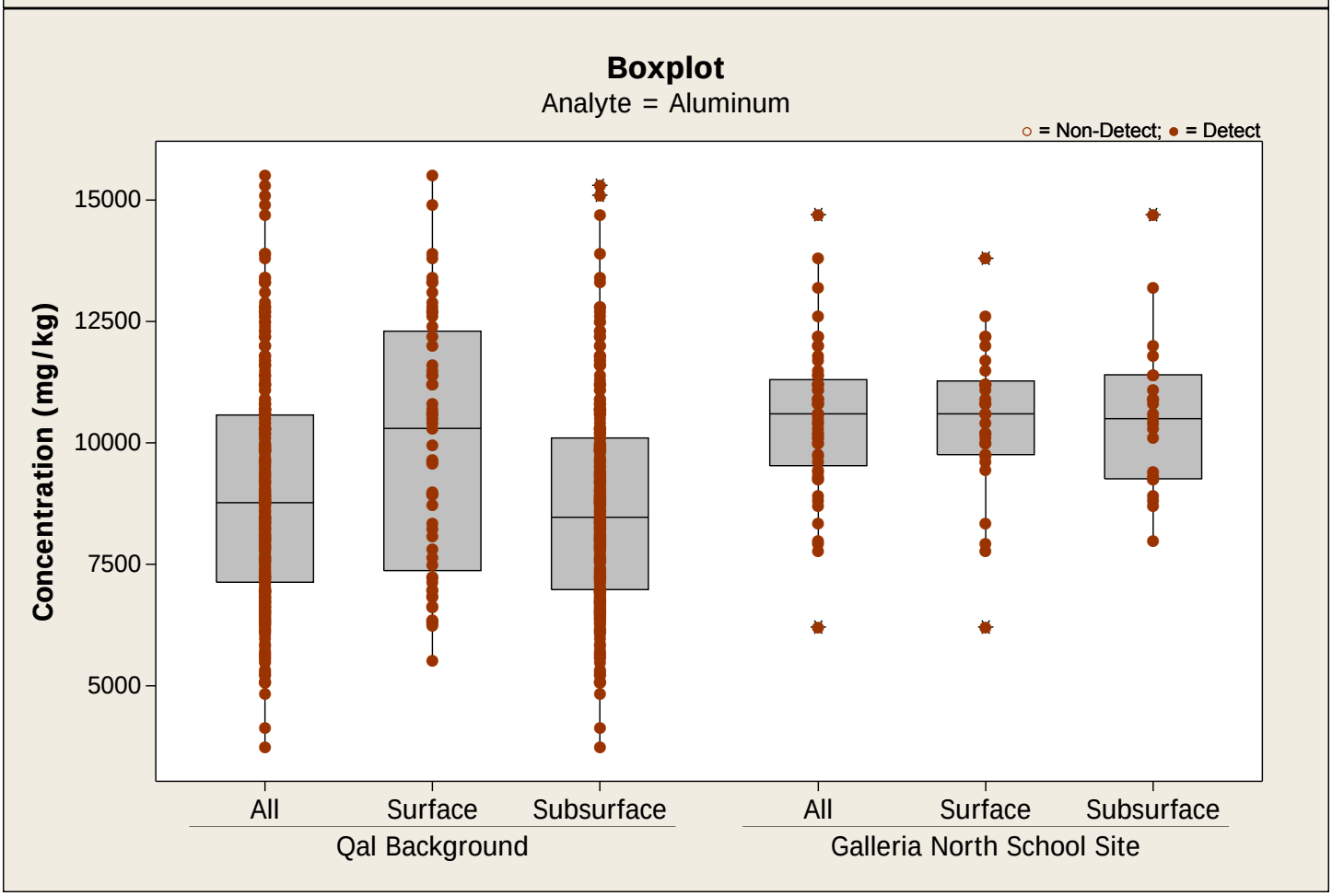
# APPENDIX F

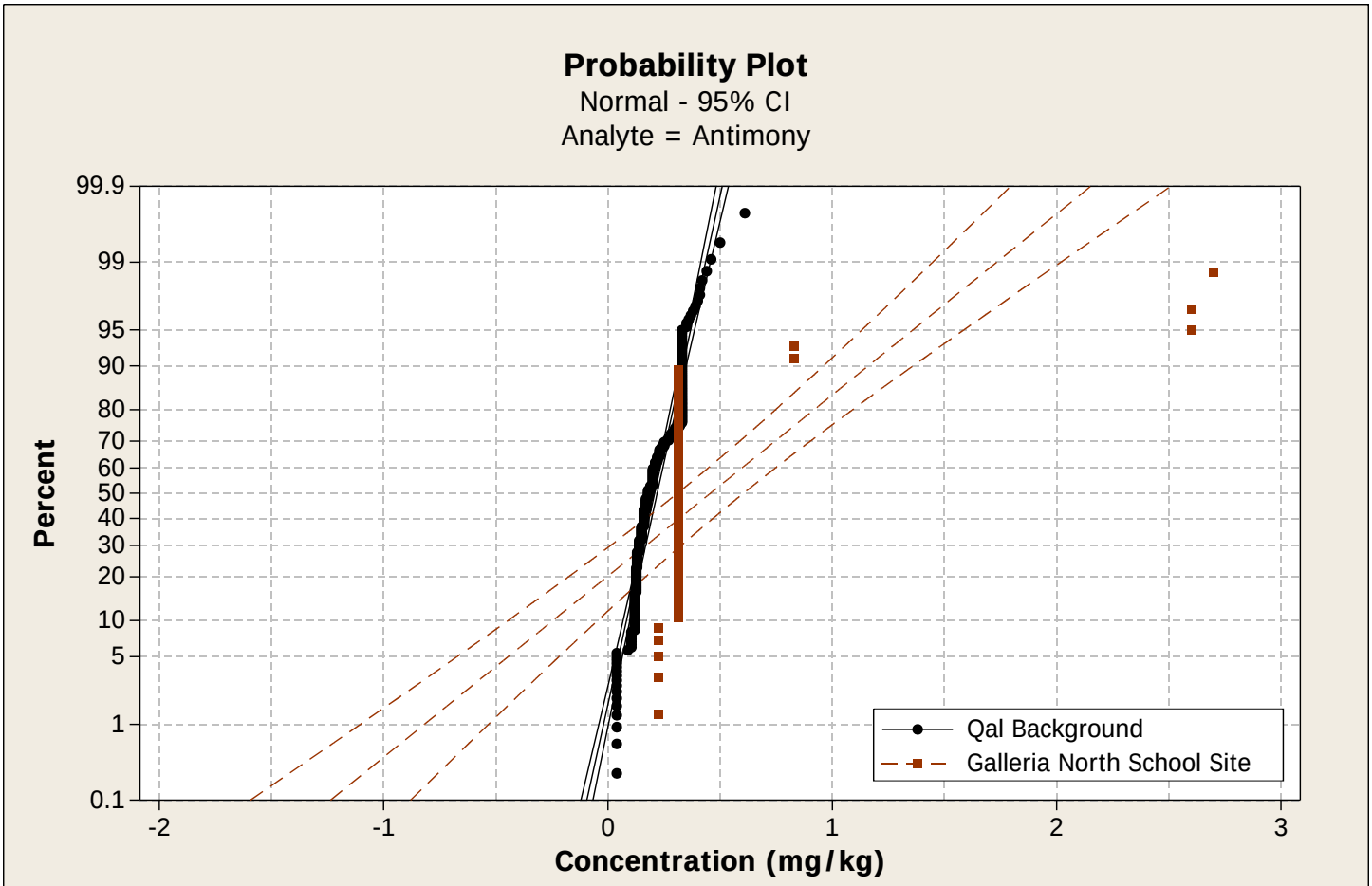
# DATA VALIDATION SUMMARY REPORTS

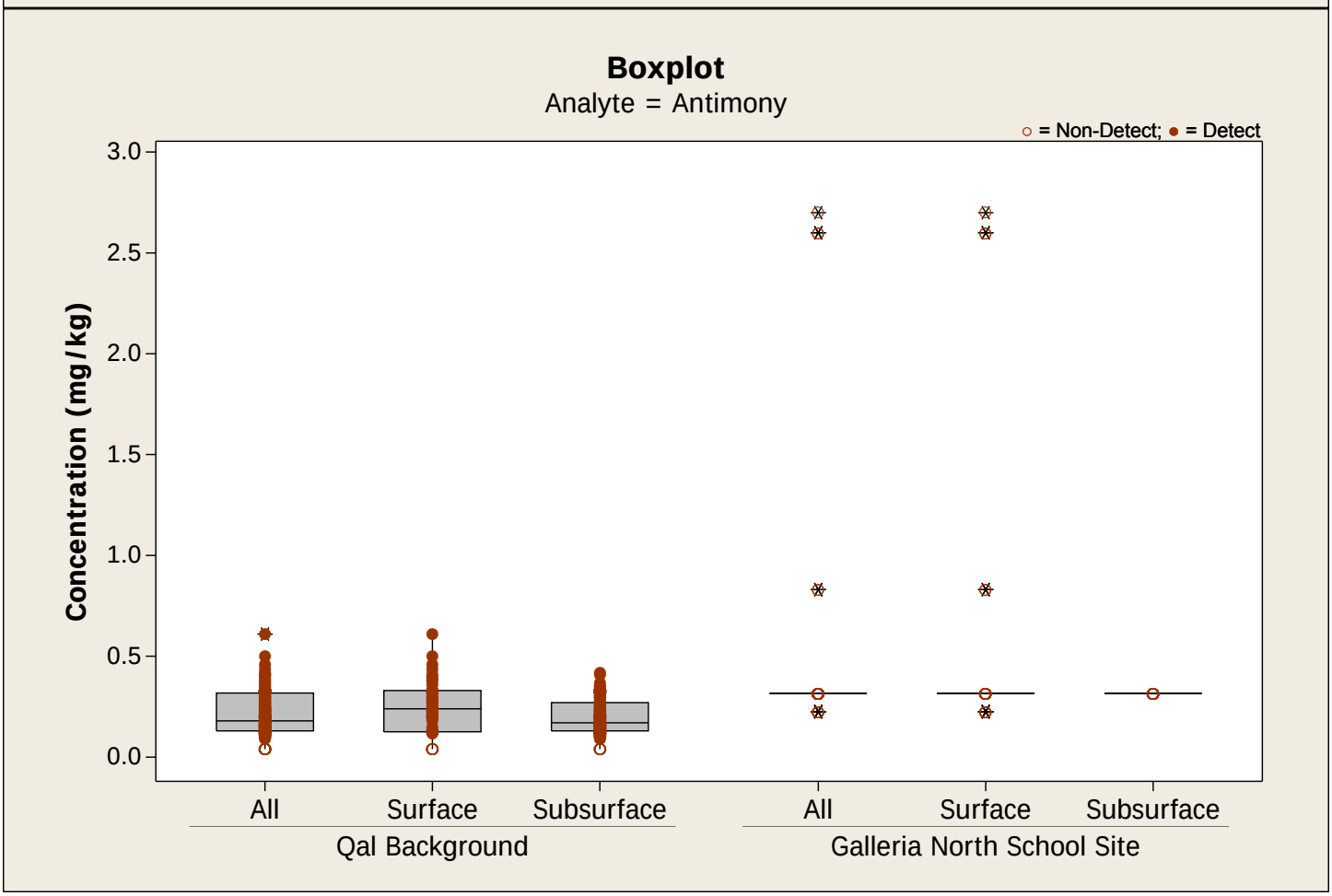
# APPENDIX G

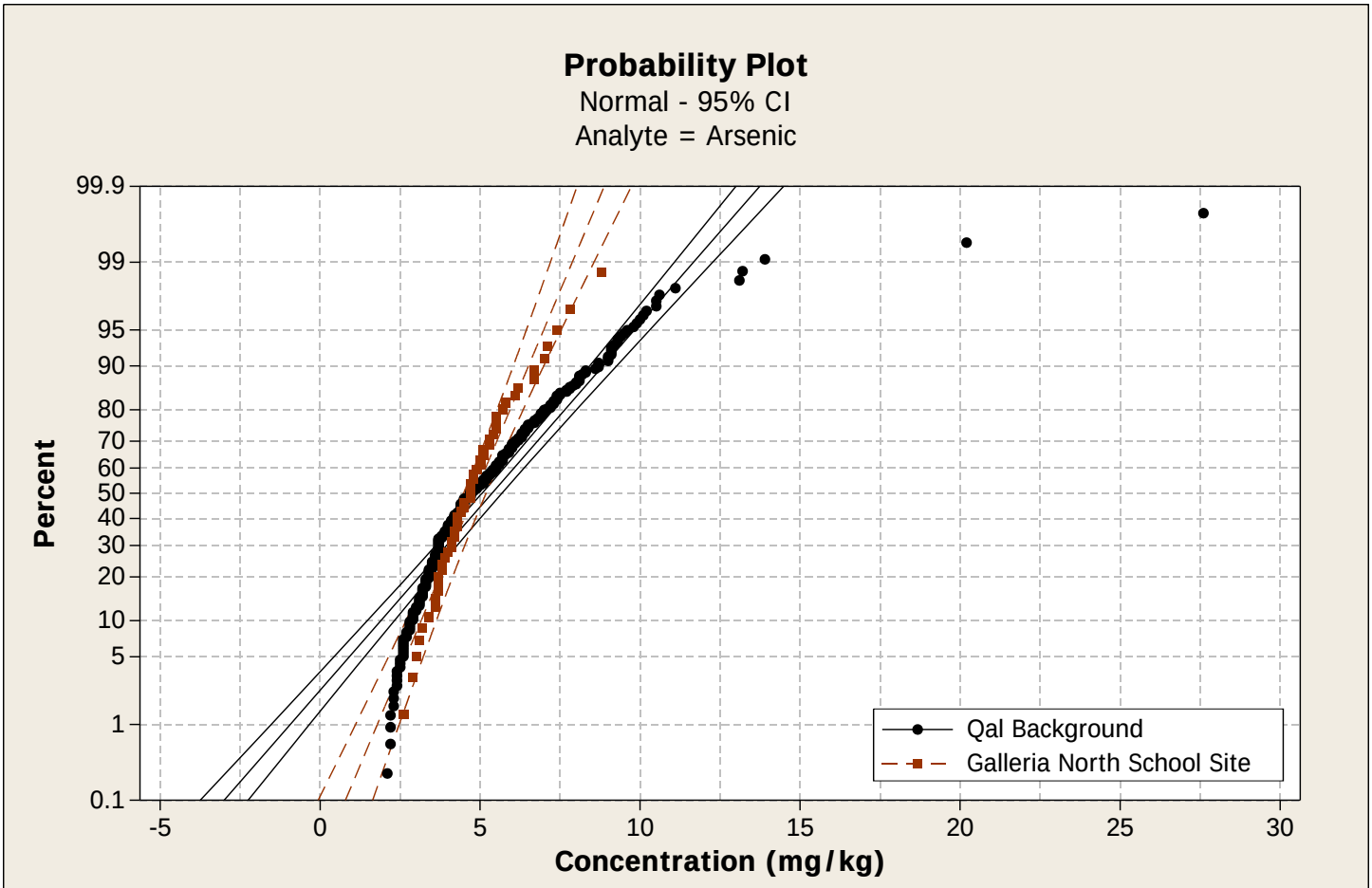
# CUMULATIVE PROBABILITY PLOTS AND BOXPLOTS FOR METALS AND RADIONUCLIDES

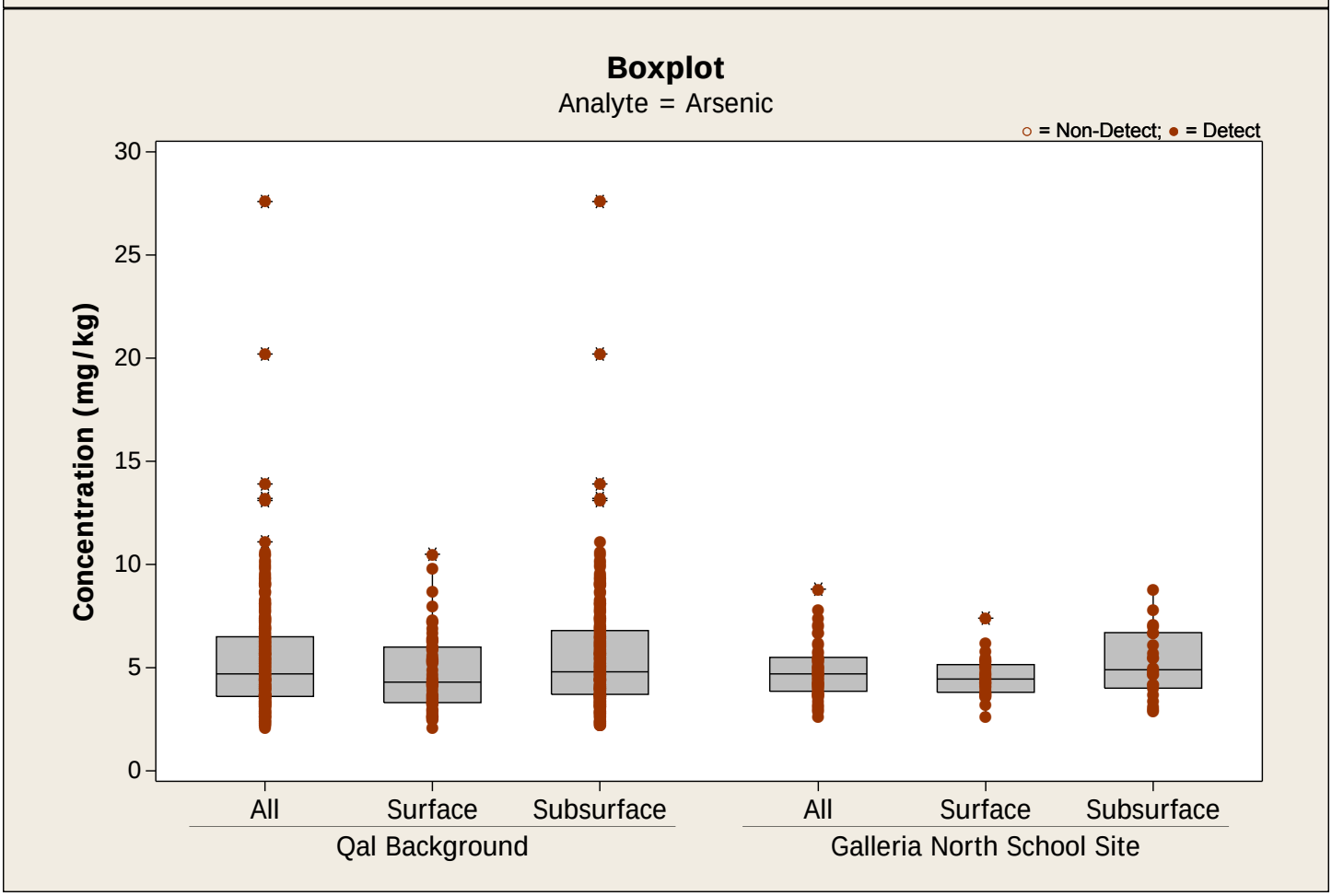

Probability Plot
Normal - 95% CI
Analyte = Aluminum
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
Concentration (mg/kg)
Qal Background
Galleria North School Site

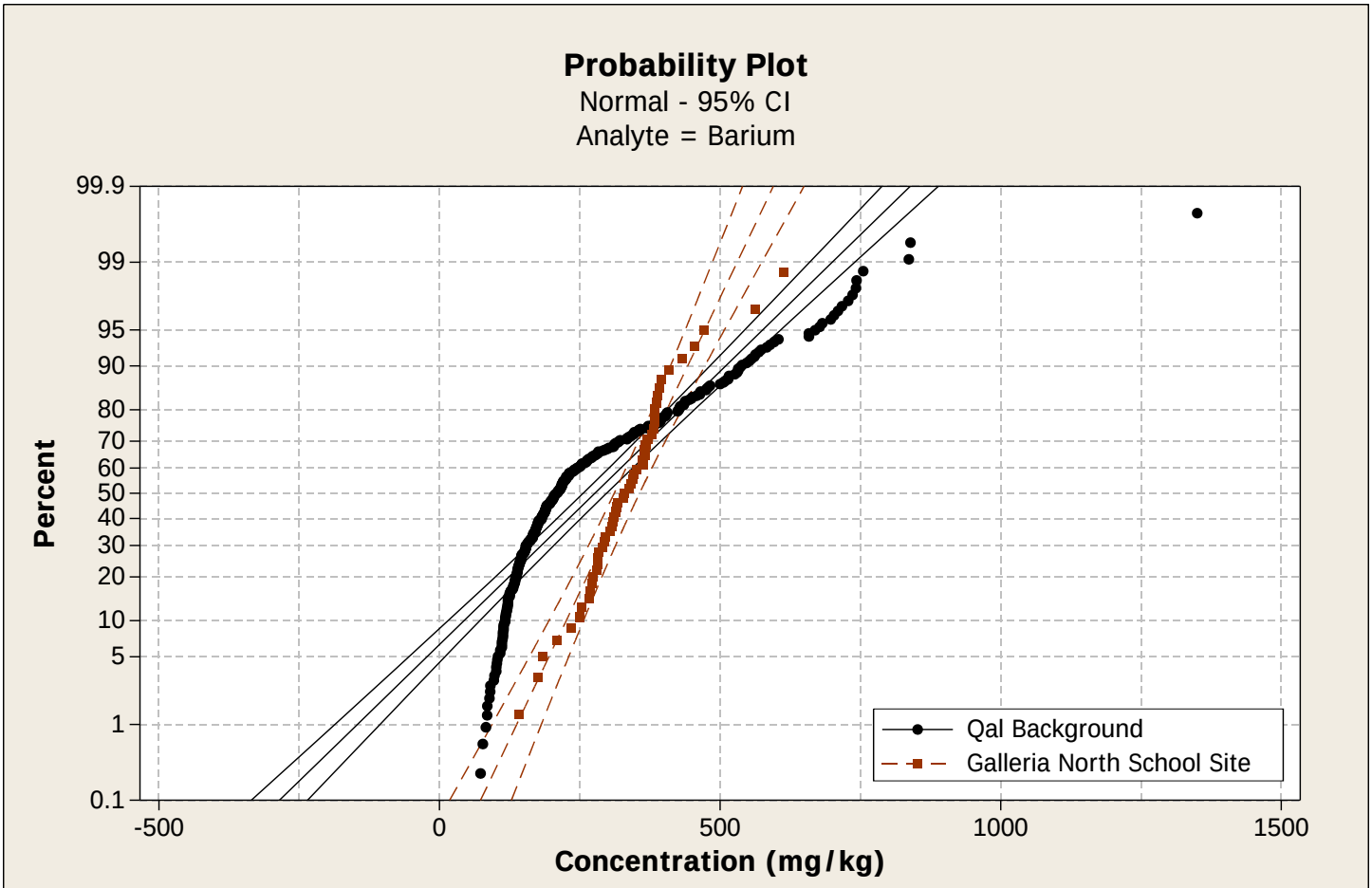

Boxplot
Analyte = Aluminum
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
15000
12500
10000
7500
5000
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

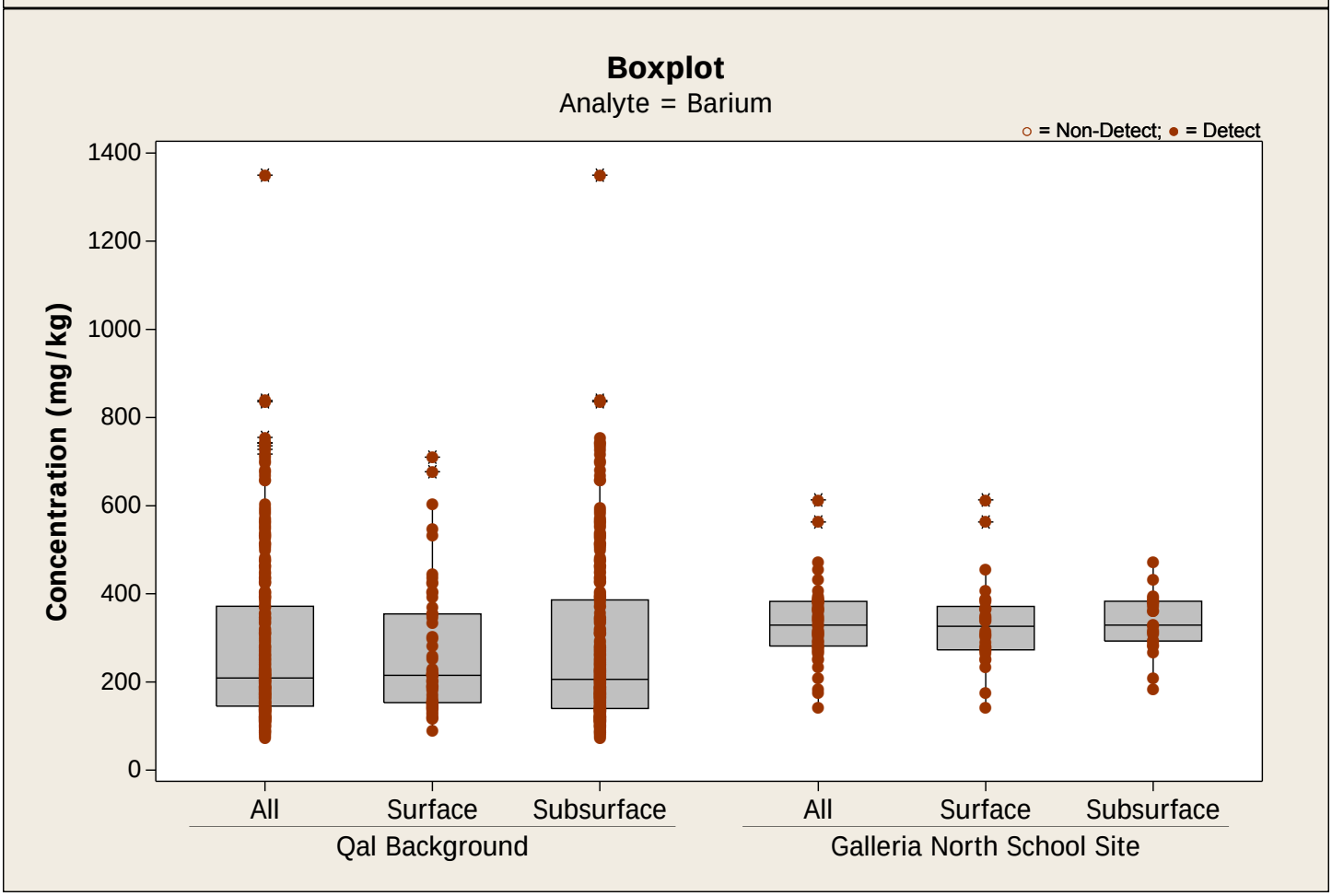

Probability Plot
Normal - 95% CI
Analyte = Antimony
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-2
-1
0
1
2
3
Concentration (mg/kg)
Qal Background
Galleria North School Site

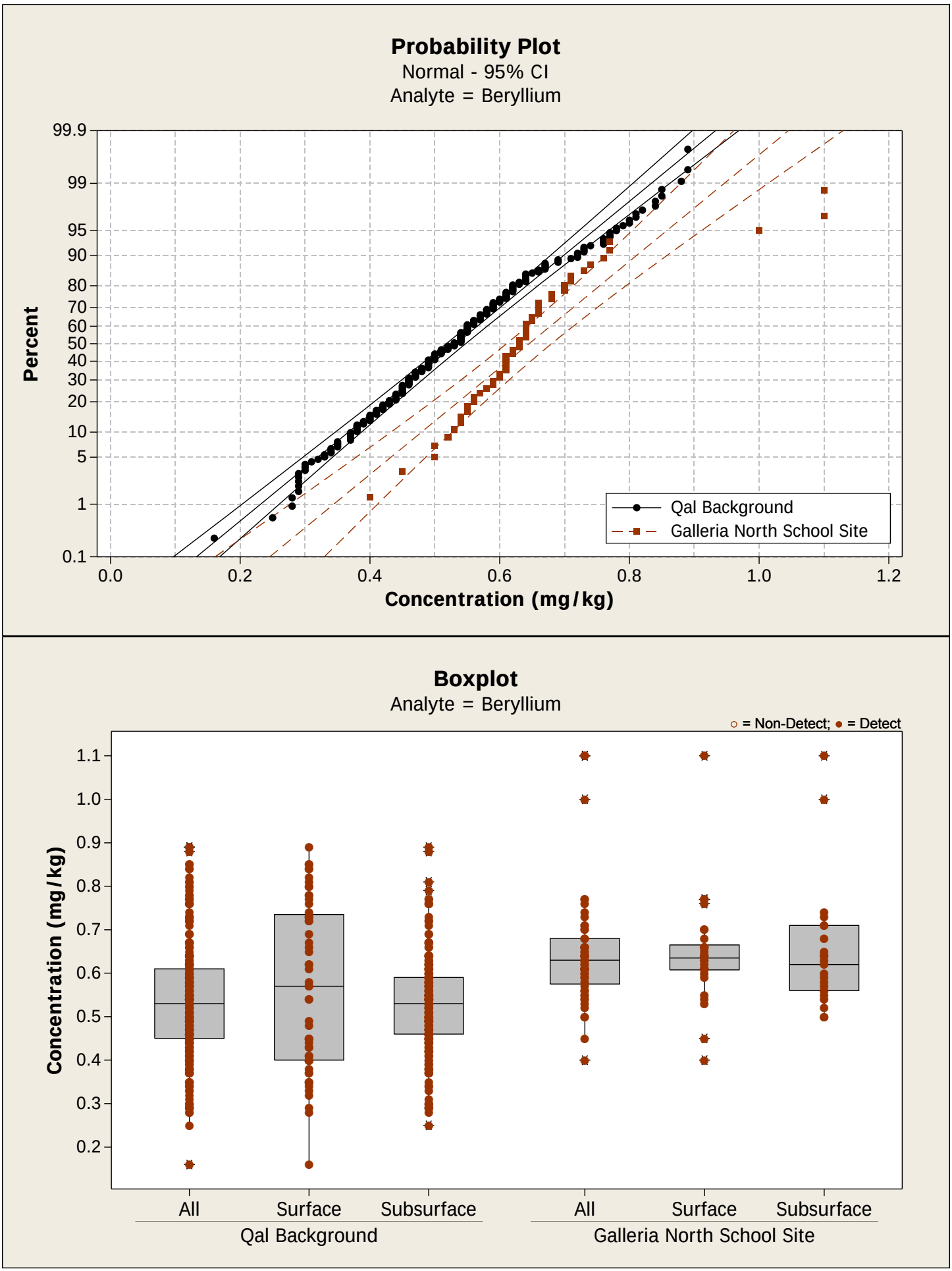

Boxplot
Analyte = Antimony
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

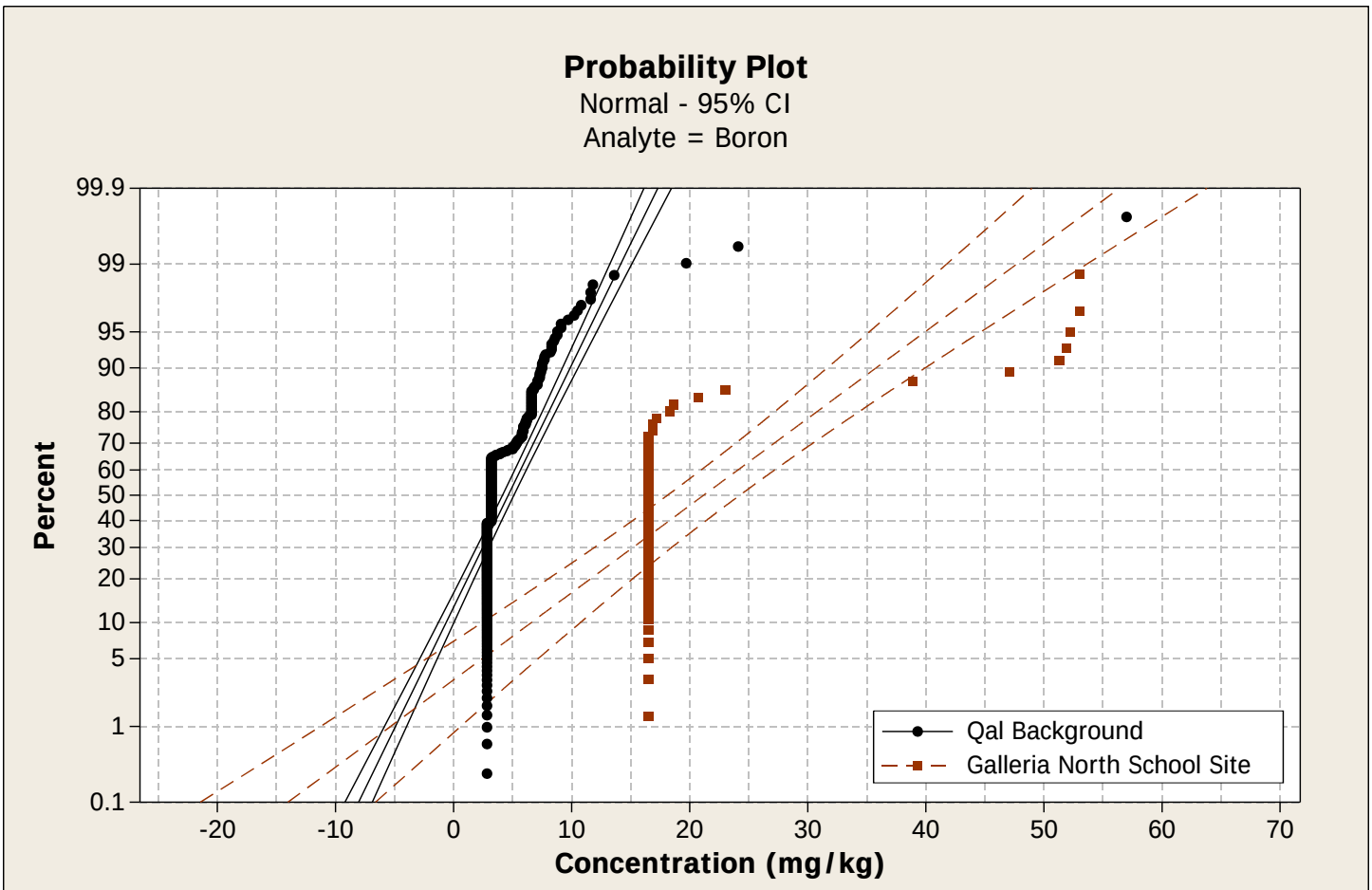

Probability Plot
Normal - 95% CI
Analyte = Arsenic
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-5
0
5
10
15
20
25
30
Concentration (mg/kg)
Qal Background
Galleria North School Site

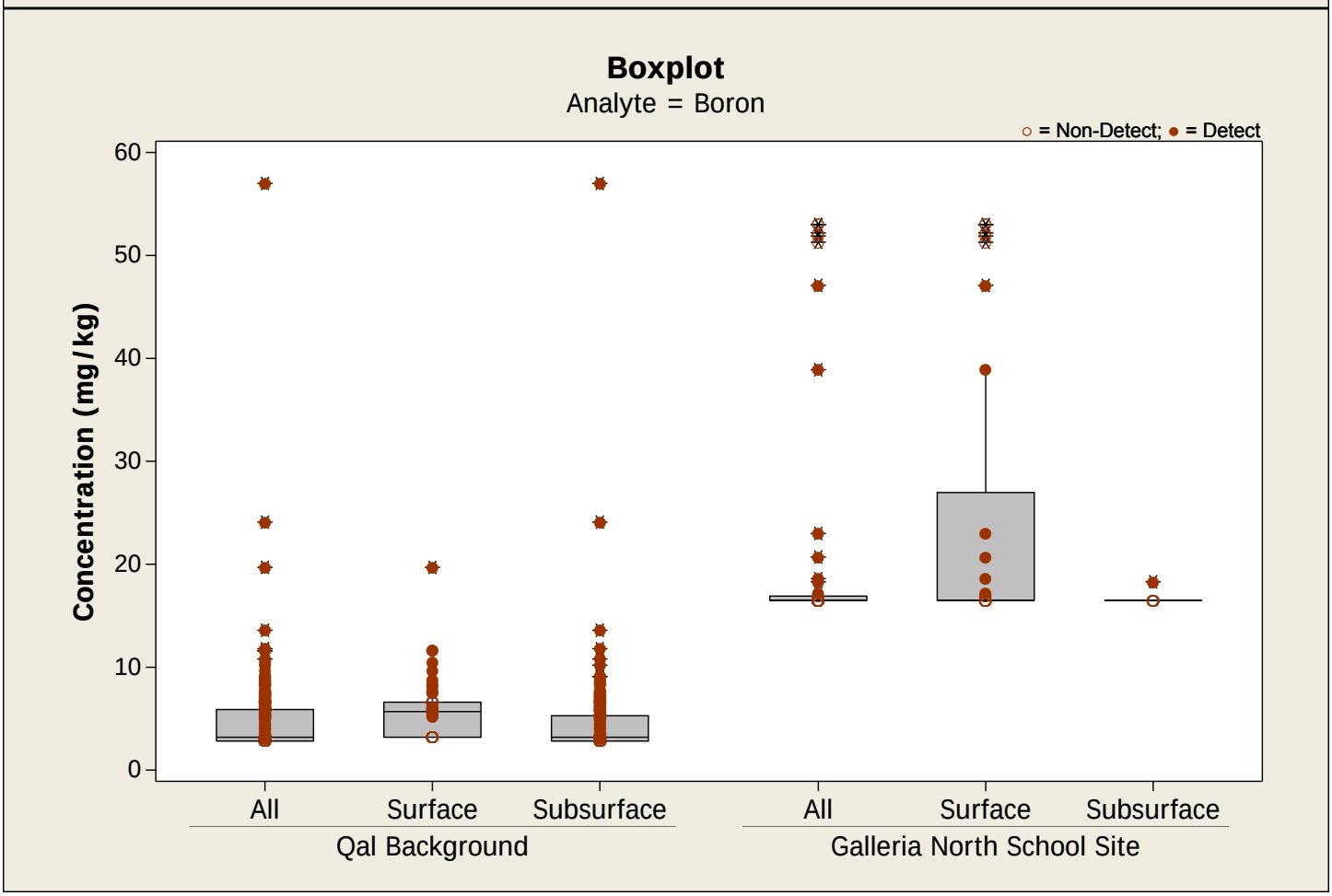

Boxplot
Analyte = Arsenic
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
30
25
20
15
10
5
0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

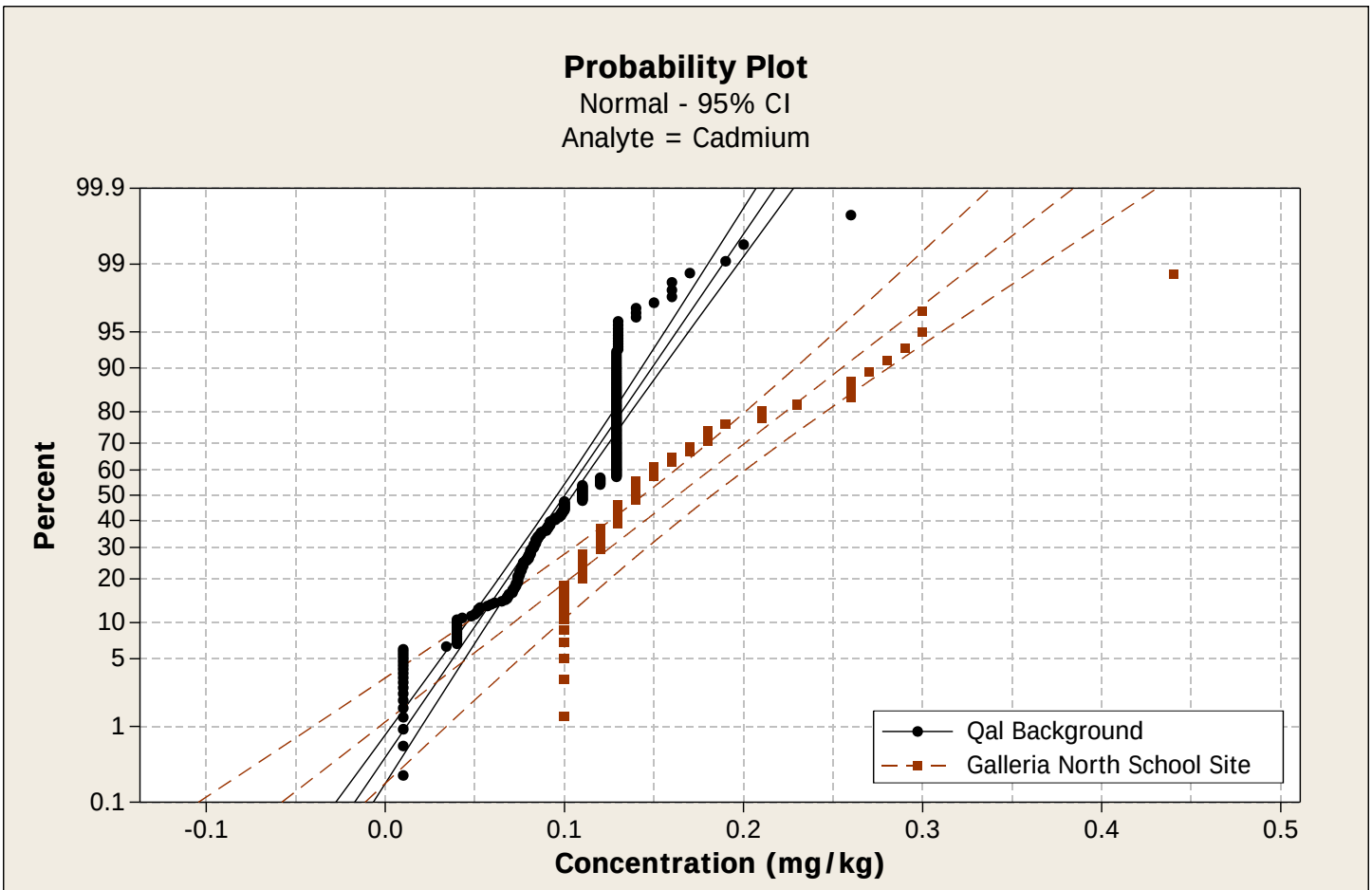

Probability Plot
Normal - 95% CI
Analyte = Barium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-500
0
500
1000
1500
Concentration (mg/kg)
Qal Background
Galleria North School Site

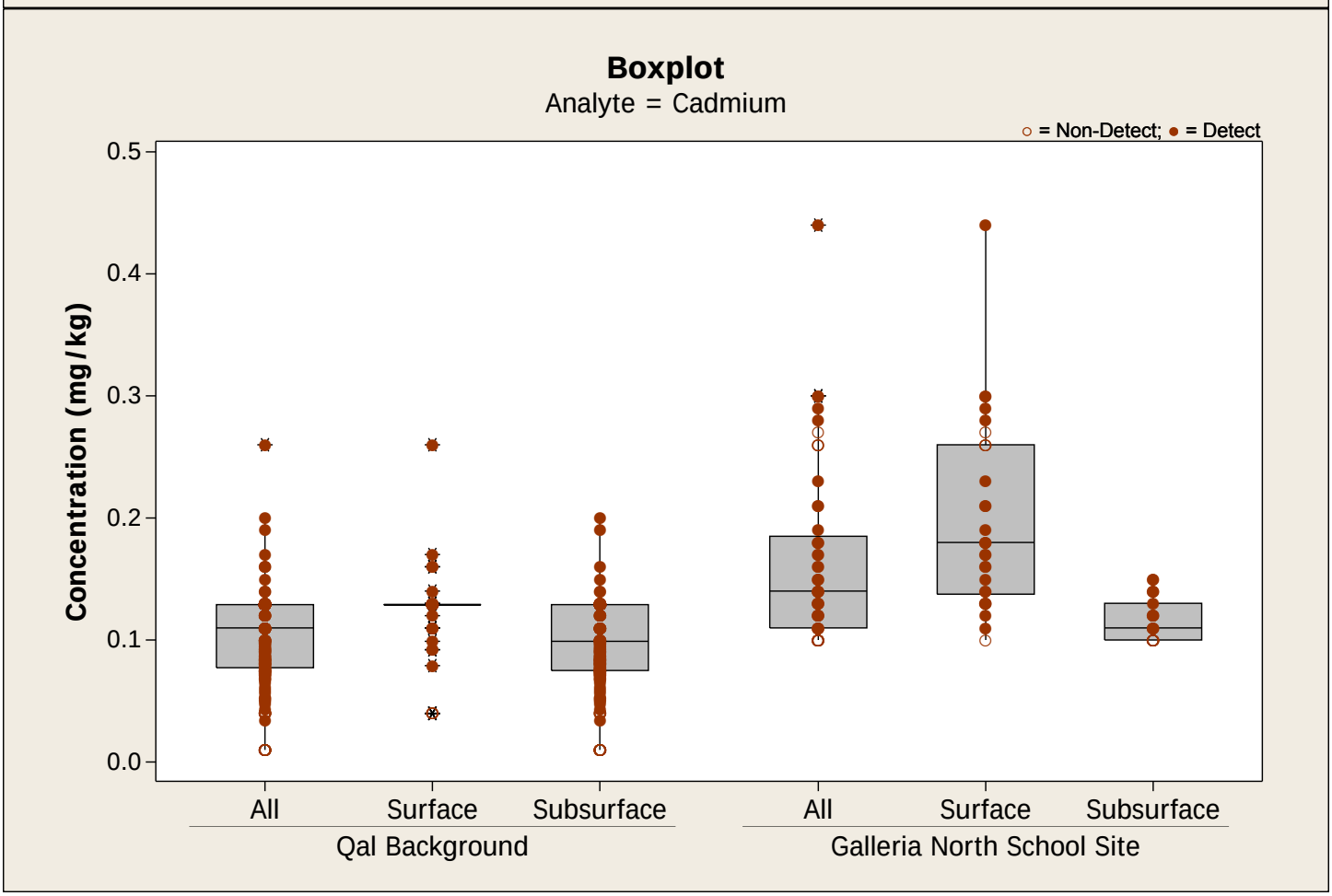

Boxplot
Analyte = Barium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
1400
1200
1000
800
600
400
200
0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

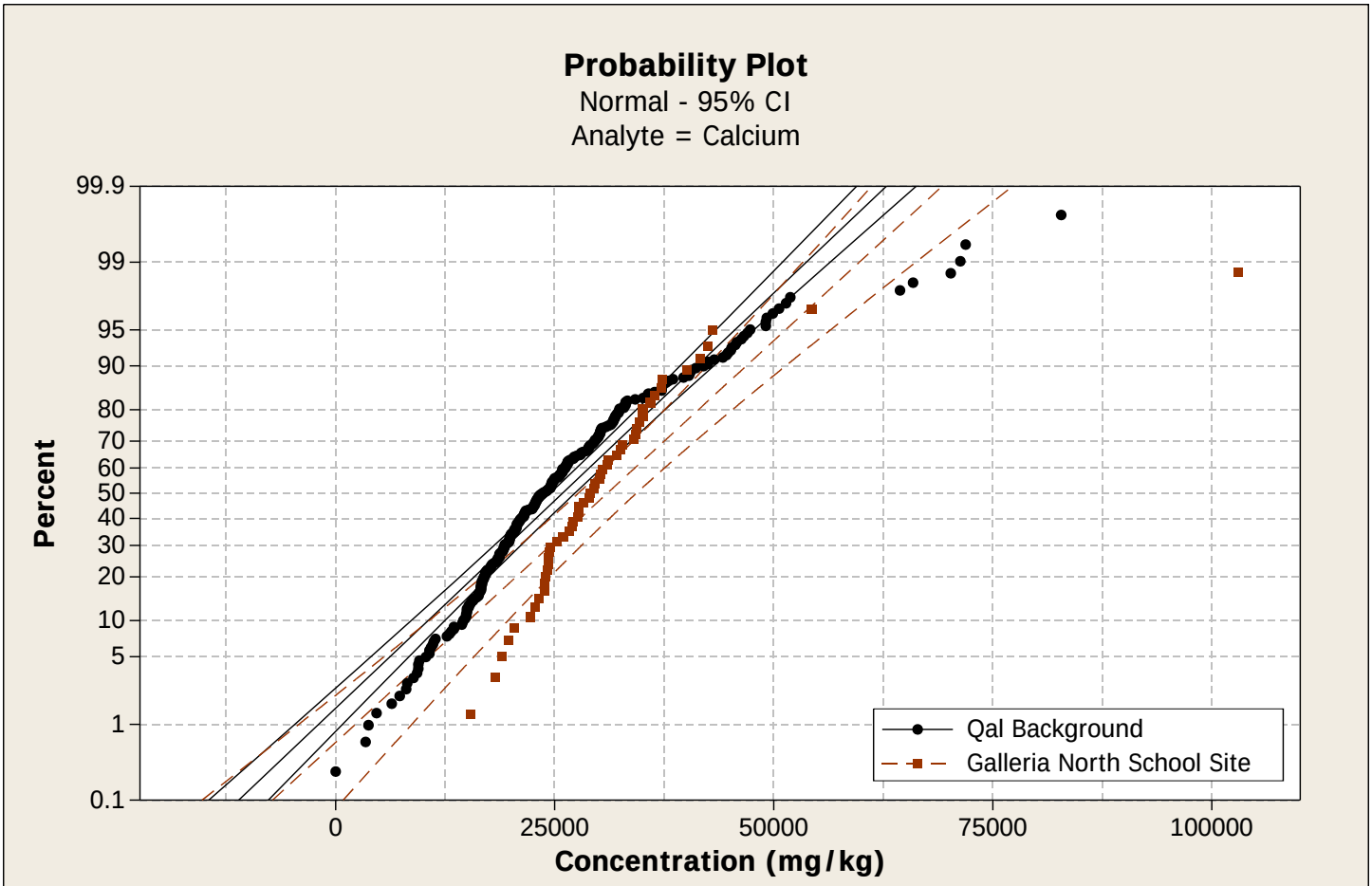

Probability Plot
Normal - 95% CI
Analyte = Beryllium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Concentration (mg/kg)
Qal Background
Galleria North School Site
Boxplot
Analyte = Beryllium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

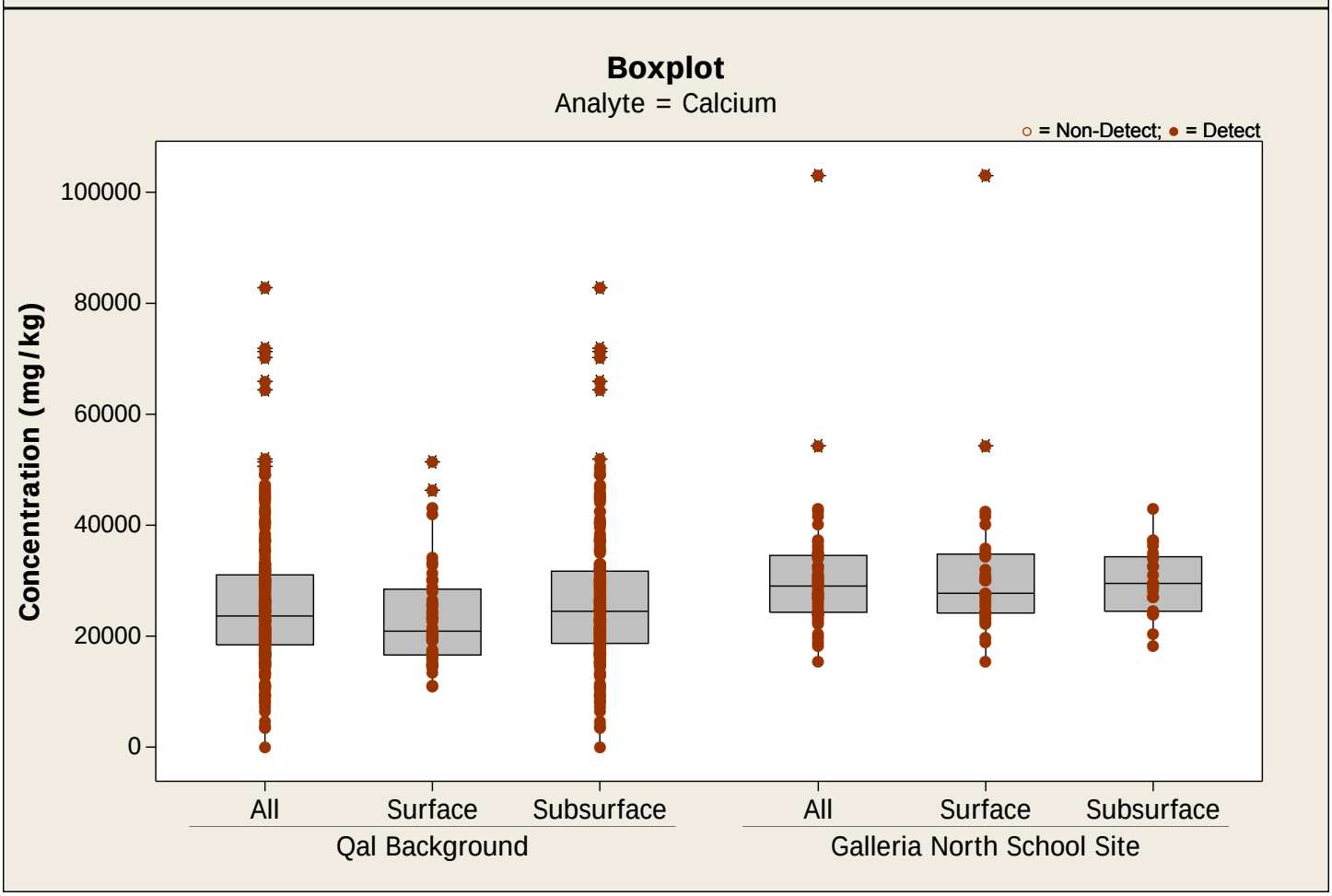

Probability Plot
Normal - 95% CI
Analyte = Boron
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-20
-10
0
10
20
30
40
50
60
70
Concentration (mg/kg)
Qal Background
Galleria North School Site

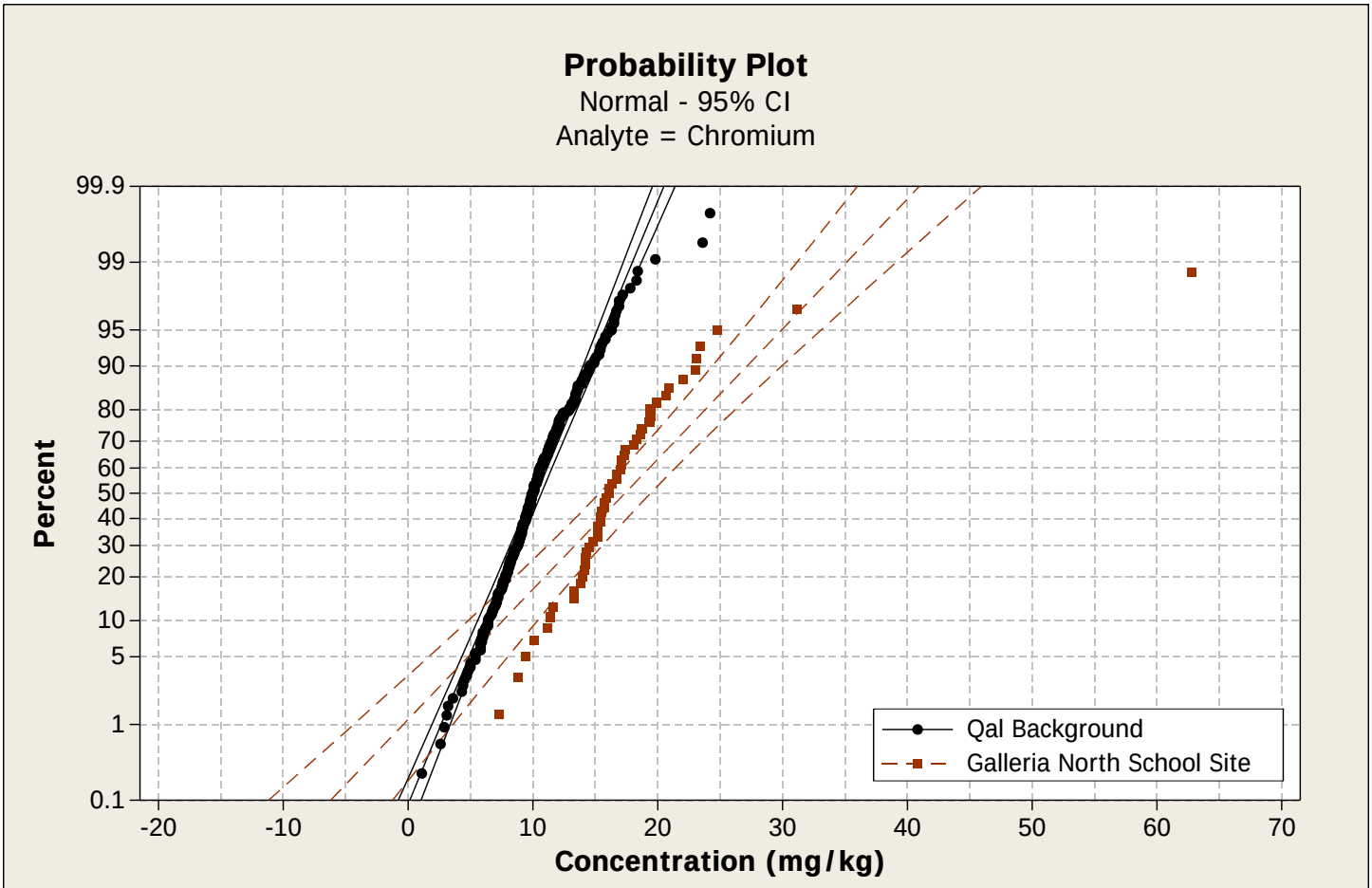

Boxplot
Analyte = Boron
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
60
50
40
30
20
10
0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

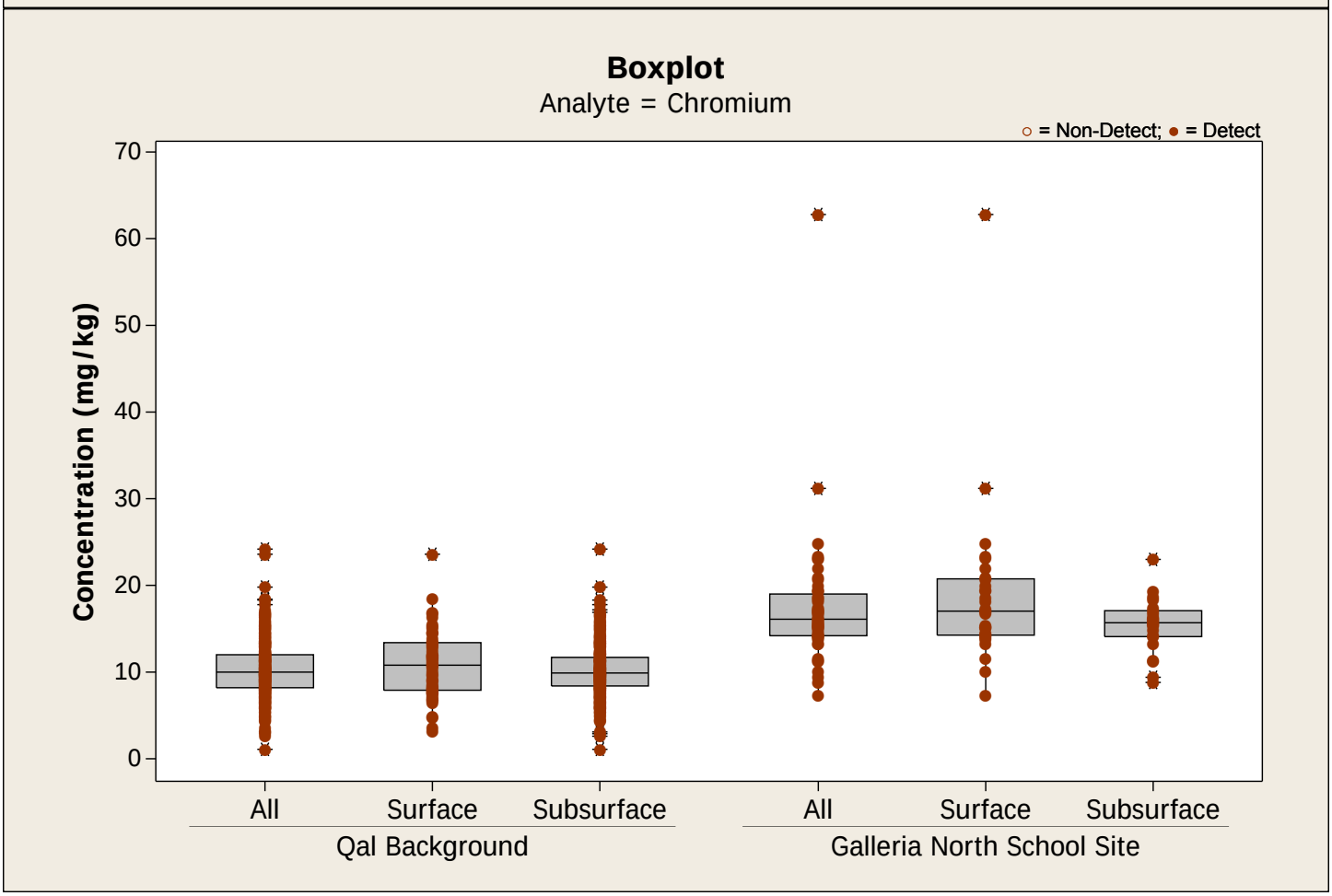

Probability Plot
Normal - 95% CI
Analyte = Cadmium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
Concentration (mg/kg)
Qal Background
Galleria North School Site

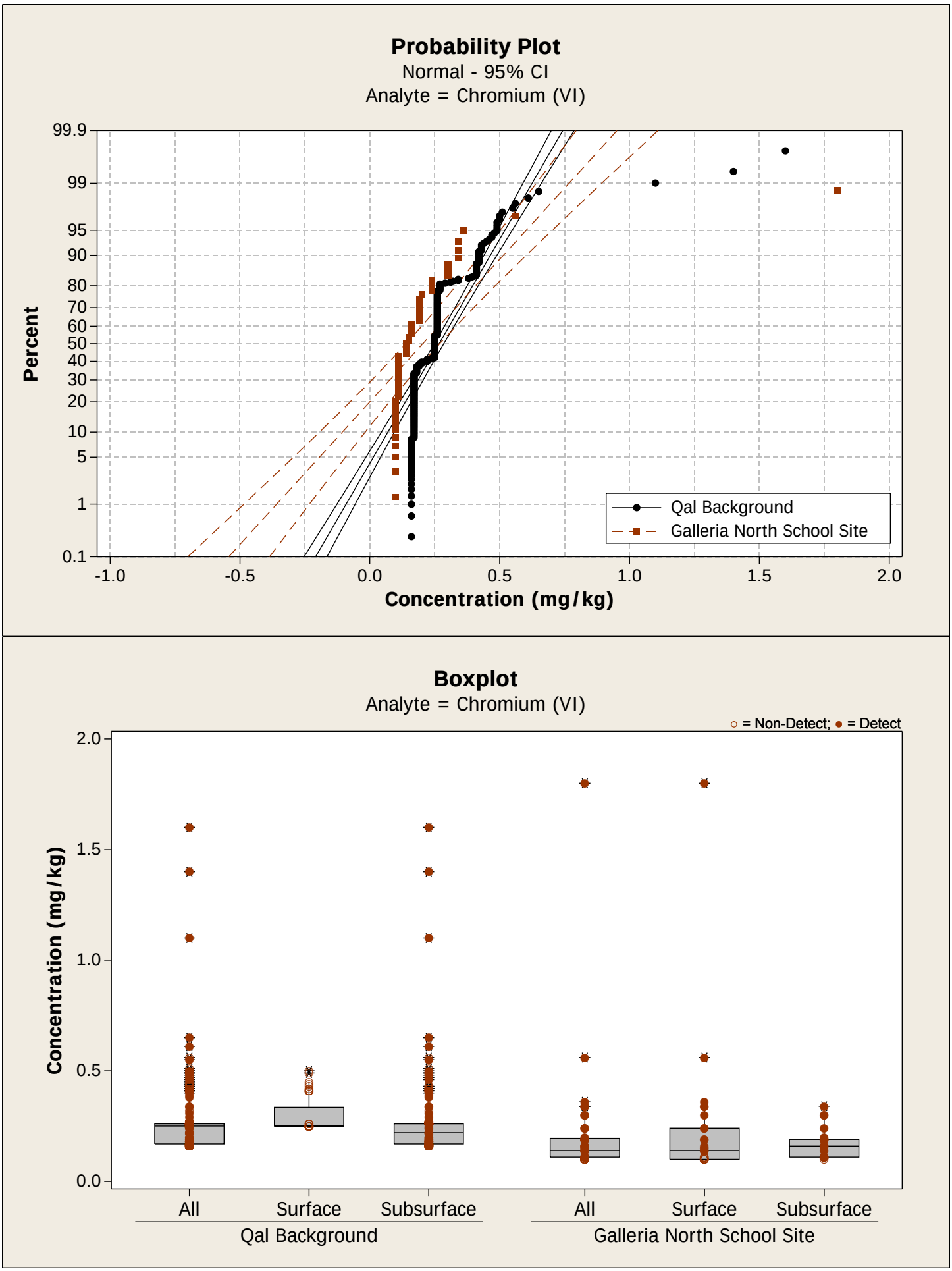

Boxplot
Analyte = Cadmium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
0.5
0.4
0.3
0.2
0.1
0.0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

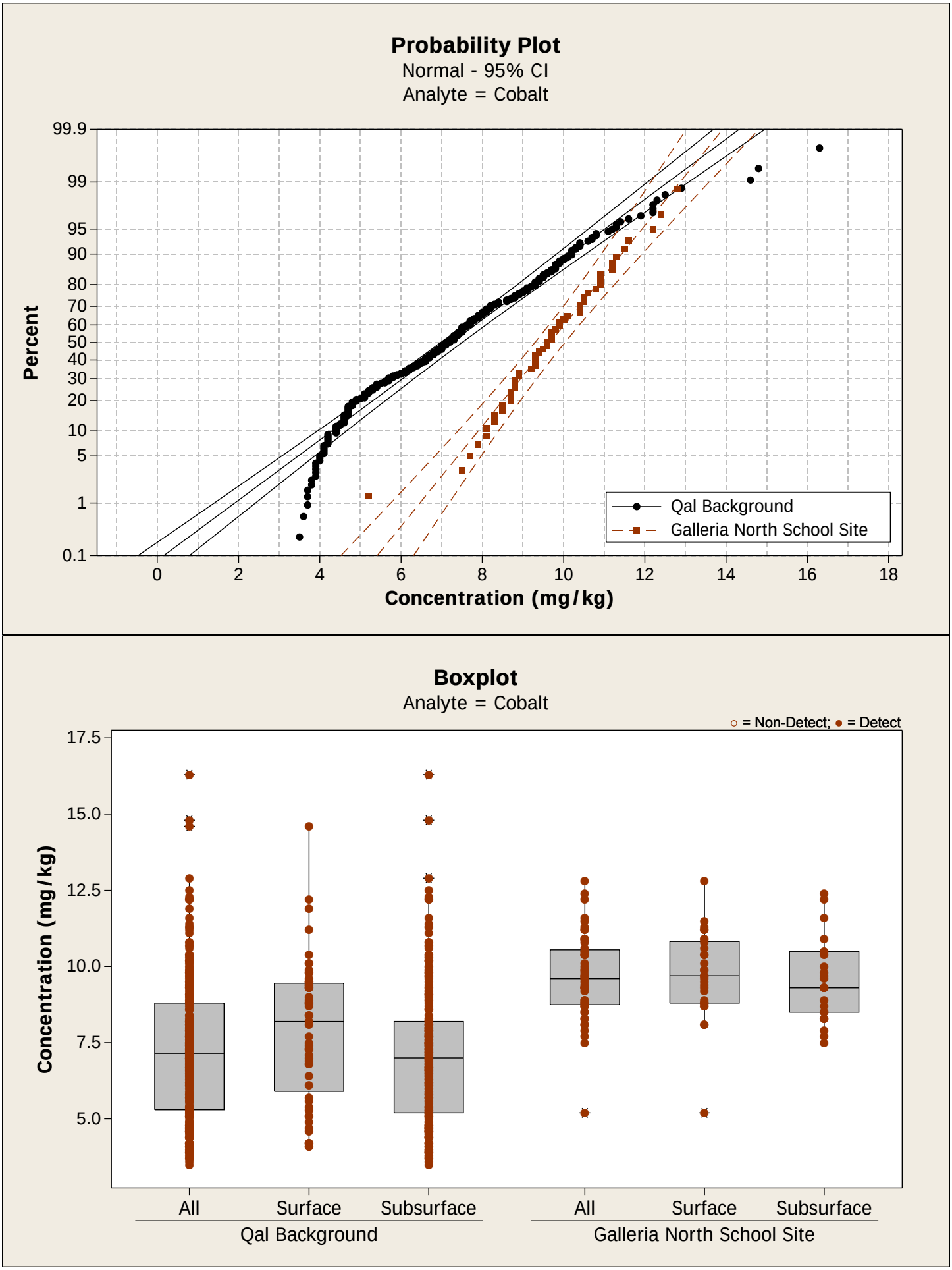

Probability Plot
Normal - 95% CI
Analyte = Calcium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
25000
50000
75000
100000
Concentration (mg/kg)
Qal Background
Galleria North School Site

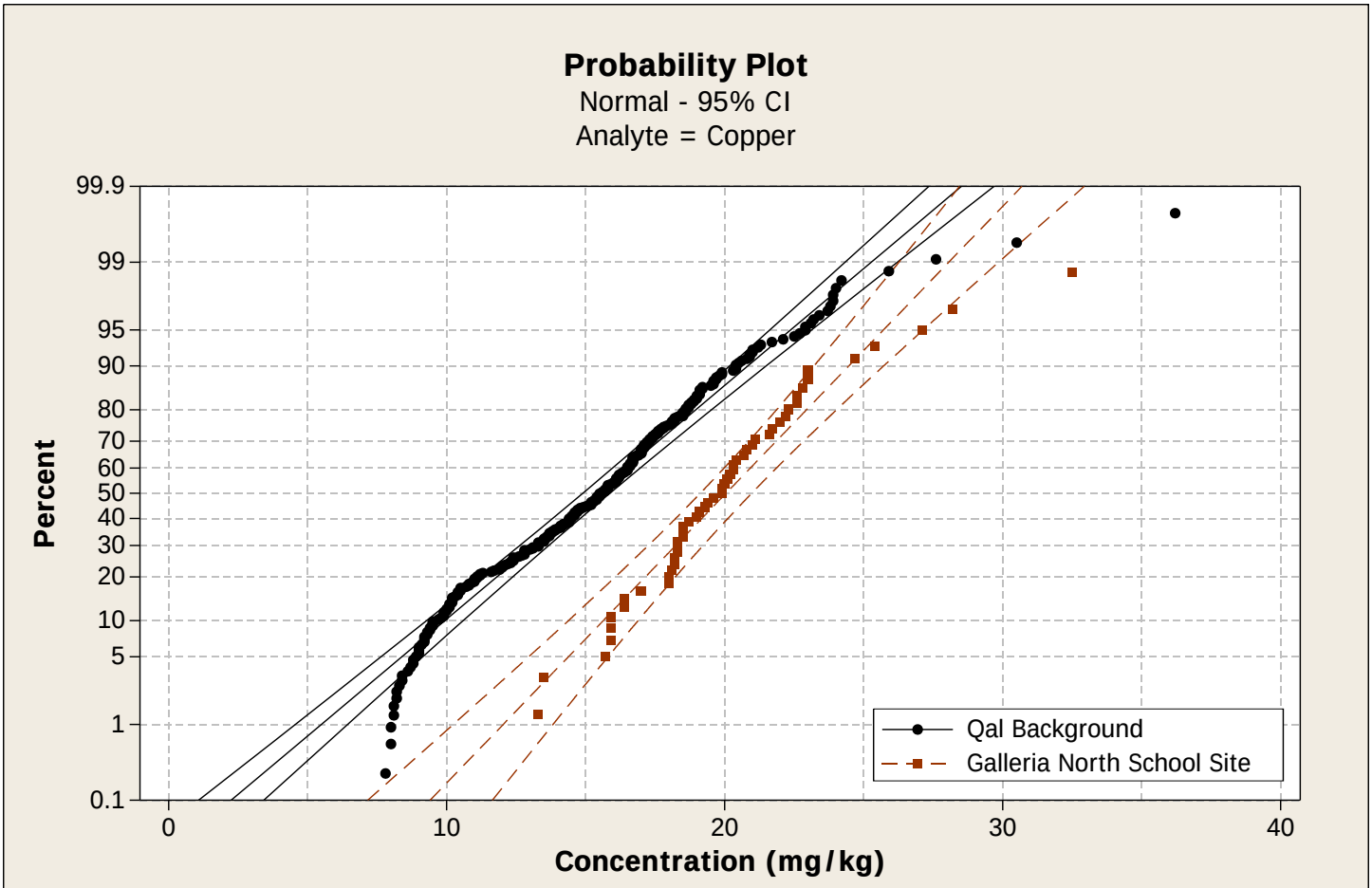

Boxplot
Analyte = Calcium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
100000
80000
60000
40000
20000
0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

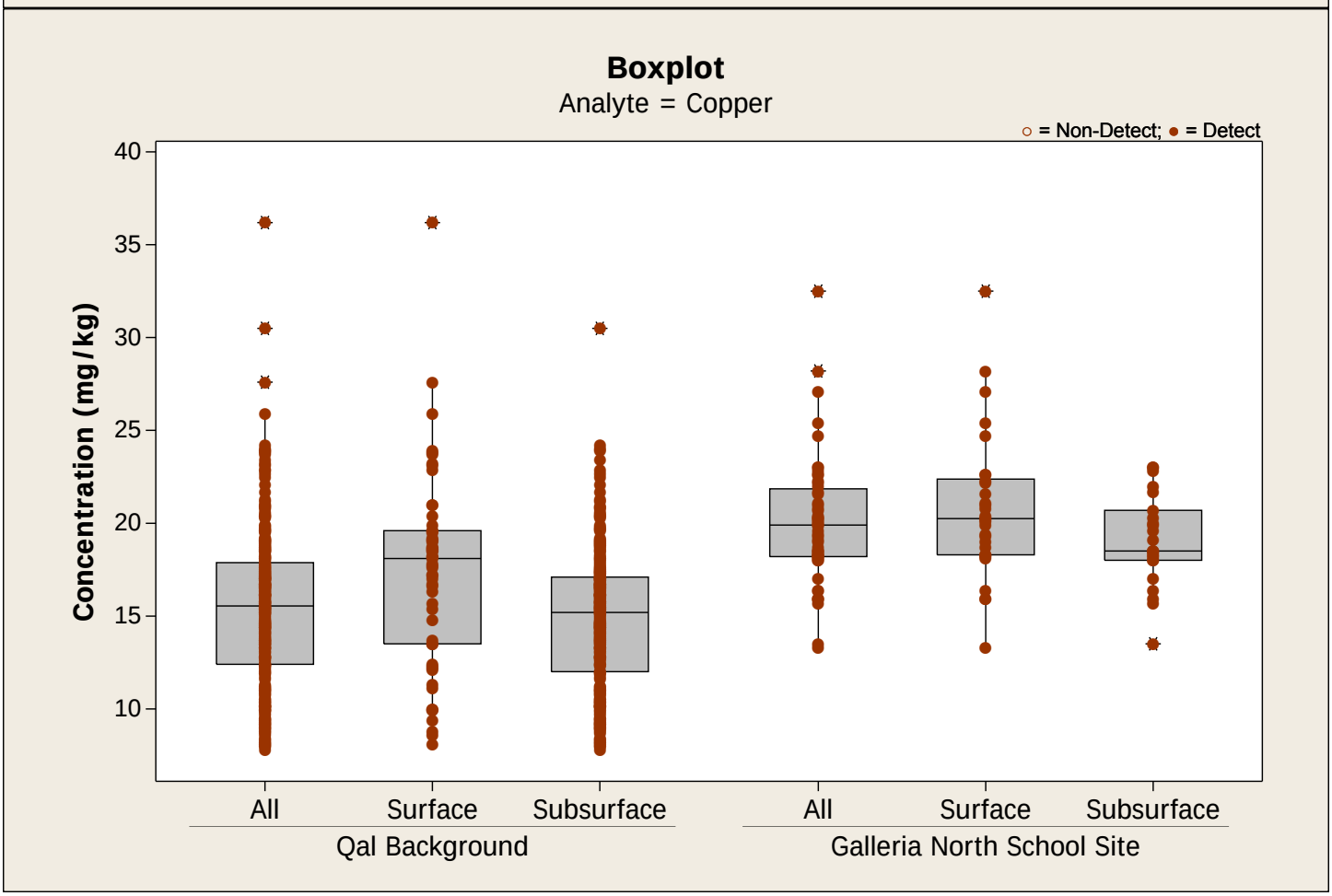

Probability Plot
Normal - 95% CI
Analyte = Chromium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-20
-10
0
10
20
30
40
50
60
70
Concentration (mg/kg)
Qal Background
Galleria North School Site

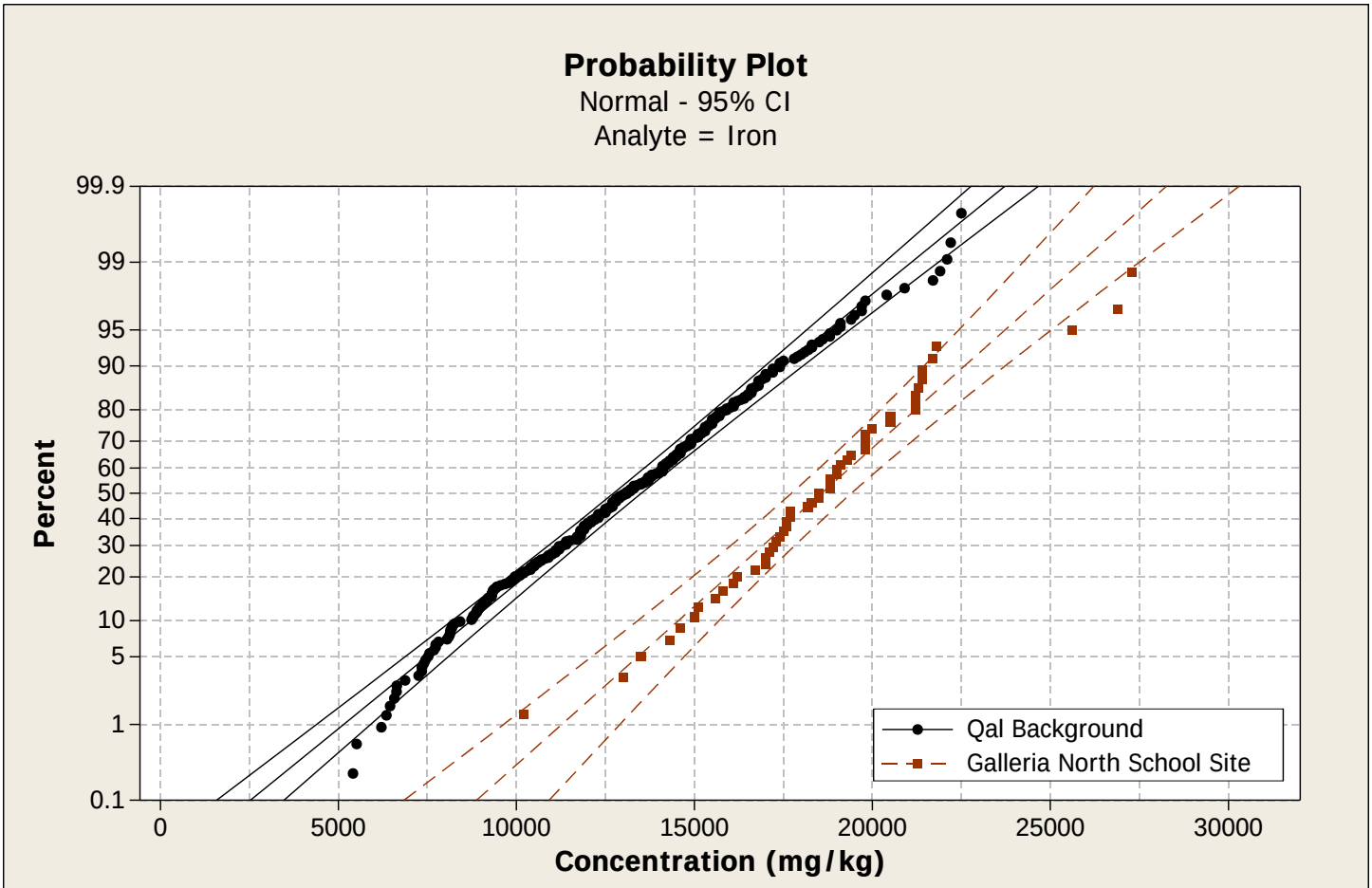

Boxplot
Analyte = Chromium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
70
60
50
40
30
20
10
0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

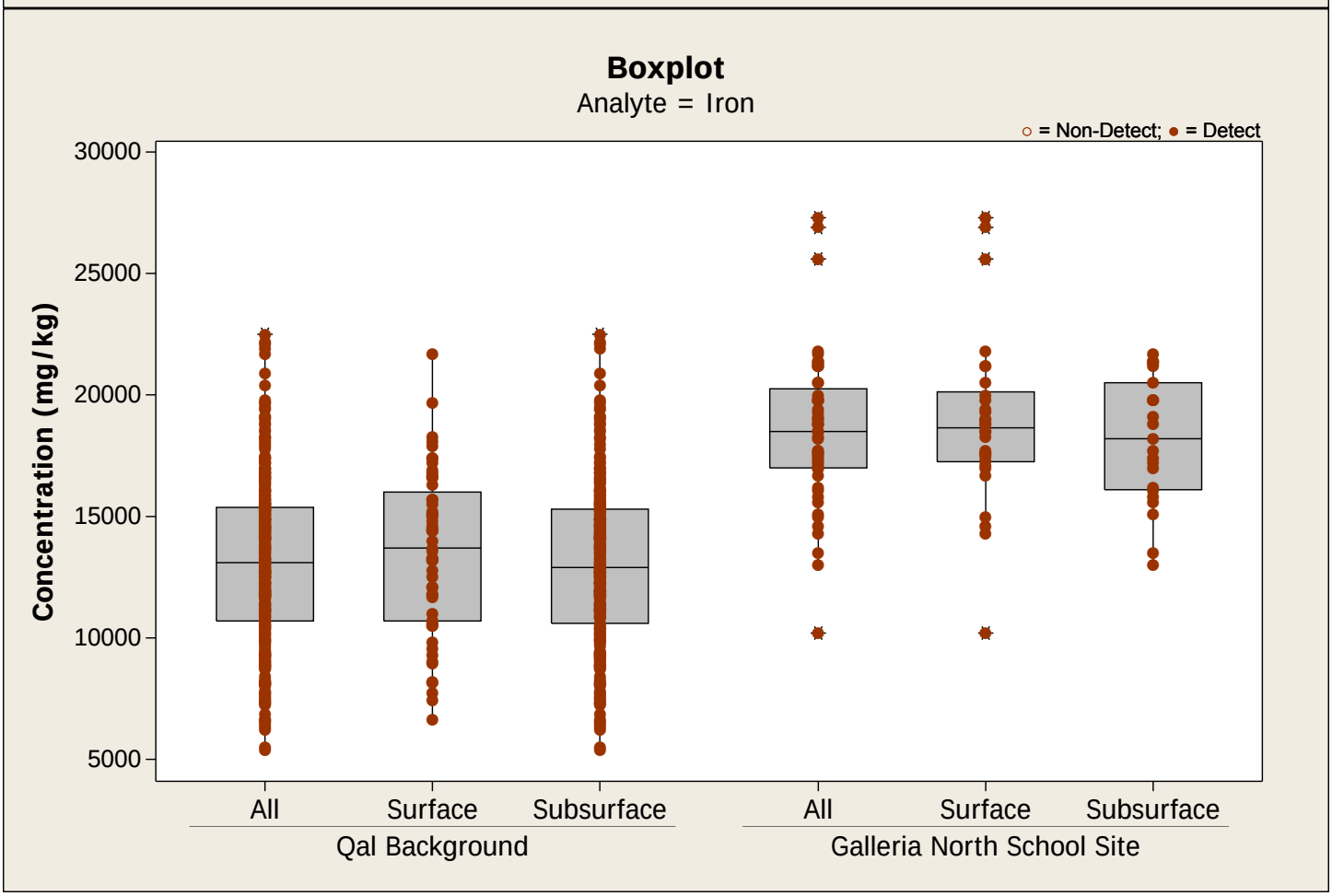

Probability Plot
Normal - 95% CI
Analyte = Chromium (VI)
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
Concentration (mg/kg)
Qal Background
Galleria North School Site
Boxplot
Analyte = Chromium (VI)
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
2.0
1.5
1.0
0.5
0.0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

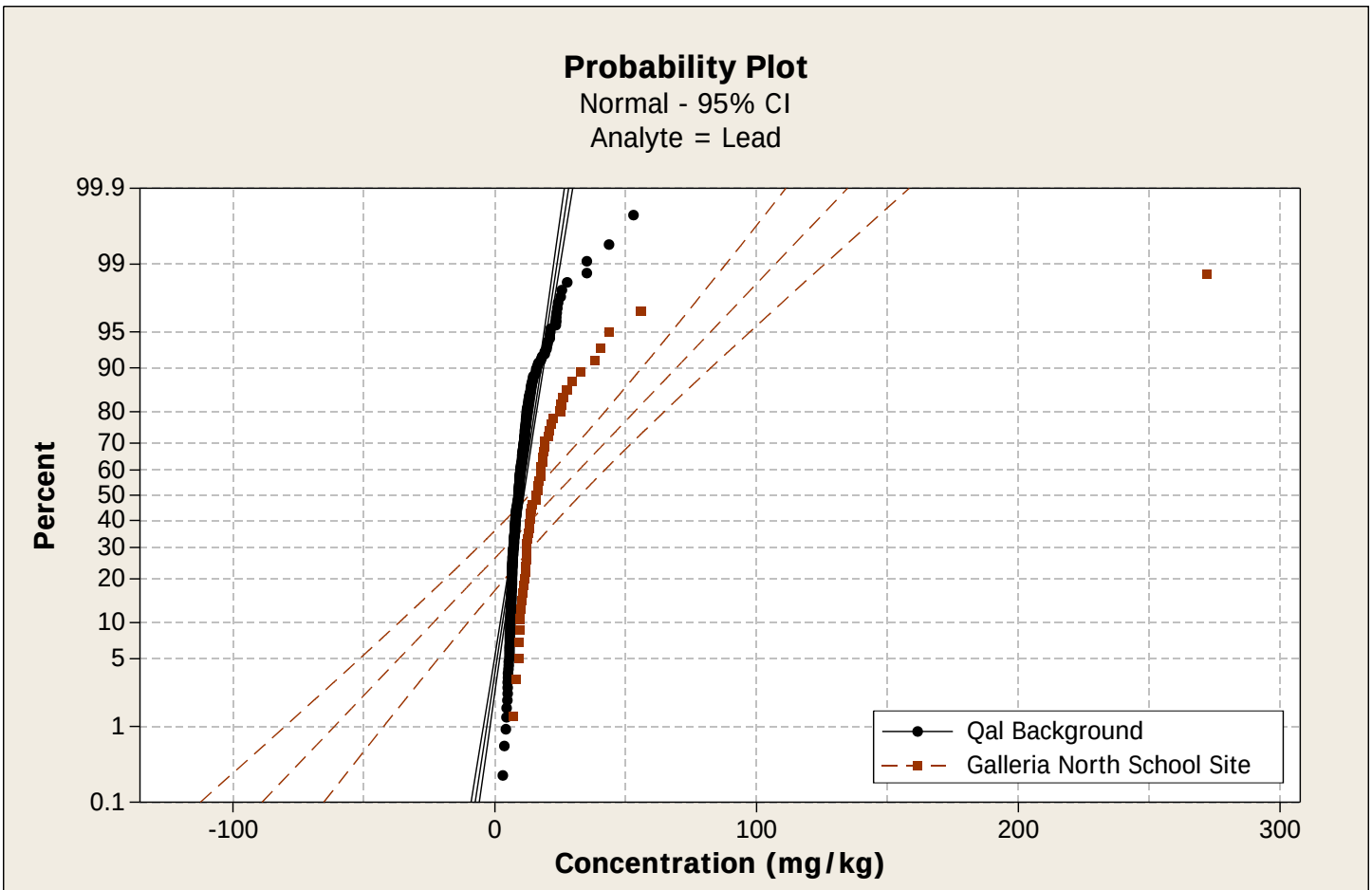

Probability Plot
Normal - 95% CI
Analyte = Cobalt
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
2
4
6
8
10
12
14
16
18
Concentration (mg/kg)
Qal Background
Galleria North School Site
Boxplot
Analyte = Cobalt
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
17.5
15.0
12.5
10.0
7.5
5.0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

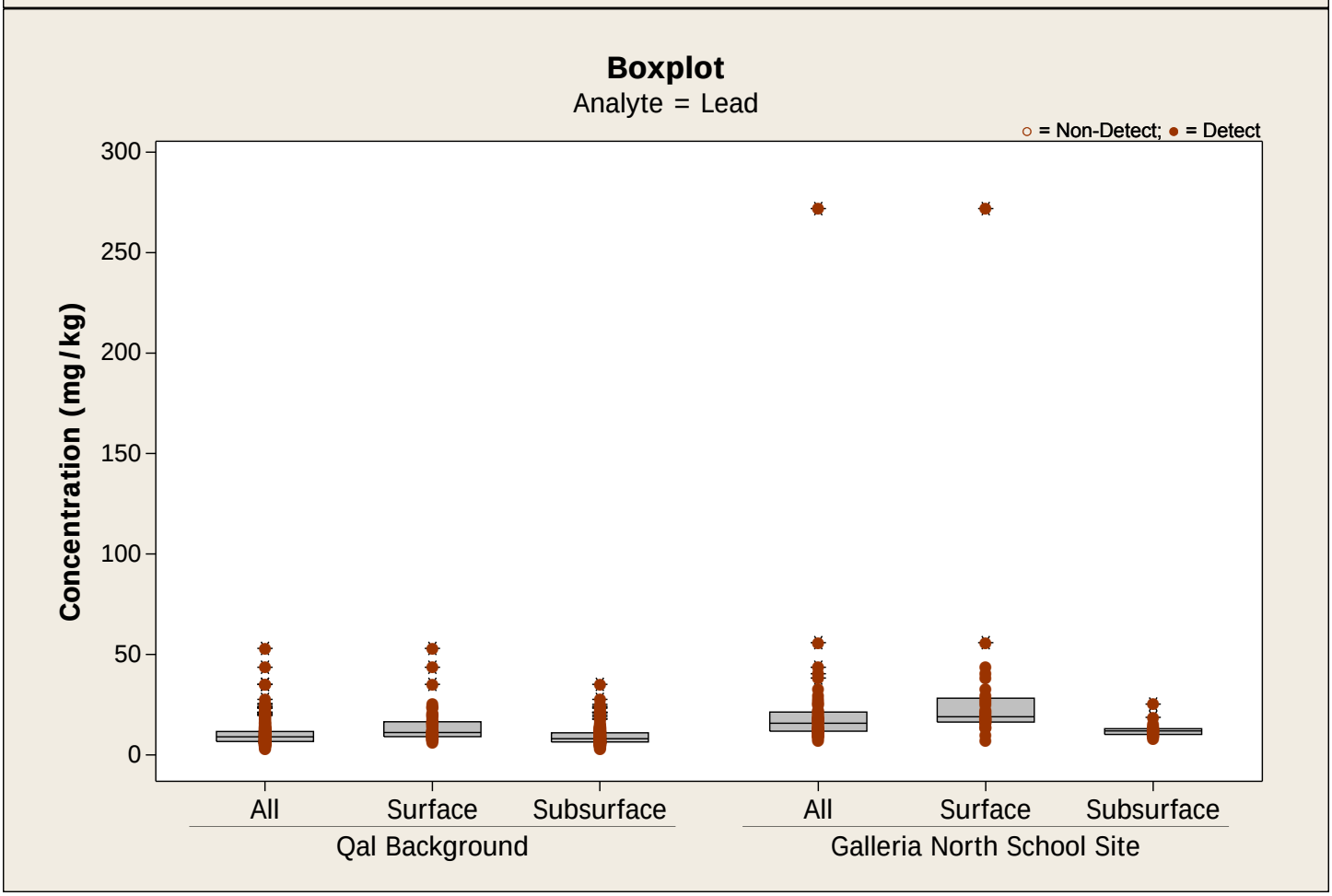

Probability Plot
Normal - 95% CI
Analyte = Copper
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
10
20
30
40
Concentration (mg/kg)
Qal Background
Galleria North School Site

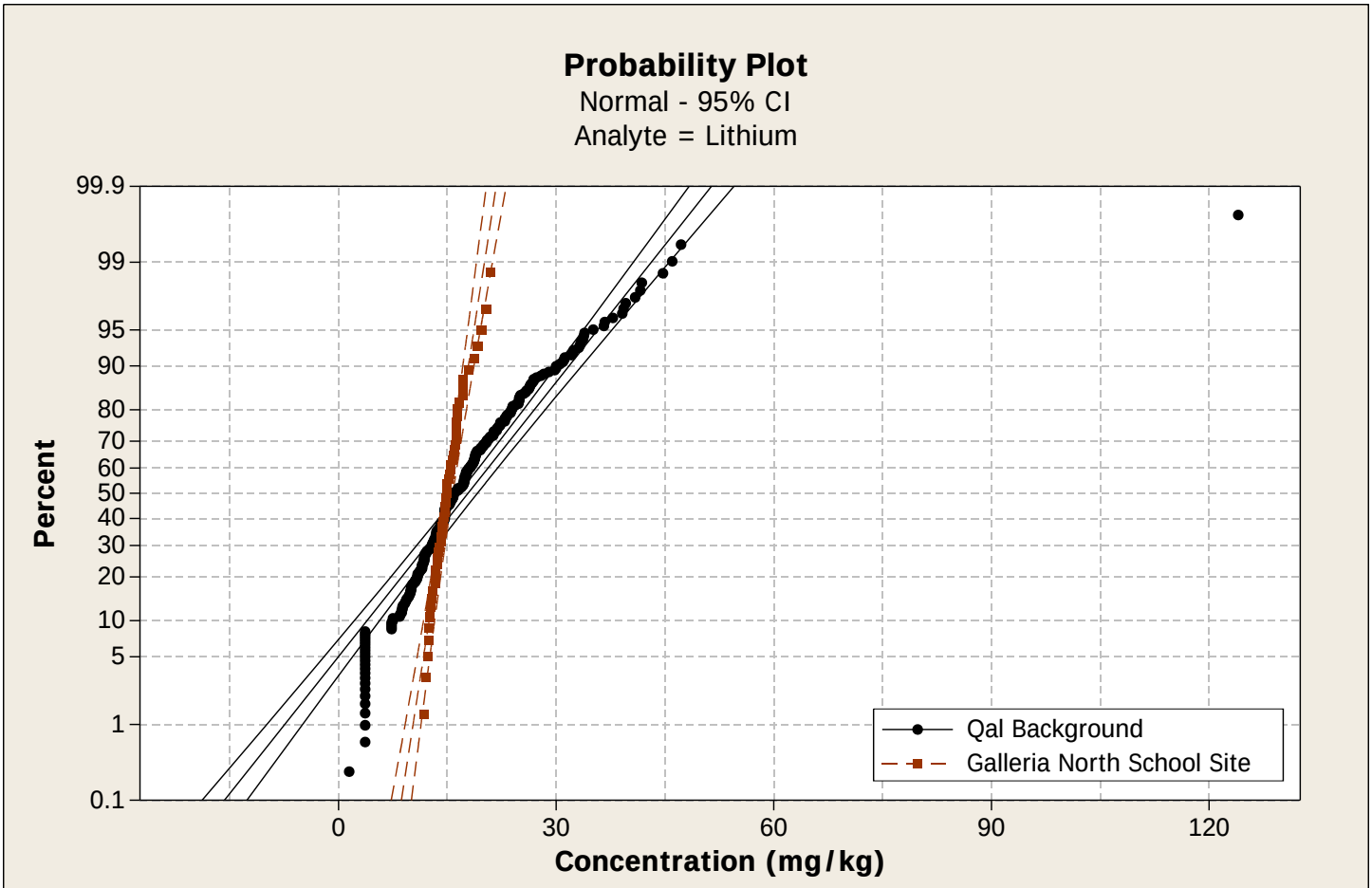

Boxplot
Analyte = Copper
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
40
35
30
25
20
15
10
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

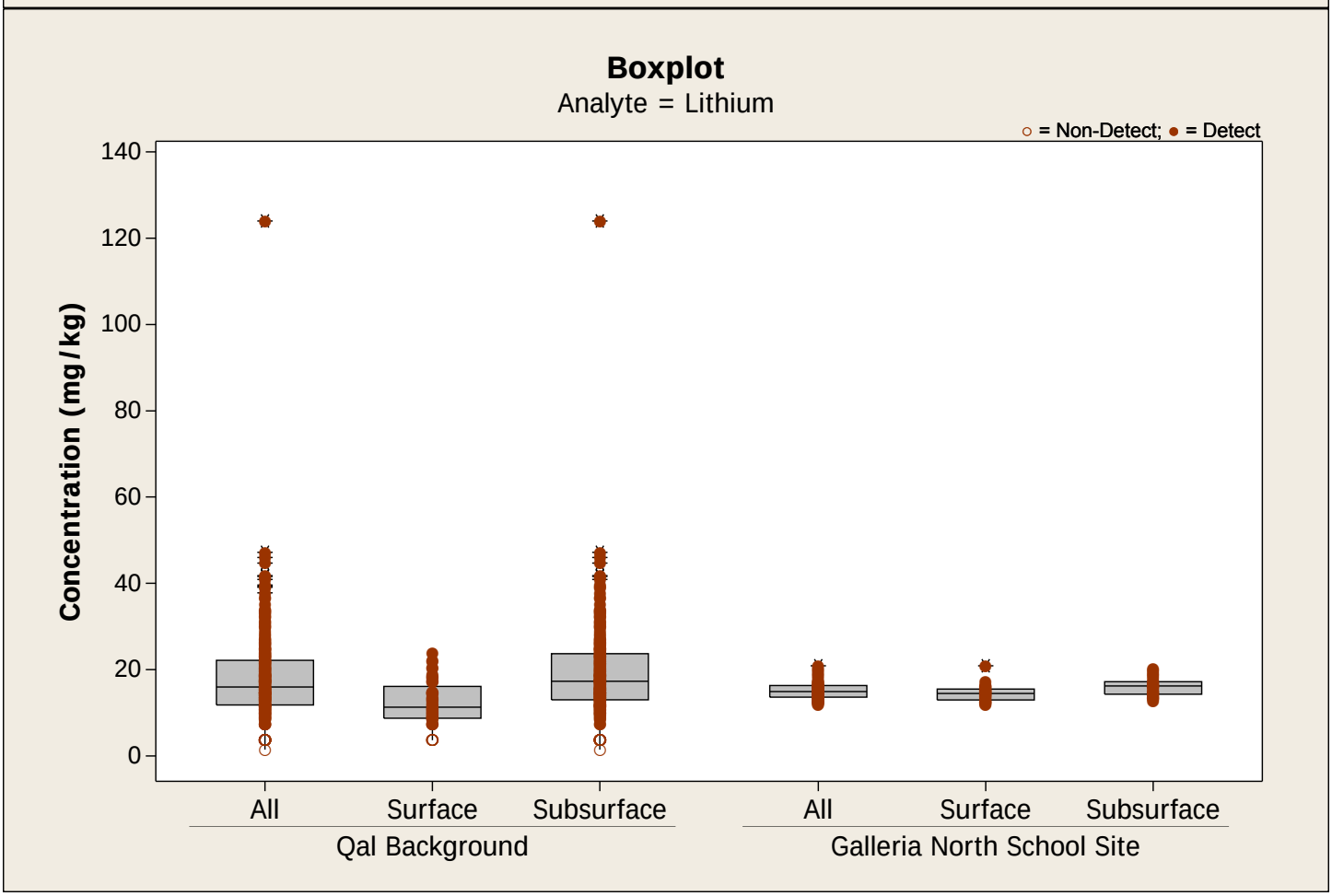

Probability Plot
Normal - 95% CI
Analyte = Iron
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
5000
10000
15000
20000
25000
30000
Concentration (mg/kg)
Qal Background
Galleria North School Site

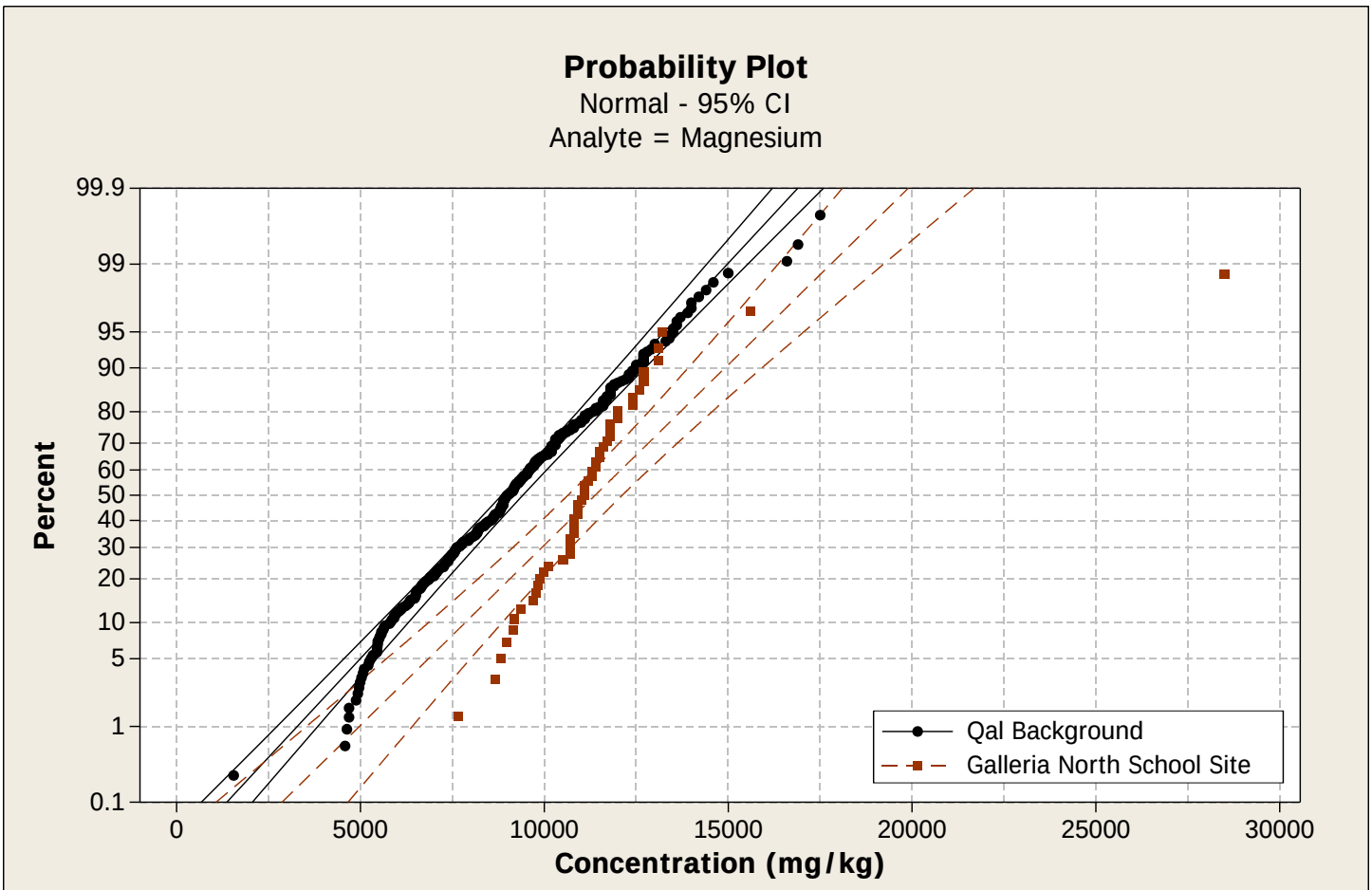

Boxplot
Analyte = Iron
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
30000
25000
20000
15000
10000
5000
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

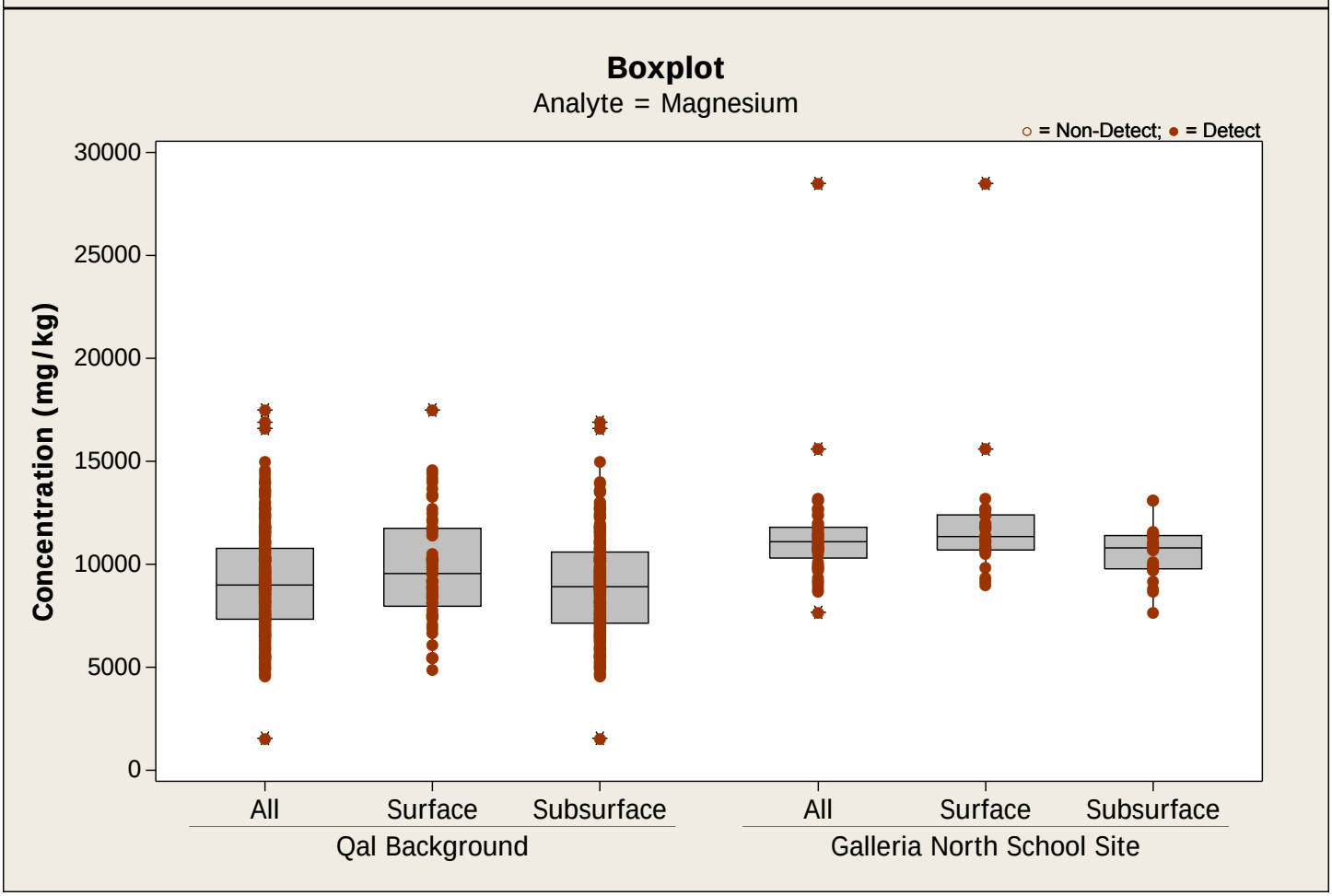

Probability Plot
Normal - 95% CI
Analyte = Lead
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-100
0
100
200
300
Concentration (mg/kg)
Qal Background
Galleria North School Site

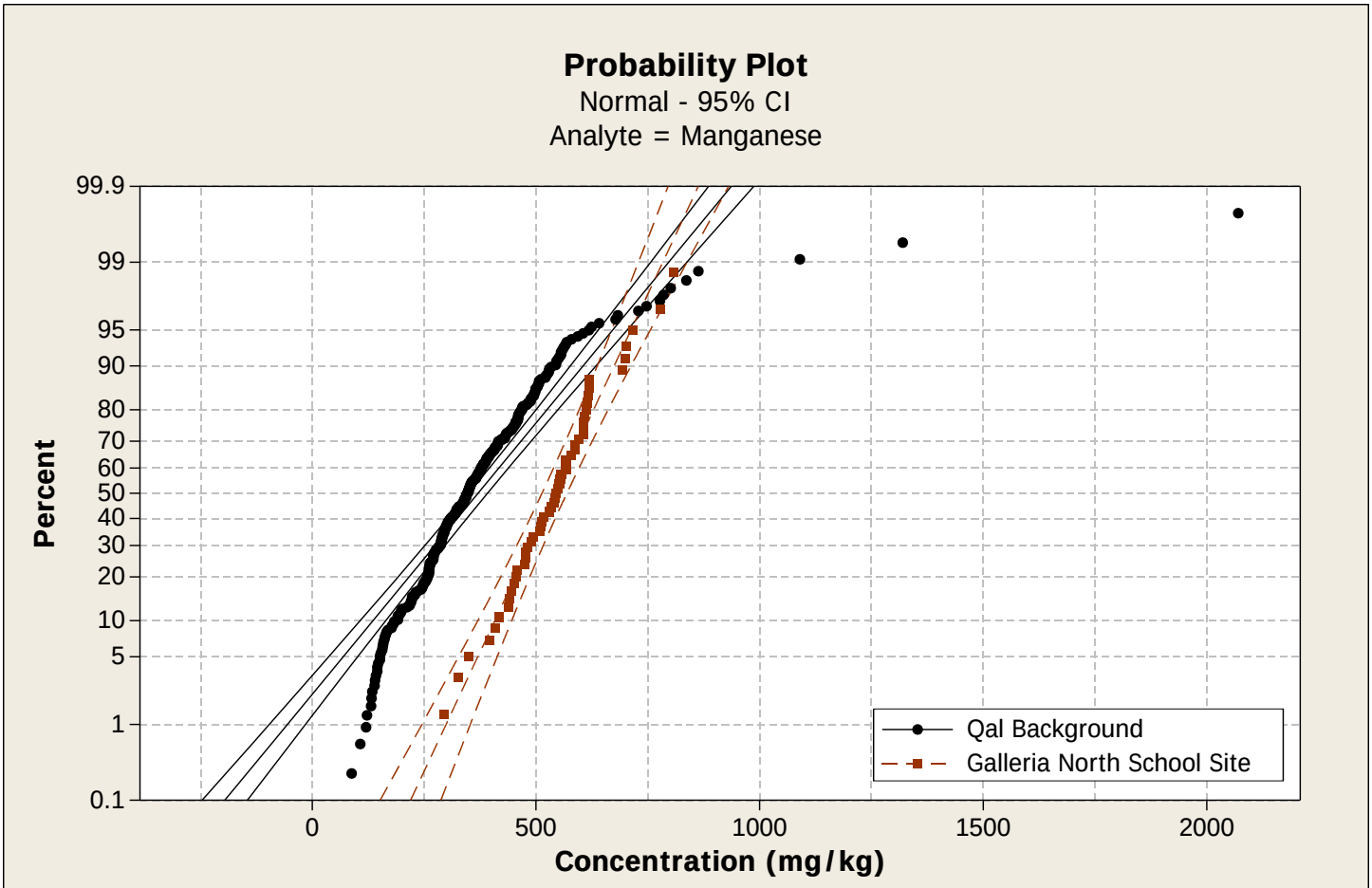

Boxplot
Analyte = Lead
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
300
250
200
150
100
50
0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

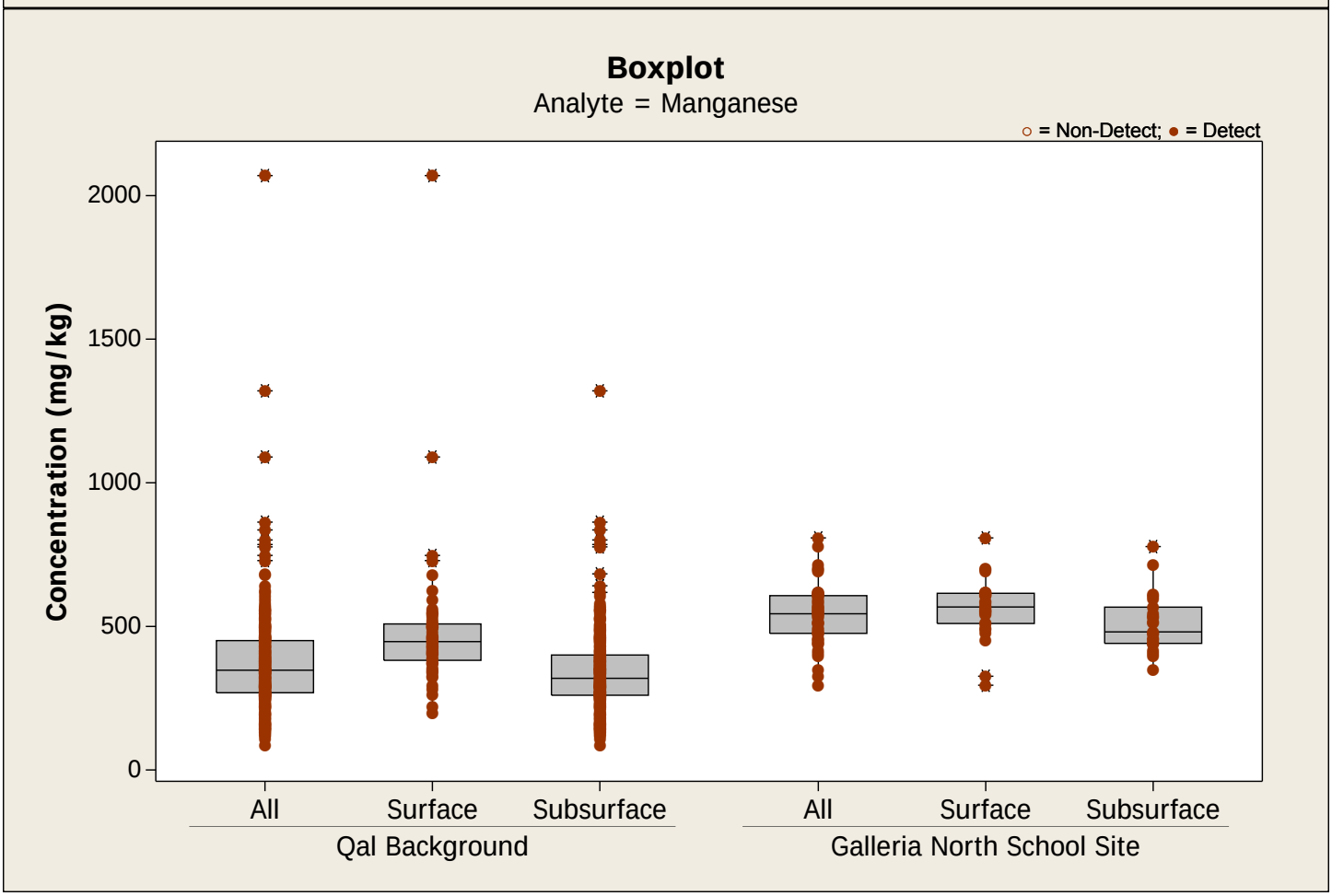

Probability Plot
Normal - 95% CI
Analyte = Lithium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
30
60
90
120
Concentration (mg/kg)
Qal Background
Galleria North School Site

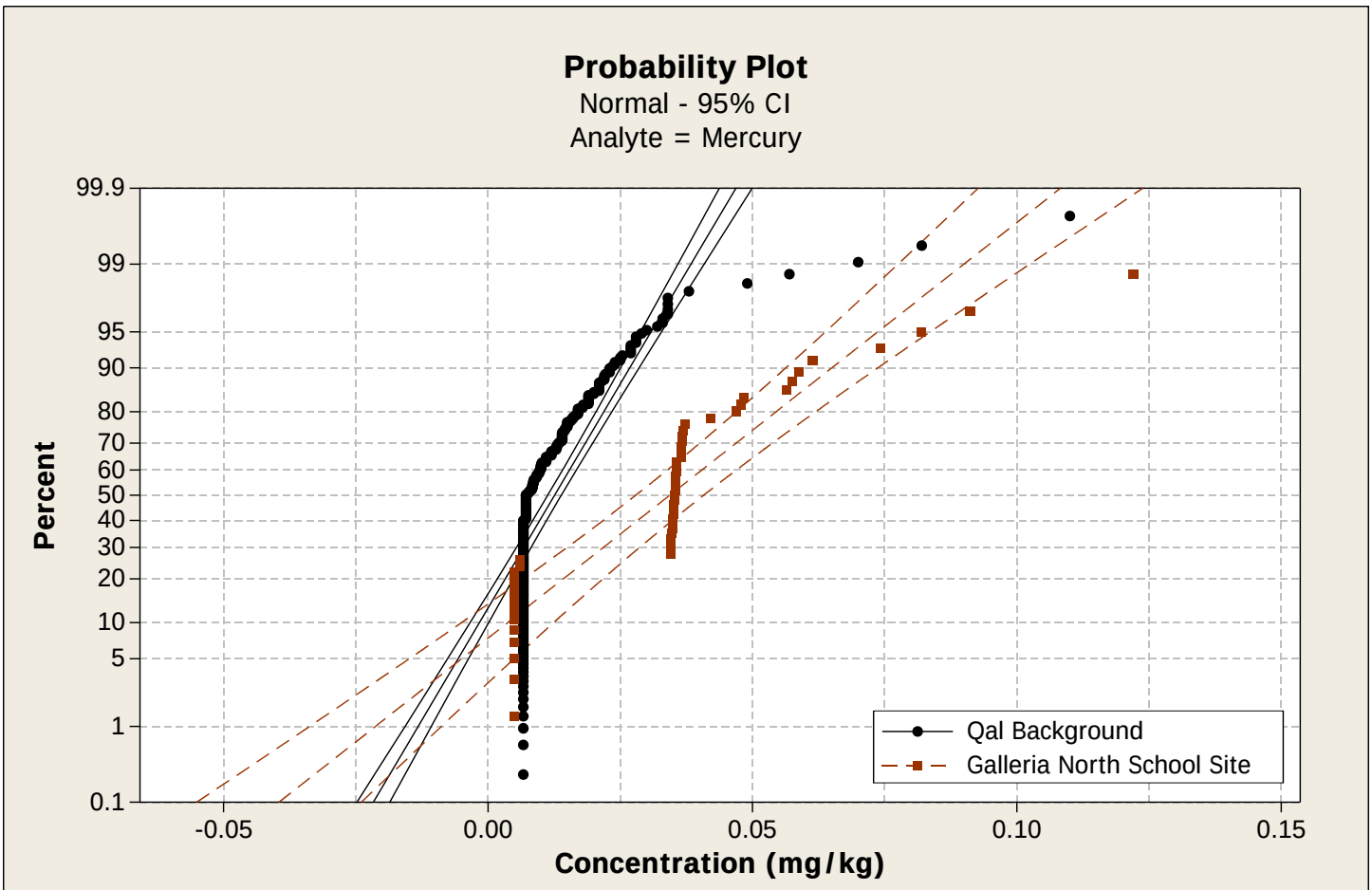

Boxplot
Analyte = Lithium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
140
120
100
80
60
40
20
0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

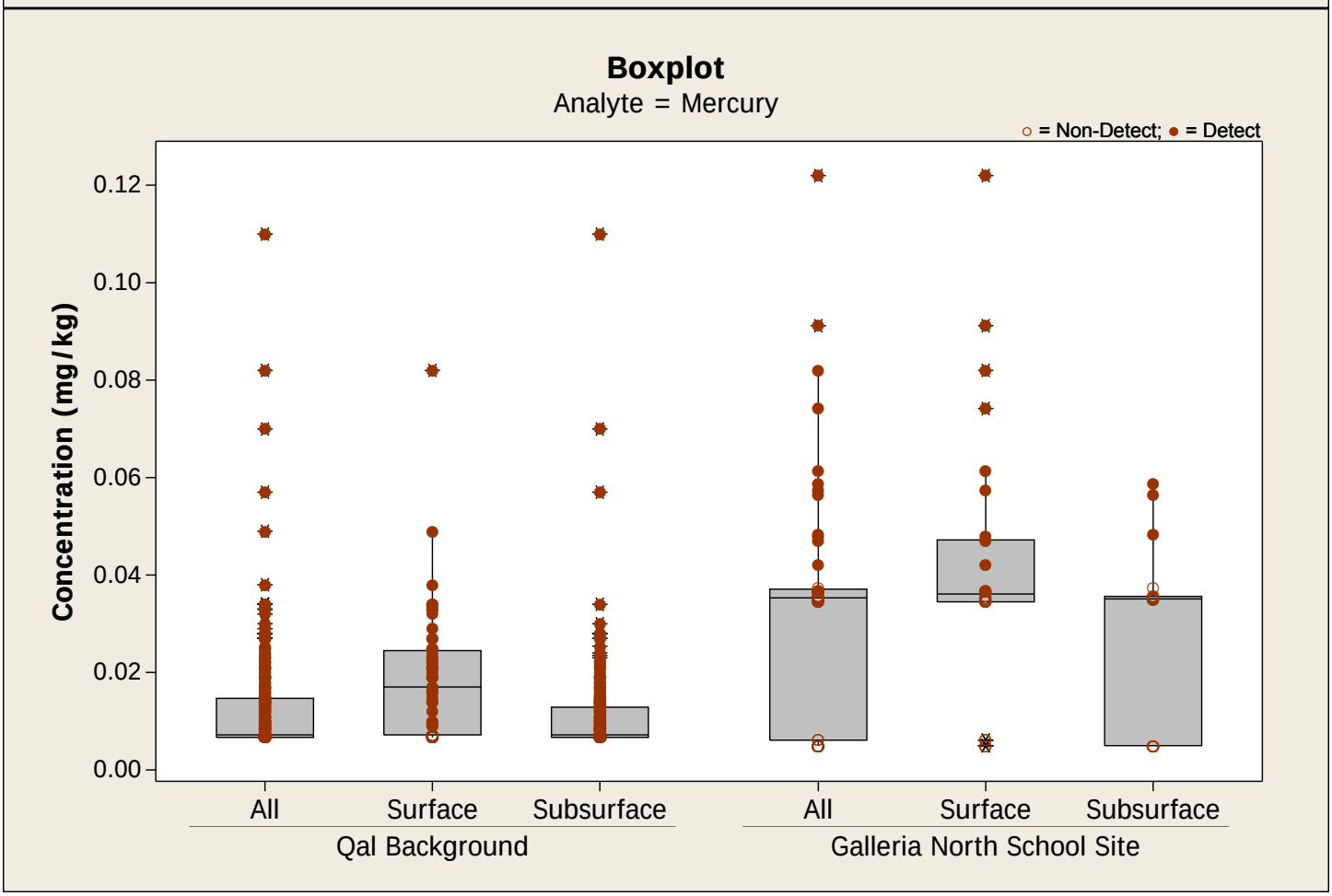

Probability Plot
Normal - 95% CI
Analyte = Magnesium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
5000
10000
15000
20000
25000
30000
Concentration (mg/kg)
Qal Background
Galleria North School Site

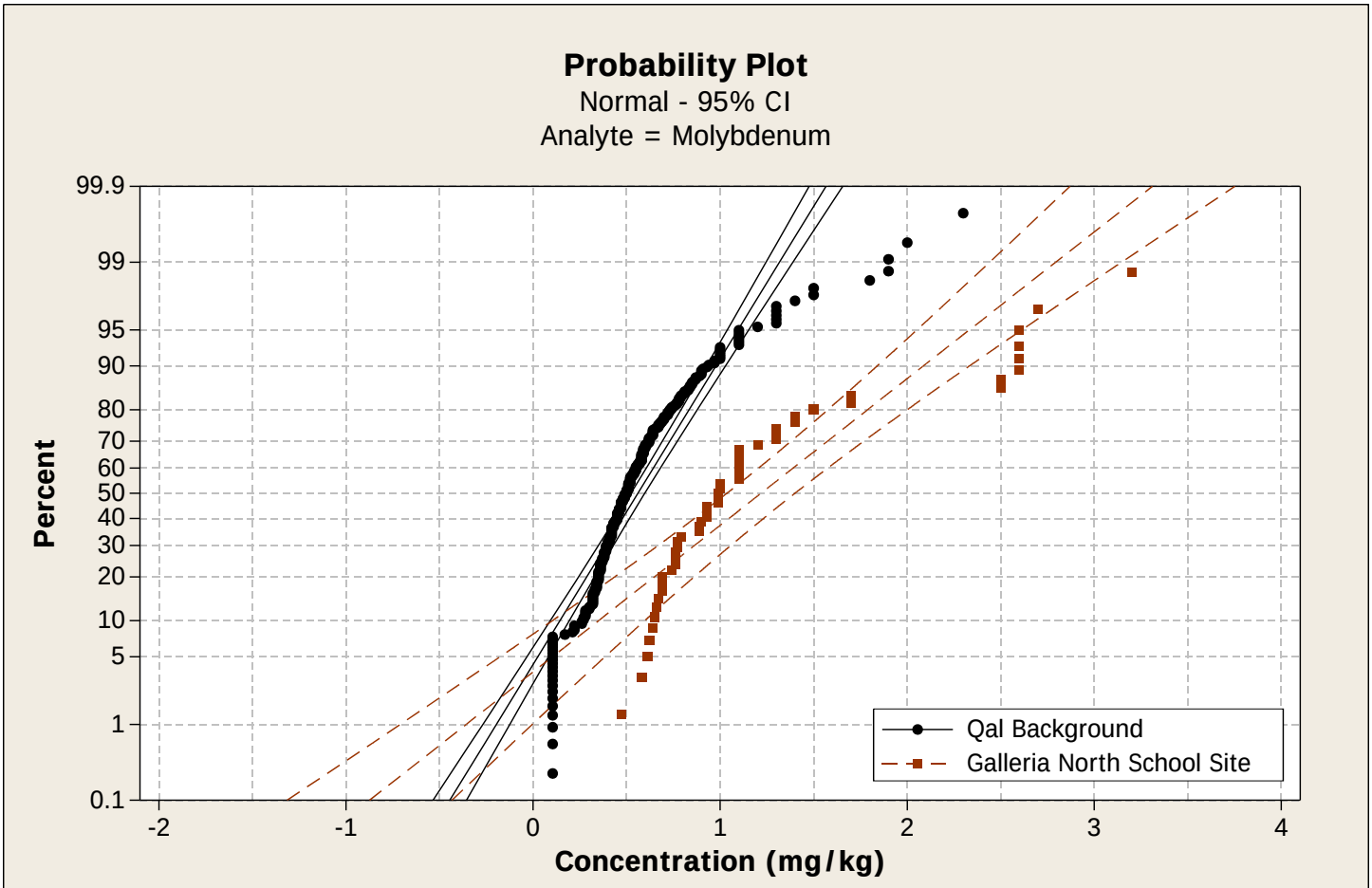

Boxplot
Analyte = Magnesium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
30000
25000
20000
15000
10000
5000
0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

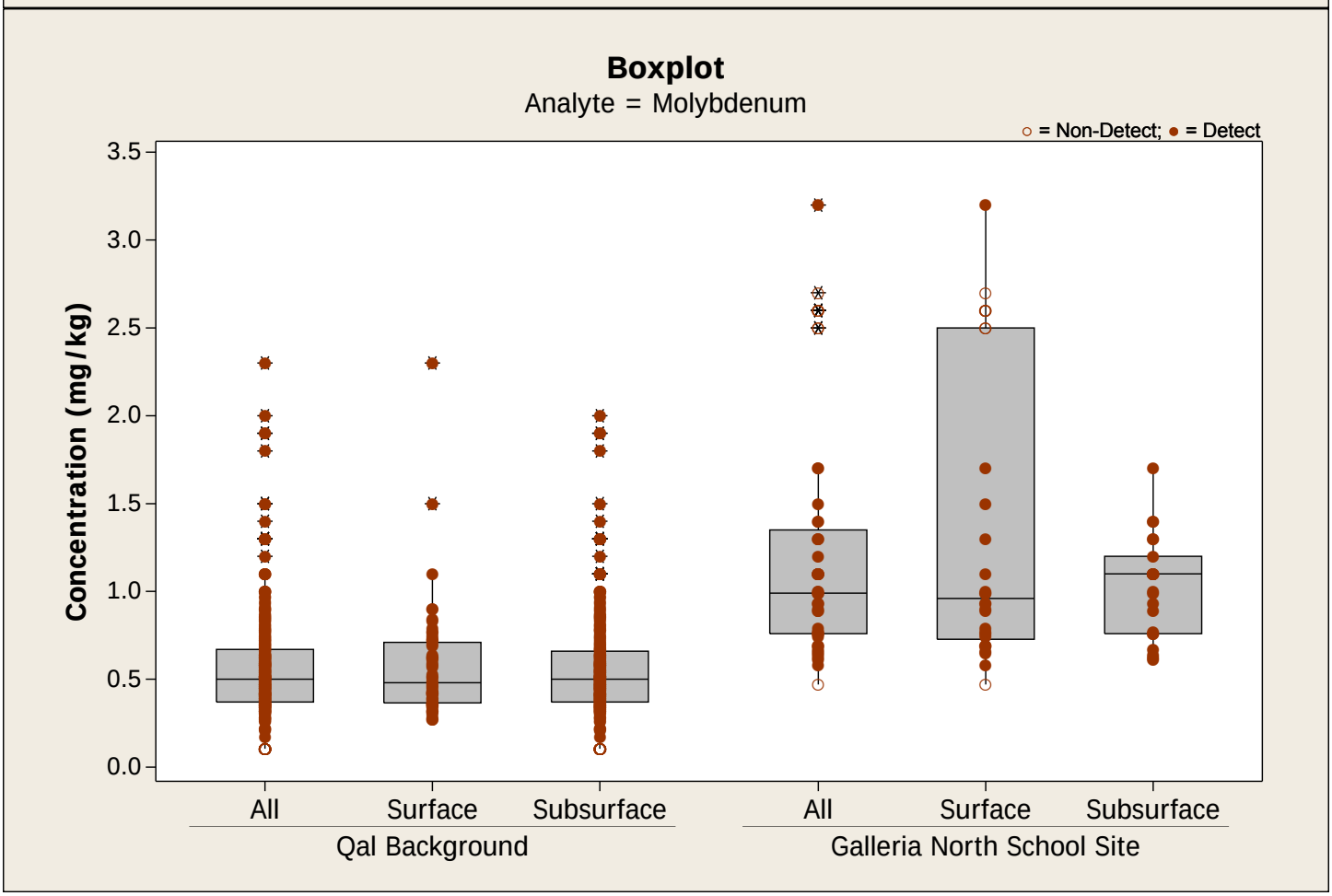

Probability Plot
Normal - 95% CI
Analyte = Manganese
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
500
1000
1500
2000
Concentration (mg/kg)
Qal Background
Galleria North School Site

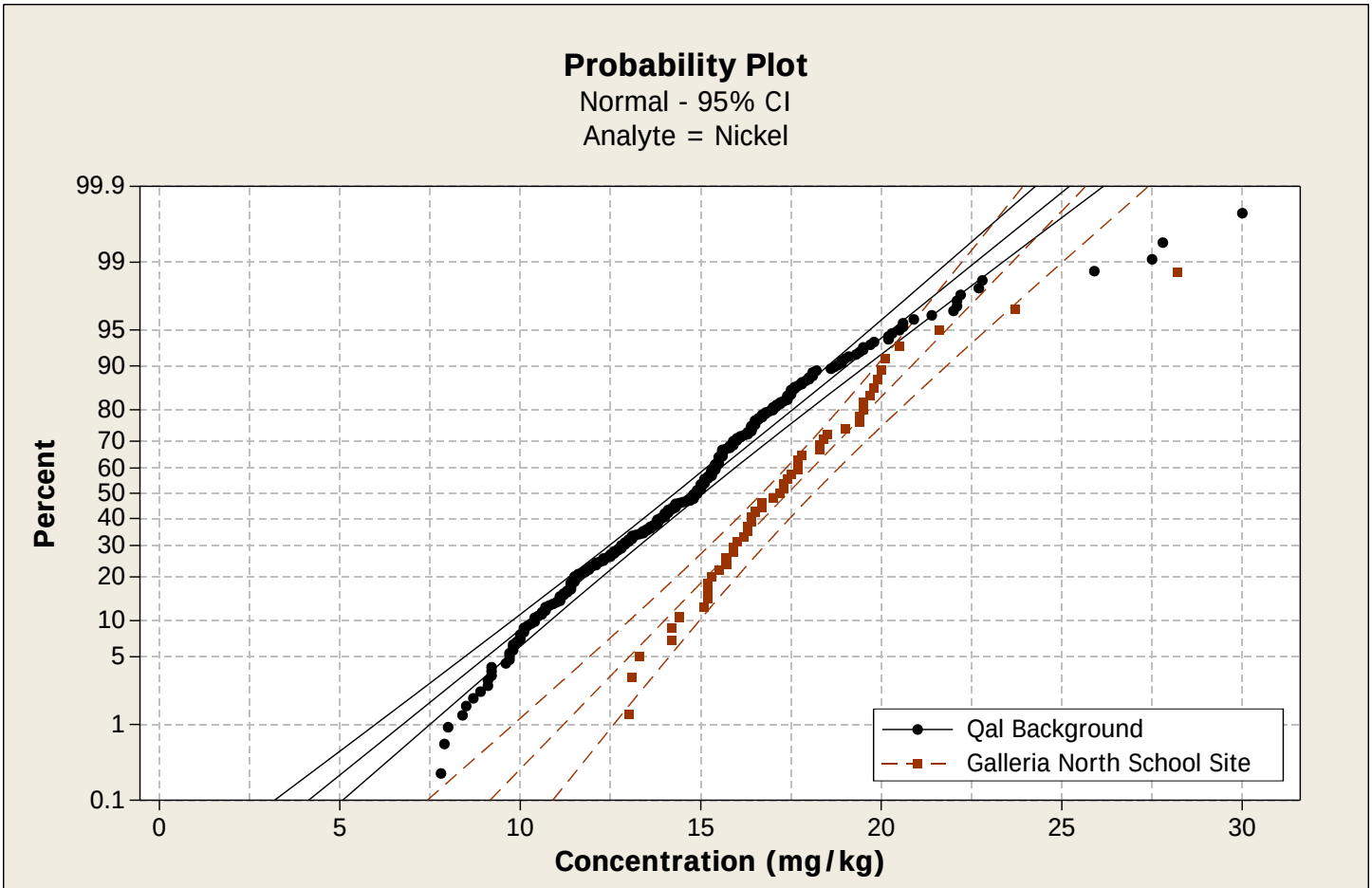

Boxplot
Analyte = Manganese
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
2000
1500
1000
500
0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

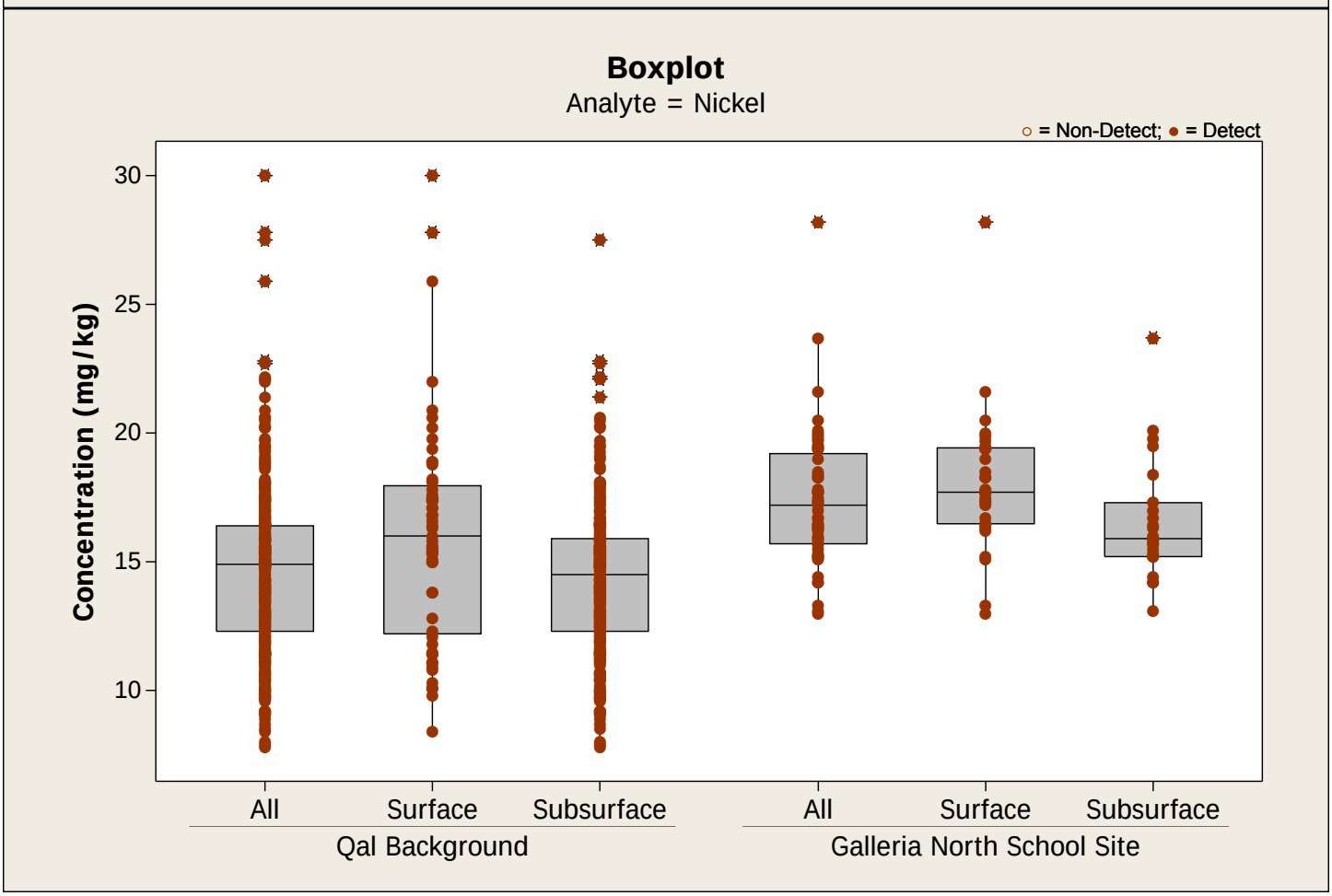

Probability Plot
Normal - 95% CI
Analyte = Mercury
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-0.05
0.00
0.05
0.10
0.15
Concentration (mg/kg)
Qal Background
Galleria North School Site

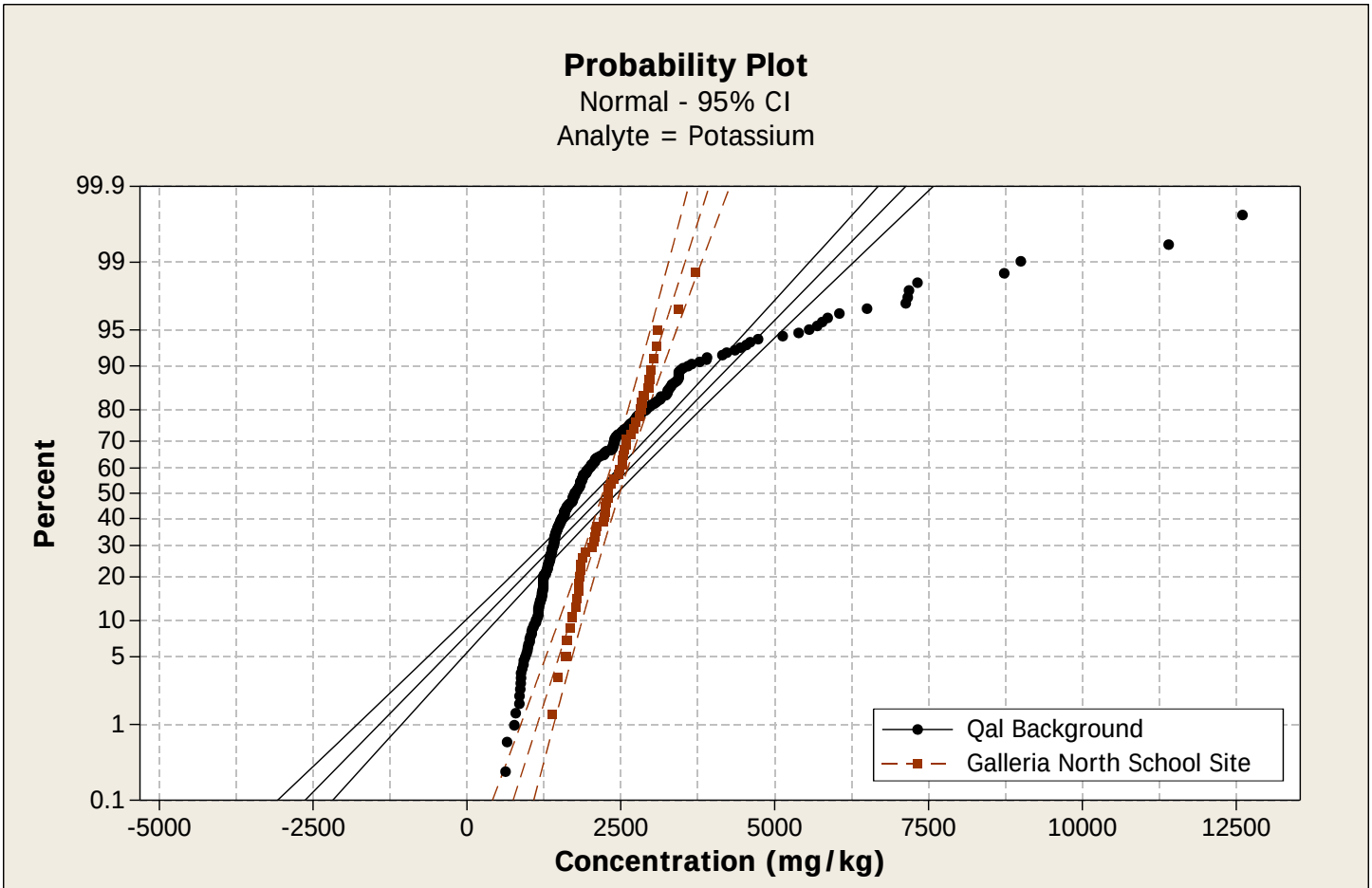

Boxplot
Analyte = Mercury
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

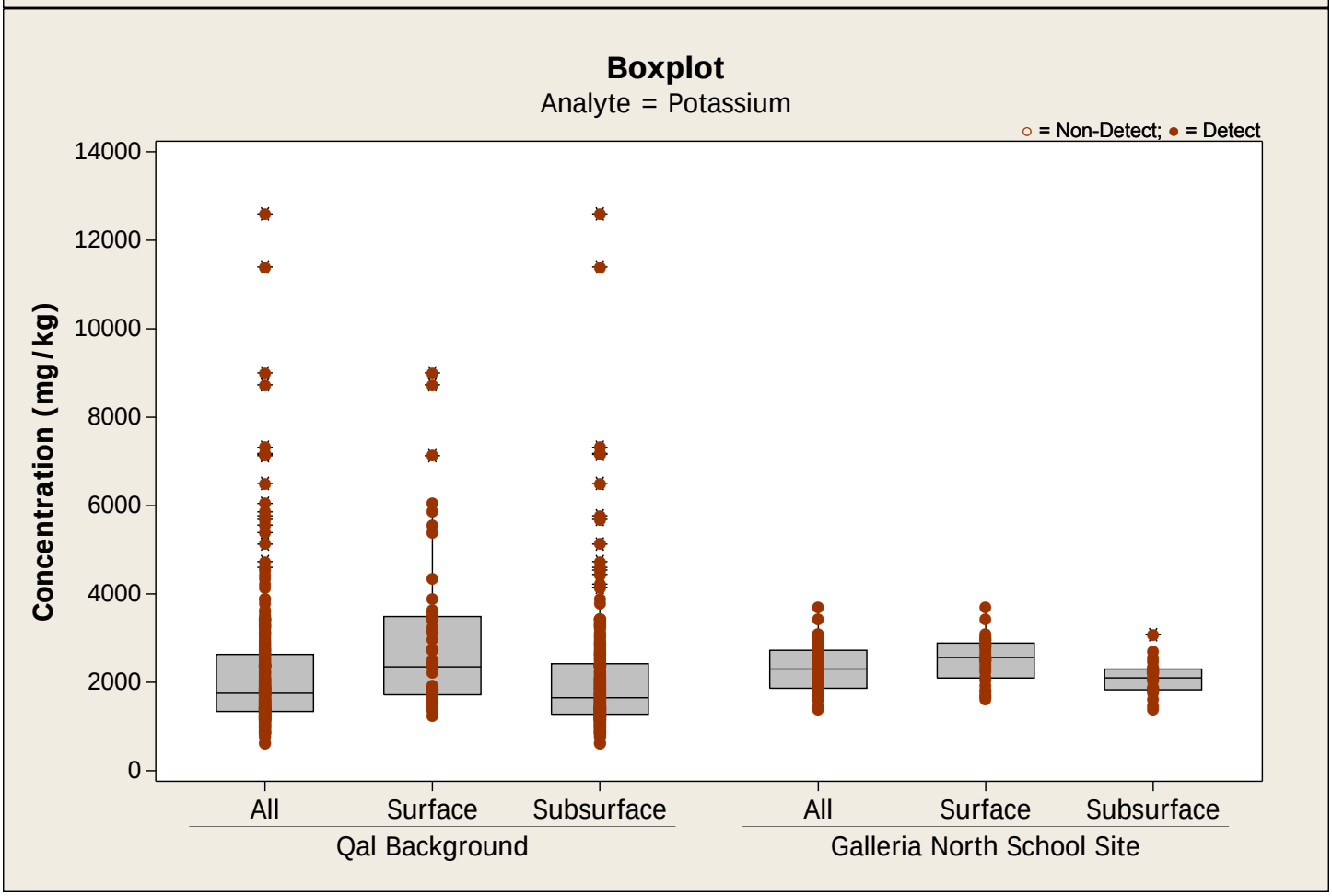

Probability Plot
Normal - 95% CI
Analyte = Molybdenum
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-2
-1
0
1
2
3
4
Concentration (mg/kg)
Qal Background
Galleria North School Site

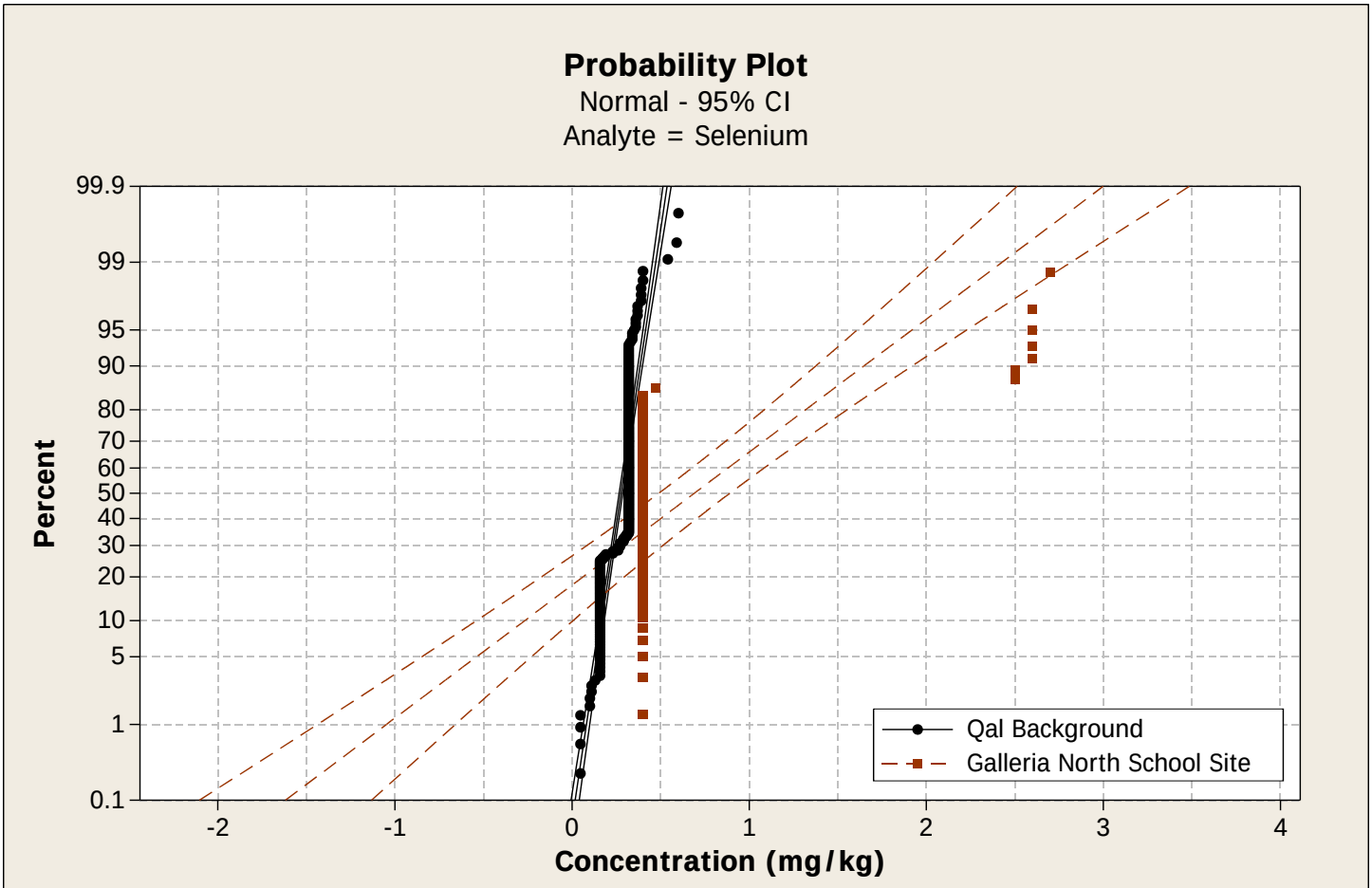

Boxplot
Analyte = Molybdenum
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

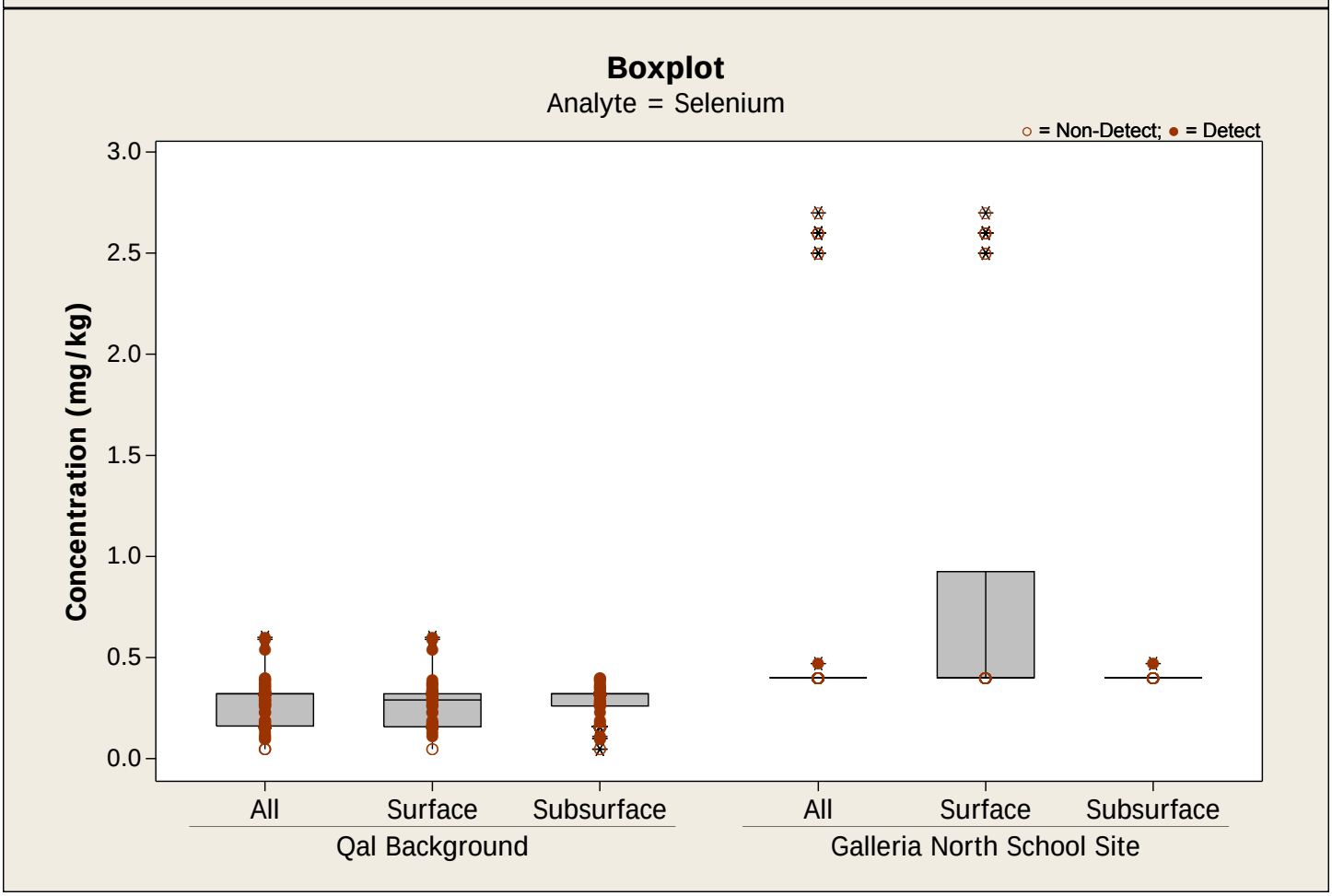

Probability Plot
Normal - 95% CI
Analyte = Nickel
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
5
10
15
20
25
30
Concentration (mg/kg)
Qal Background
Galleria North School Site

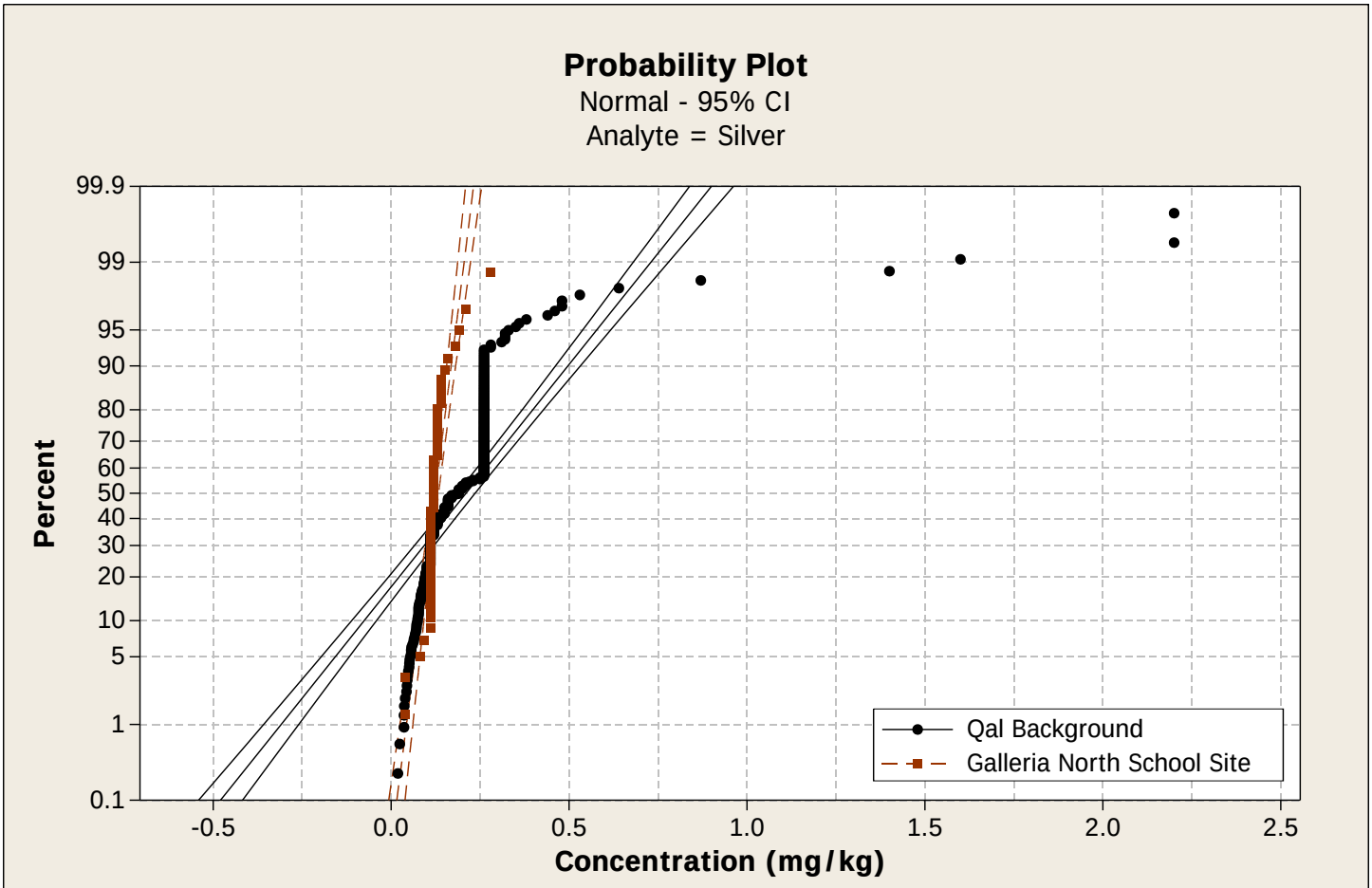

Boxplot
Analyte = Nickel
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
30
25
20
15
10
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

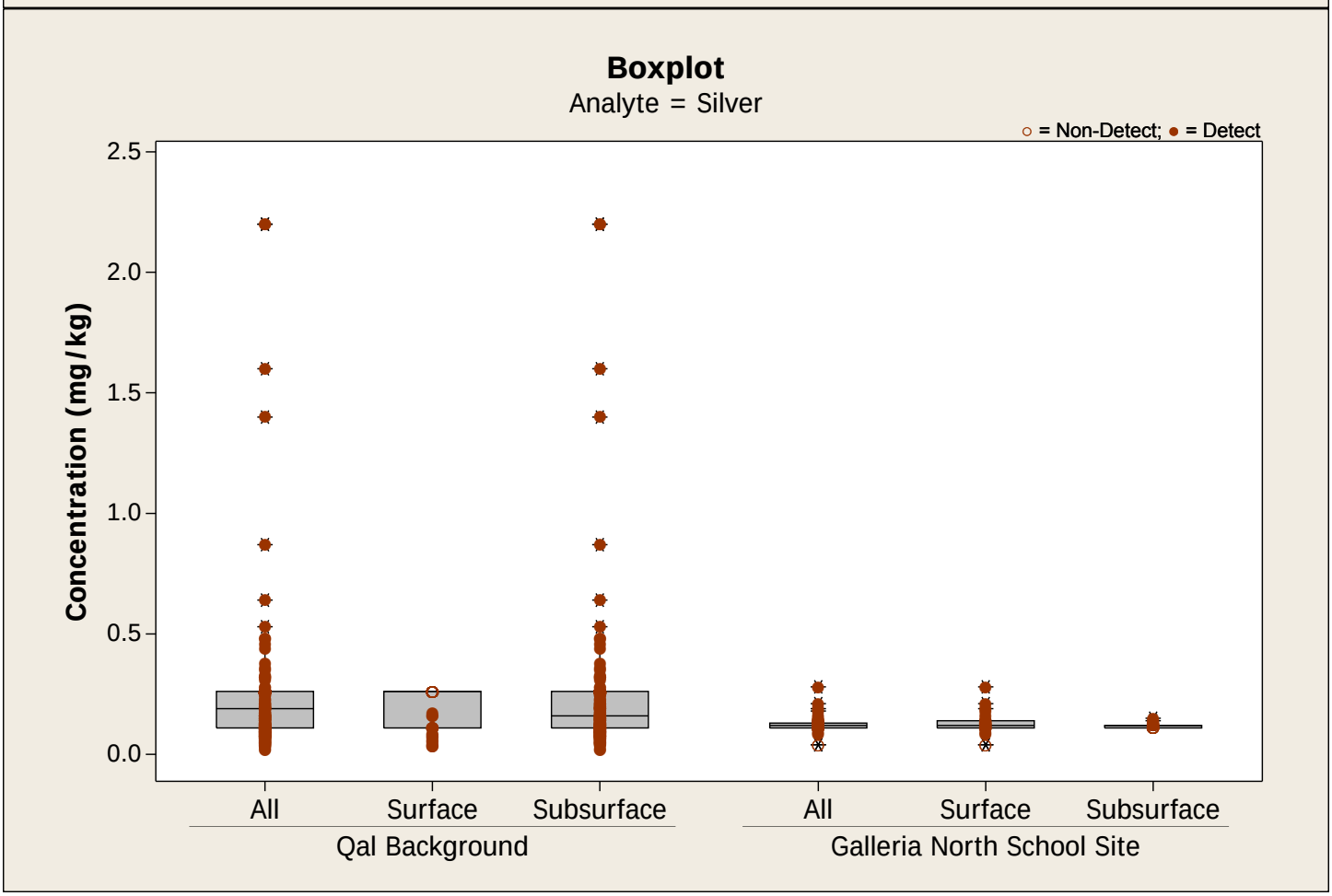

Probability Plot
Normal - 95% CI
Analyte = Potassium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-5000
-2500
0
2500
5000
7500
10000
12500
Concentration (mg/kg)
Qal Background
Galleria North School Site

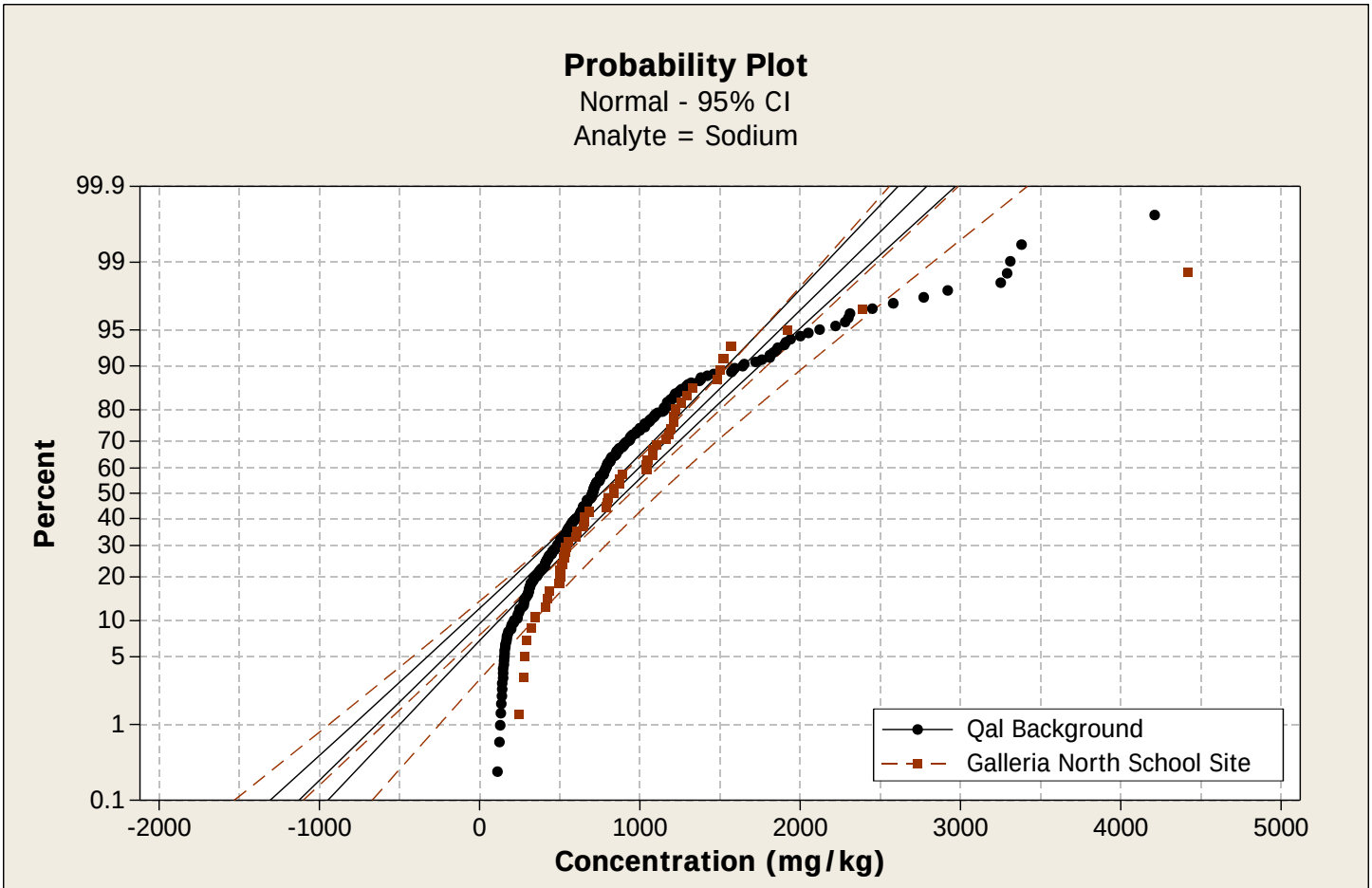

Boxplot
Analyte = Potassium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
14000
12000
10000
8000
6000
4000
2000
0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

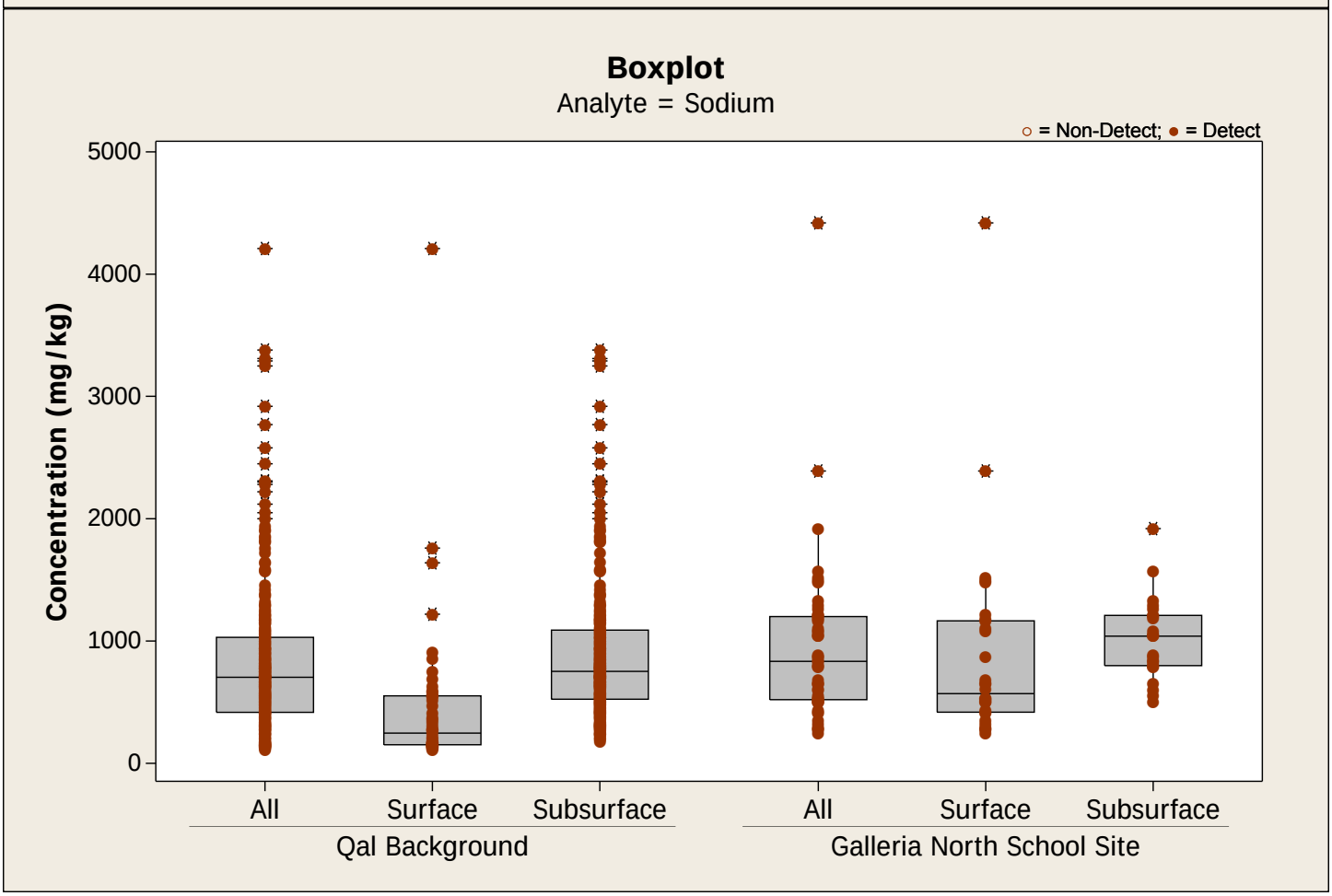

Probability Plot
Normal - 95% CI
Analyte = Selenium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-2
-1
0
1
2
3
4
Concentration (mg/kg)
Qal Background
Galleria North School Site

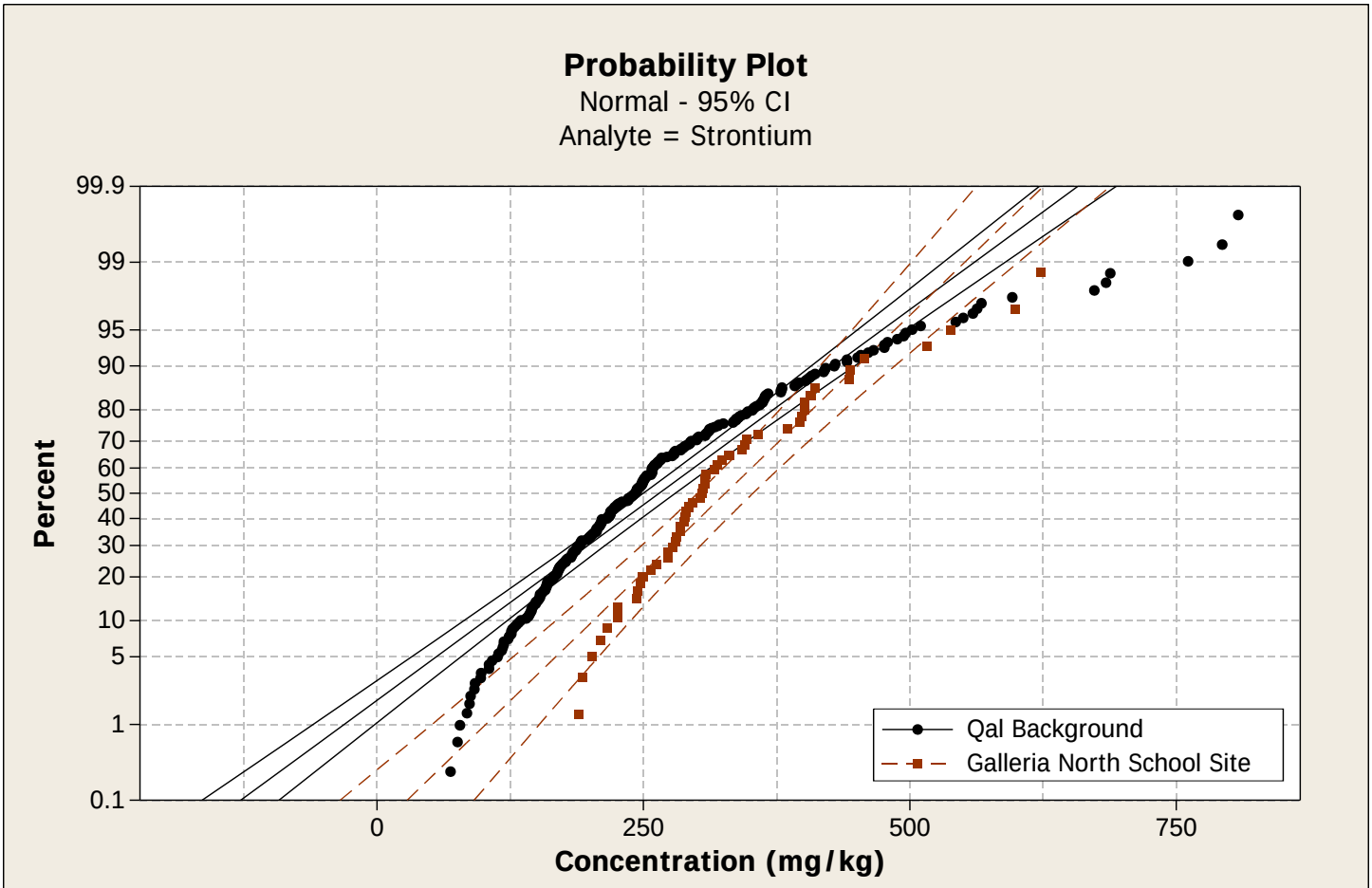

Boxplot
Analyte = Selenium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

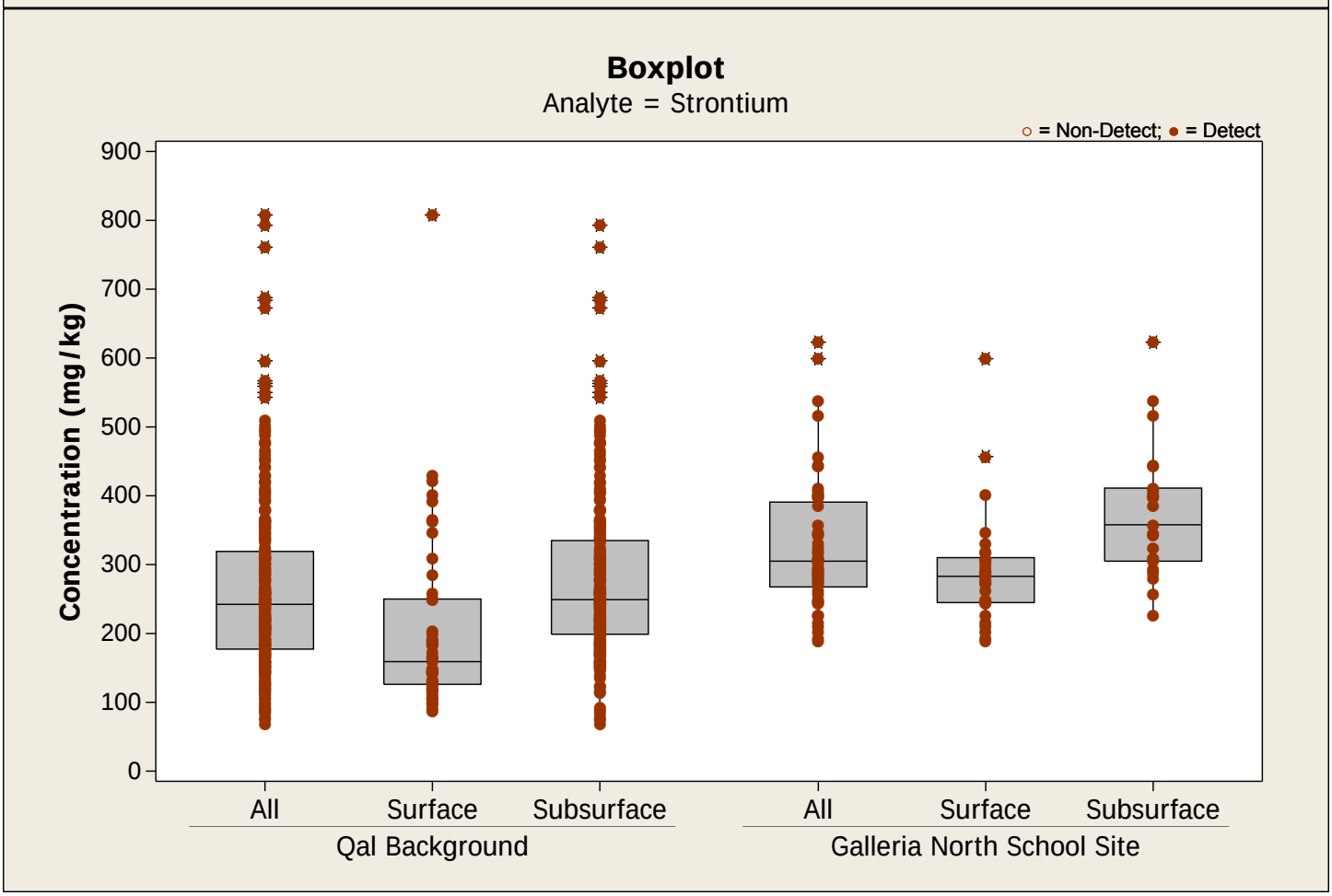

Probability Plot
Normal - 95% CI
Analyte = Silver
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
Concentration (mg/kg)
Qal Background
Galleria North School Site

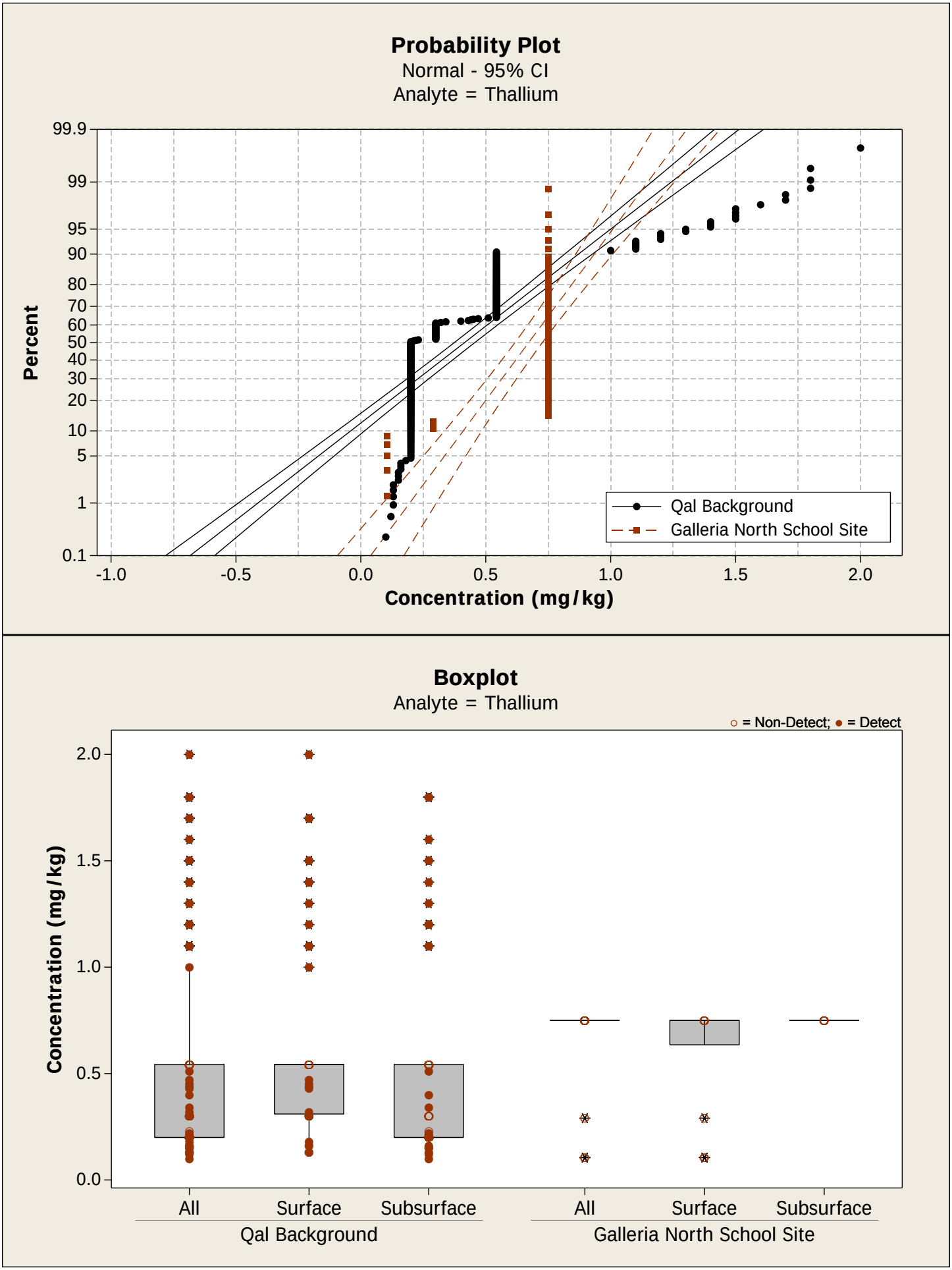

Boxplot
Analyte = Silver
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
2.5
2.0
1.5
1.0
0.5
0.0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

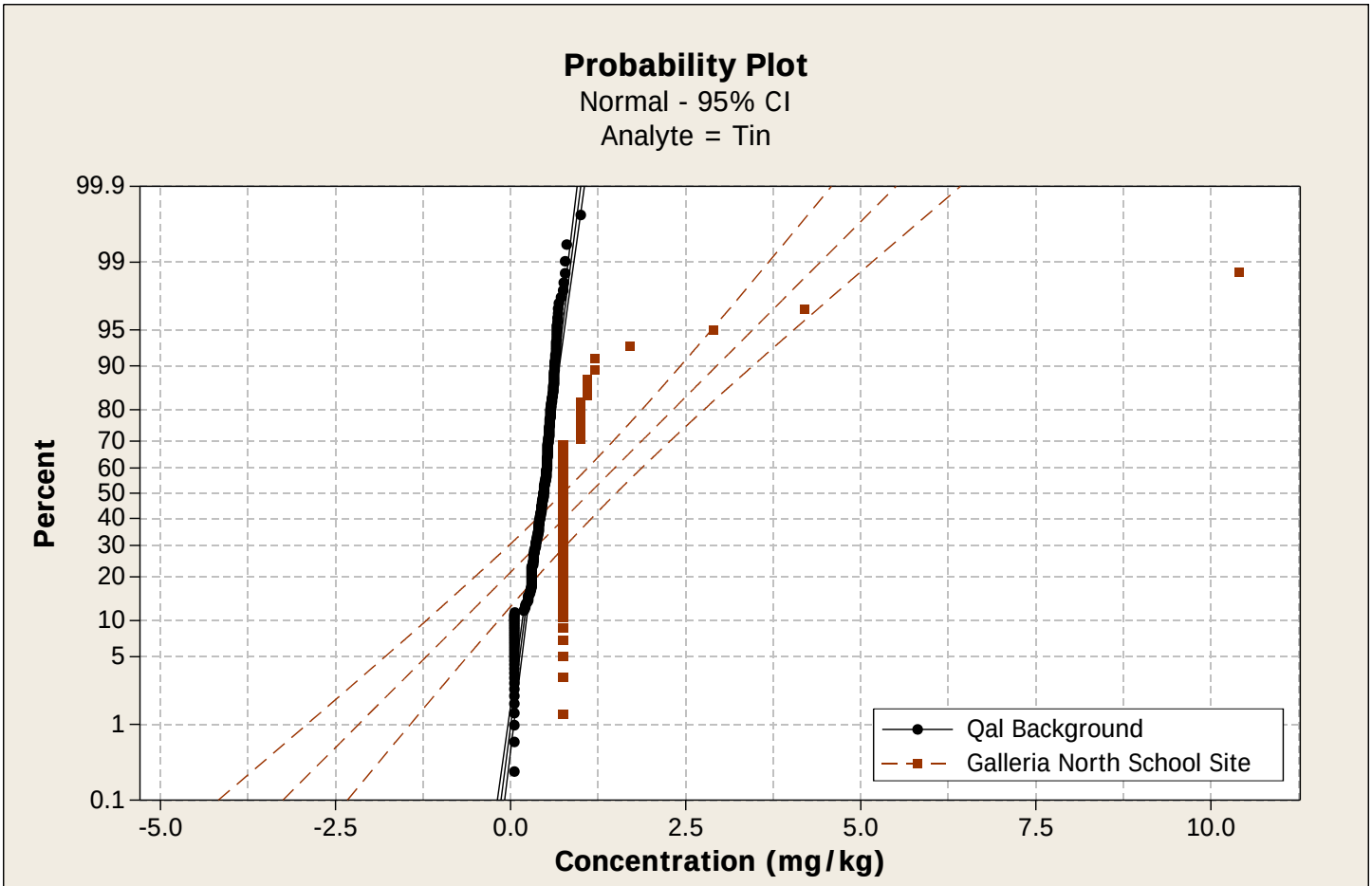

Probability Plot
Normal - 95% CI
Analyte = Sodium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-2000
-1000
0
1000
2000
3000
4000
5000
Concentration (mg/kg)
Qal Background
Galleria North School Site

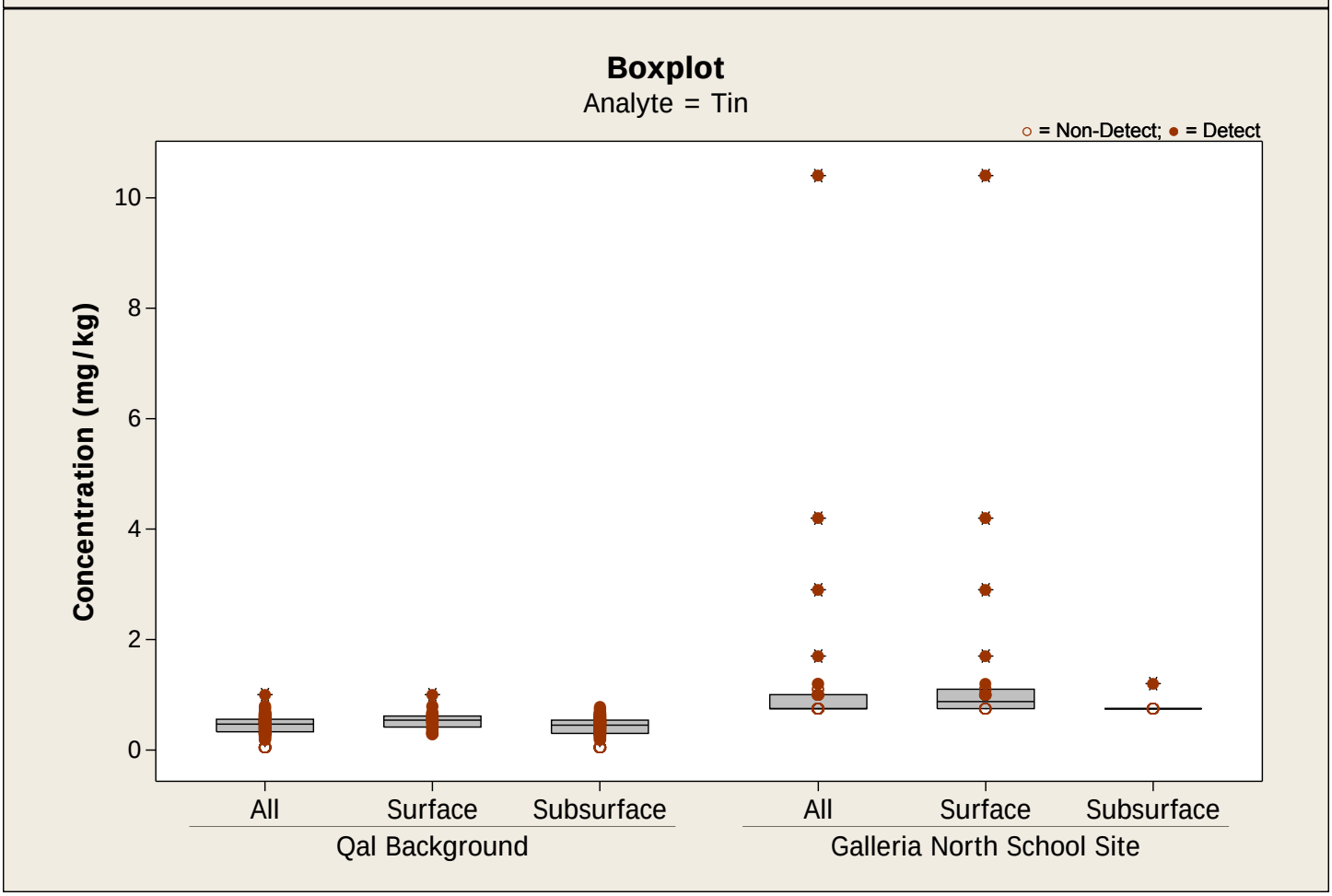

Boxplot
Analyte = Sodium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
5000
4000
3000
2000
1000
0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

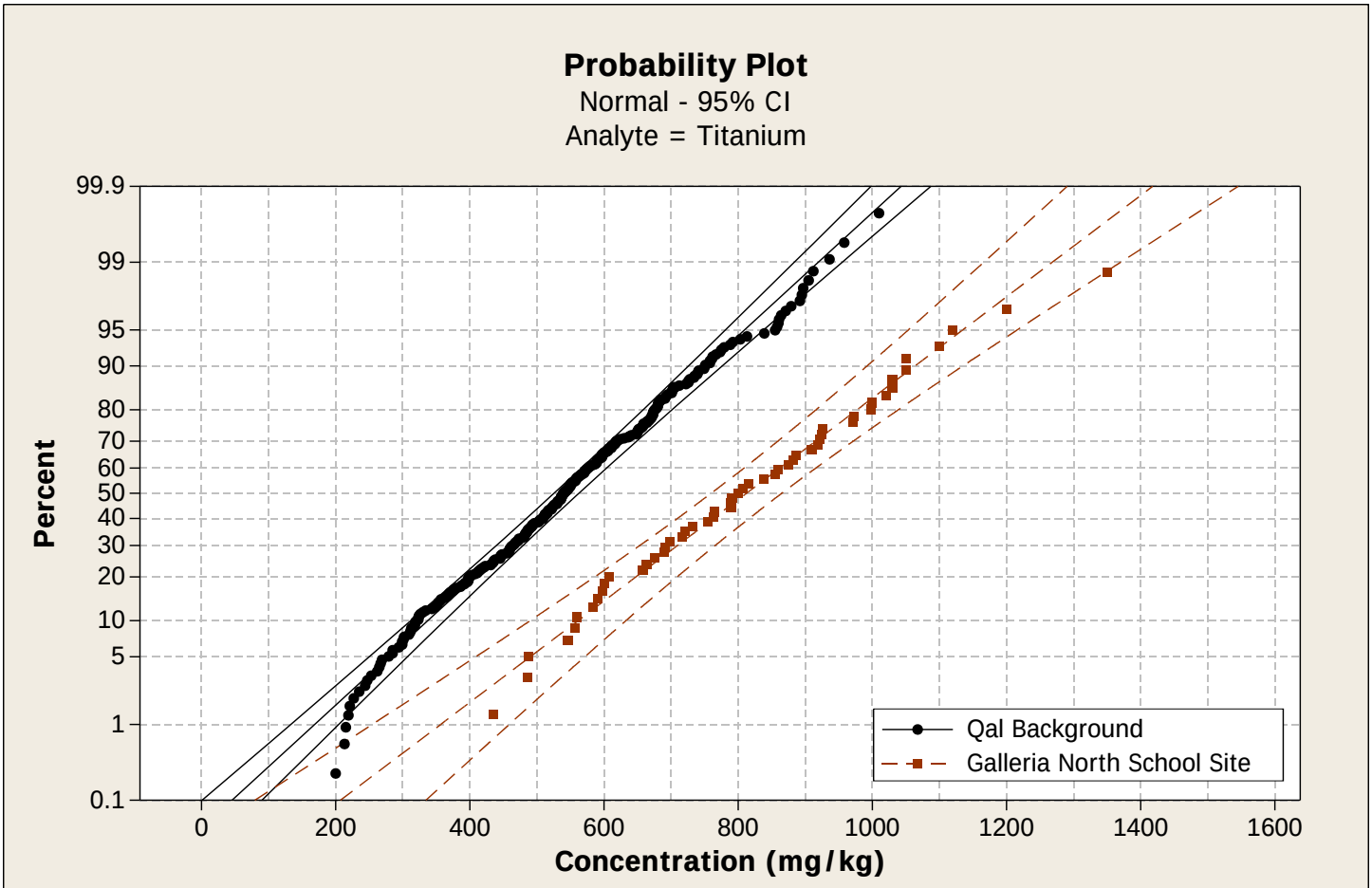

Probability Plot
Normal - 95% CI
Analyte = Strontium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
250
500
750
Concentration (mg/kg)
Qal Background
Galleria North School Site

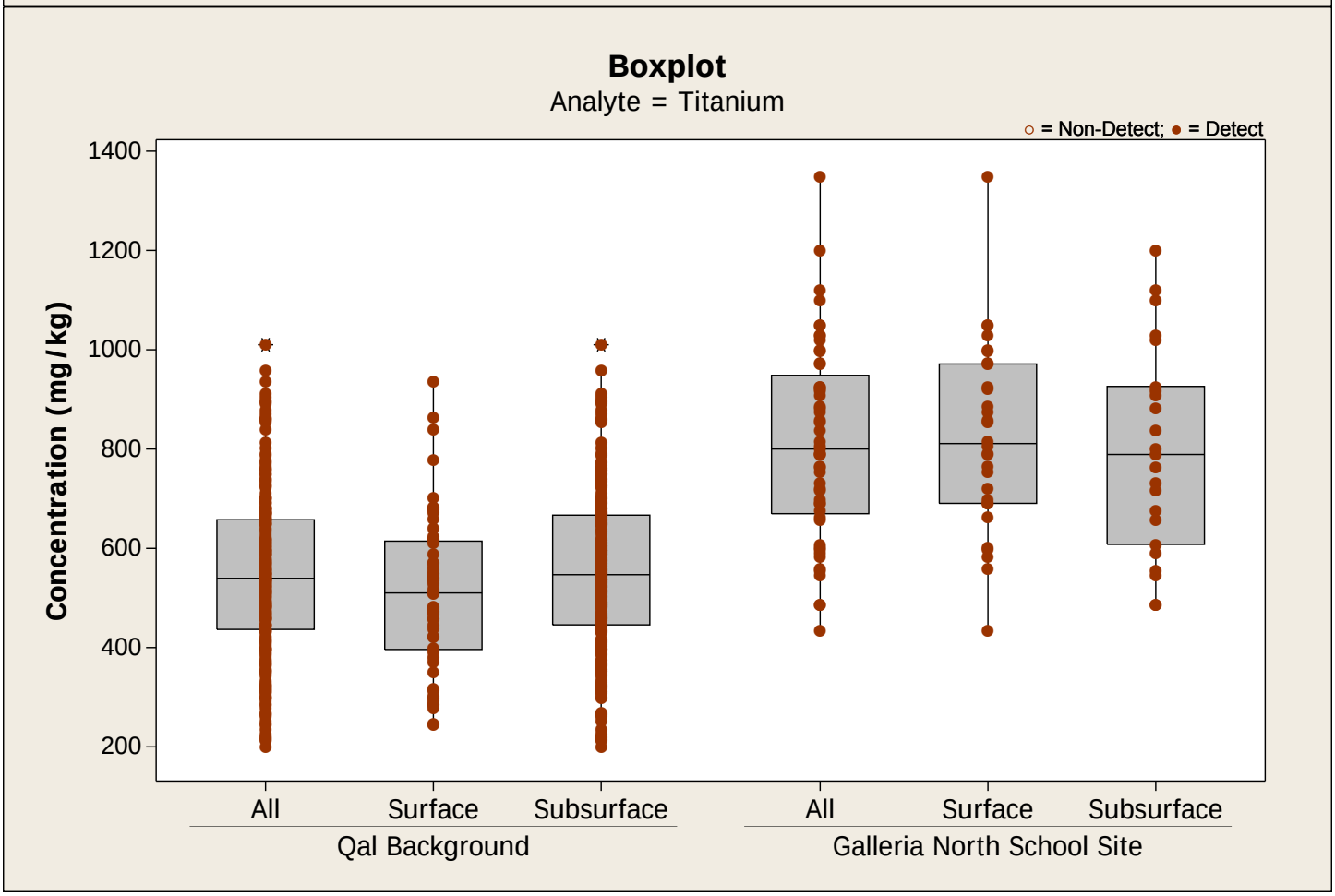

Boxplot
Analyte = Strontium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
900
800
700
600
500
400
300
200
100
0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

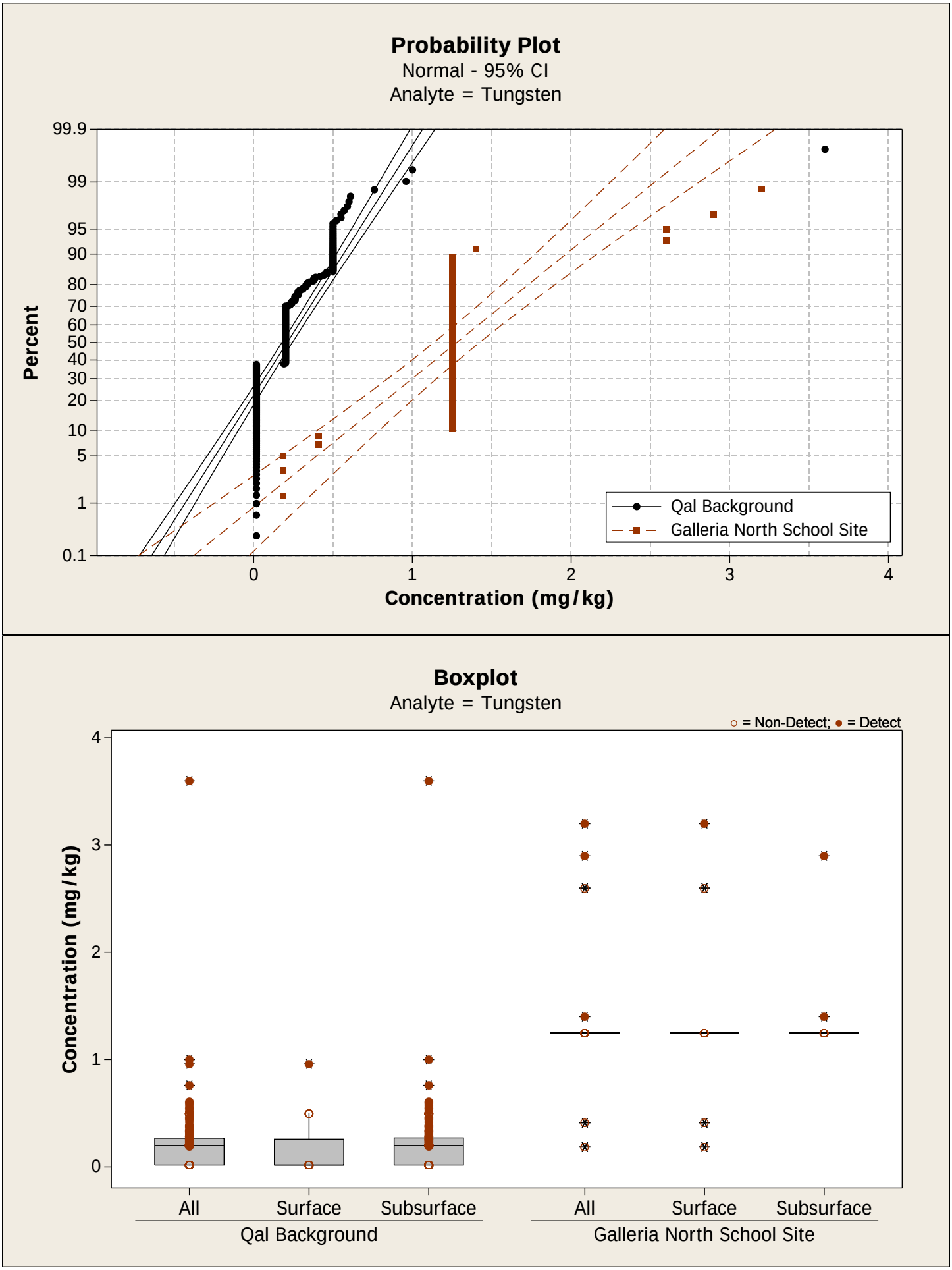

Probability Plot
Normal - 95% CI
Analyte = Thallium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
Concentration (mg/kg)
Qal Background
Galleria North School Site
Boxplot
Analyte = Thallium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
2.0
1.5
1.0
0.5
0.0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

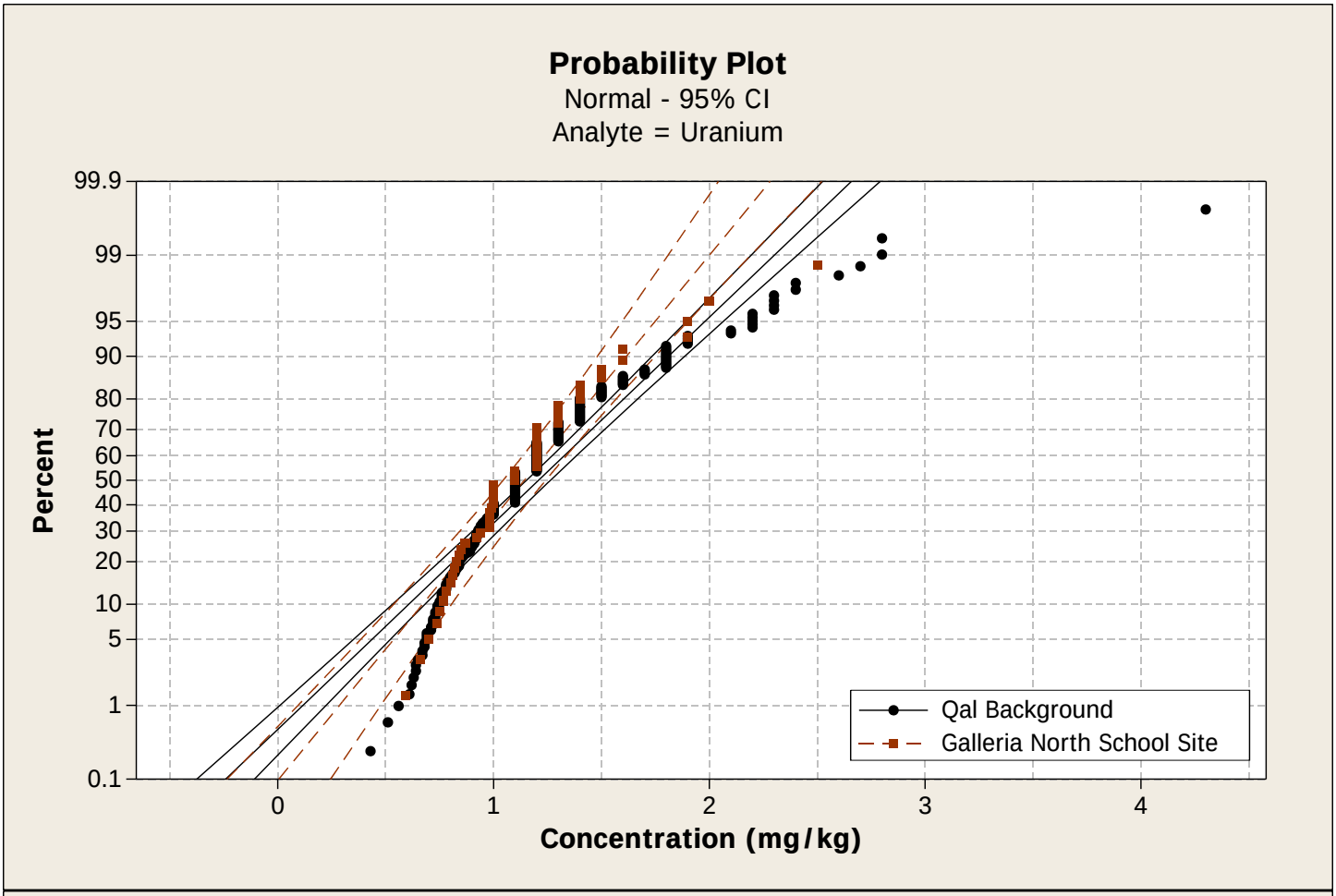

Probability Plot
Normal - 95% CI
Analyte = Tin
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-5.0
-2.5
0.0
2.5
5.0
7.5
10.0
Concentration (mg/kg)
Qal Background
Galleria North School Site

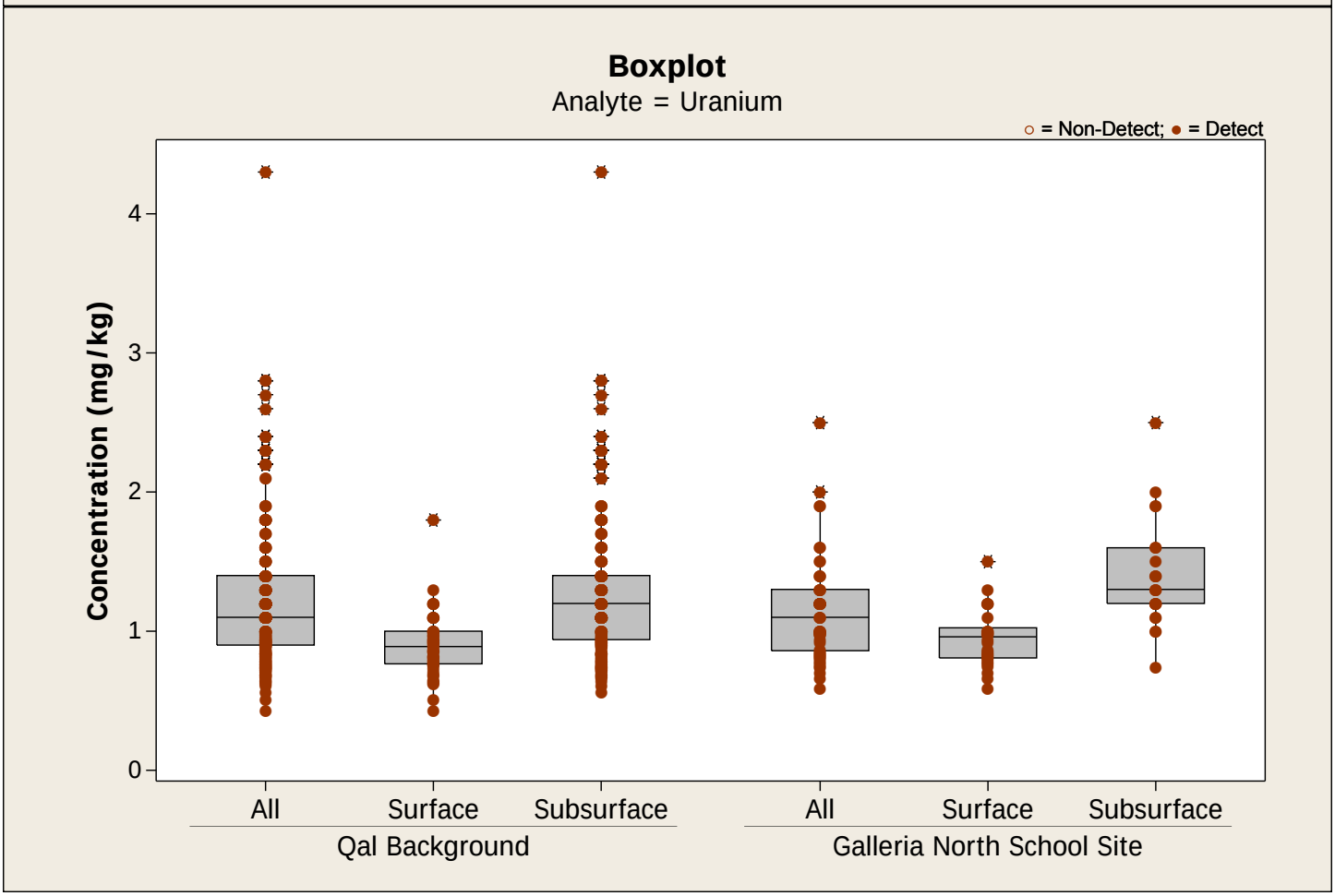

Boxplot
Analyte = Tin
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
10
8
6
4
2
0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

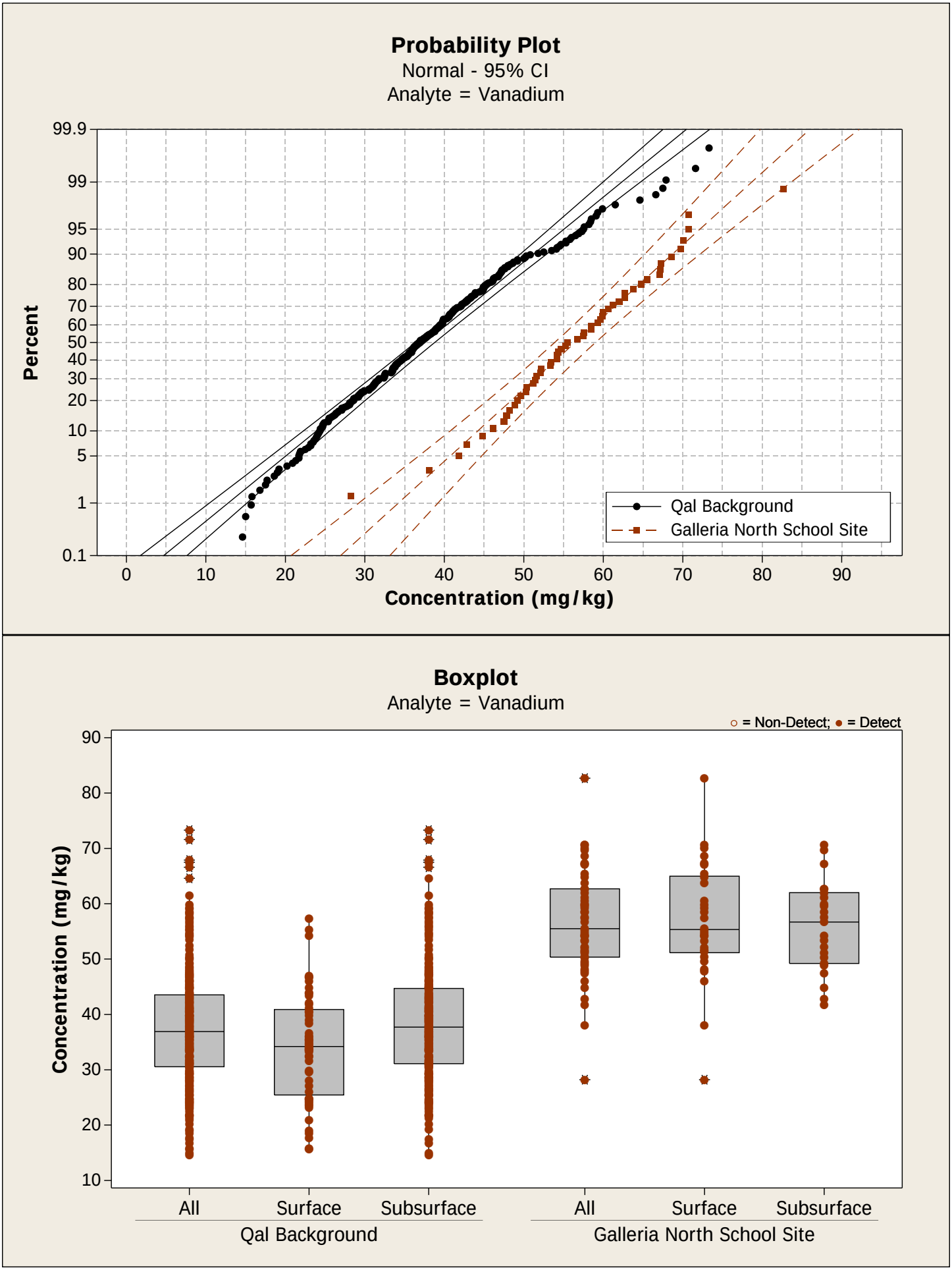

Probability Plot
Normal - 95% CI
Analyte = Titanium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
200
400
600
800
1000
1200
1400
1600
Concentration (mg/kg)
Qal Background
Galleria North School Site

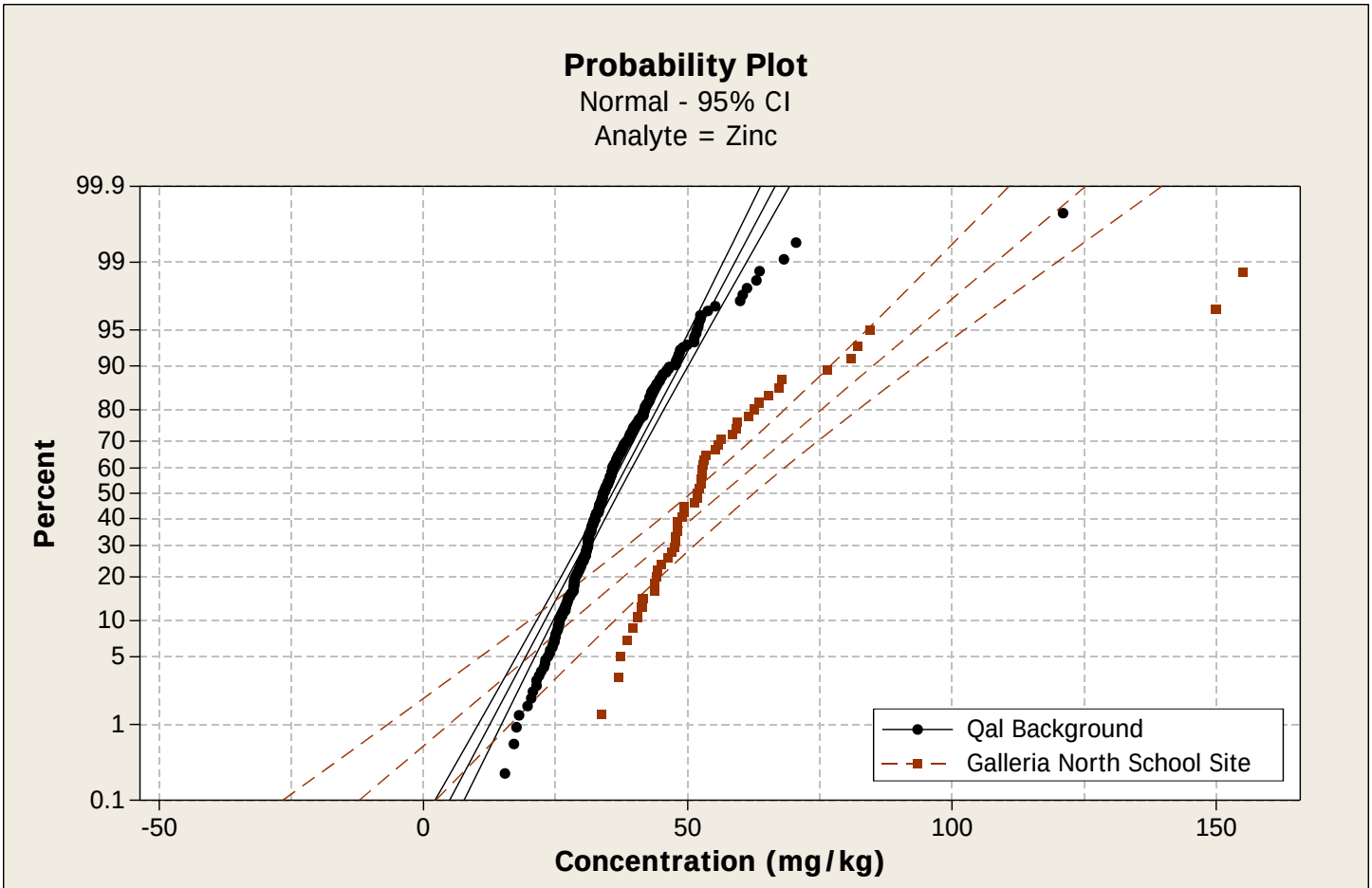

Boxplot
Analyte = Titanium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
1400
1200
1000
800
600
400
200
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

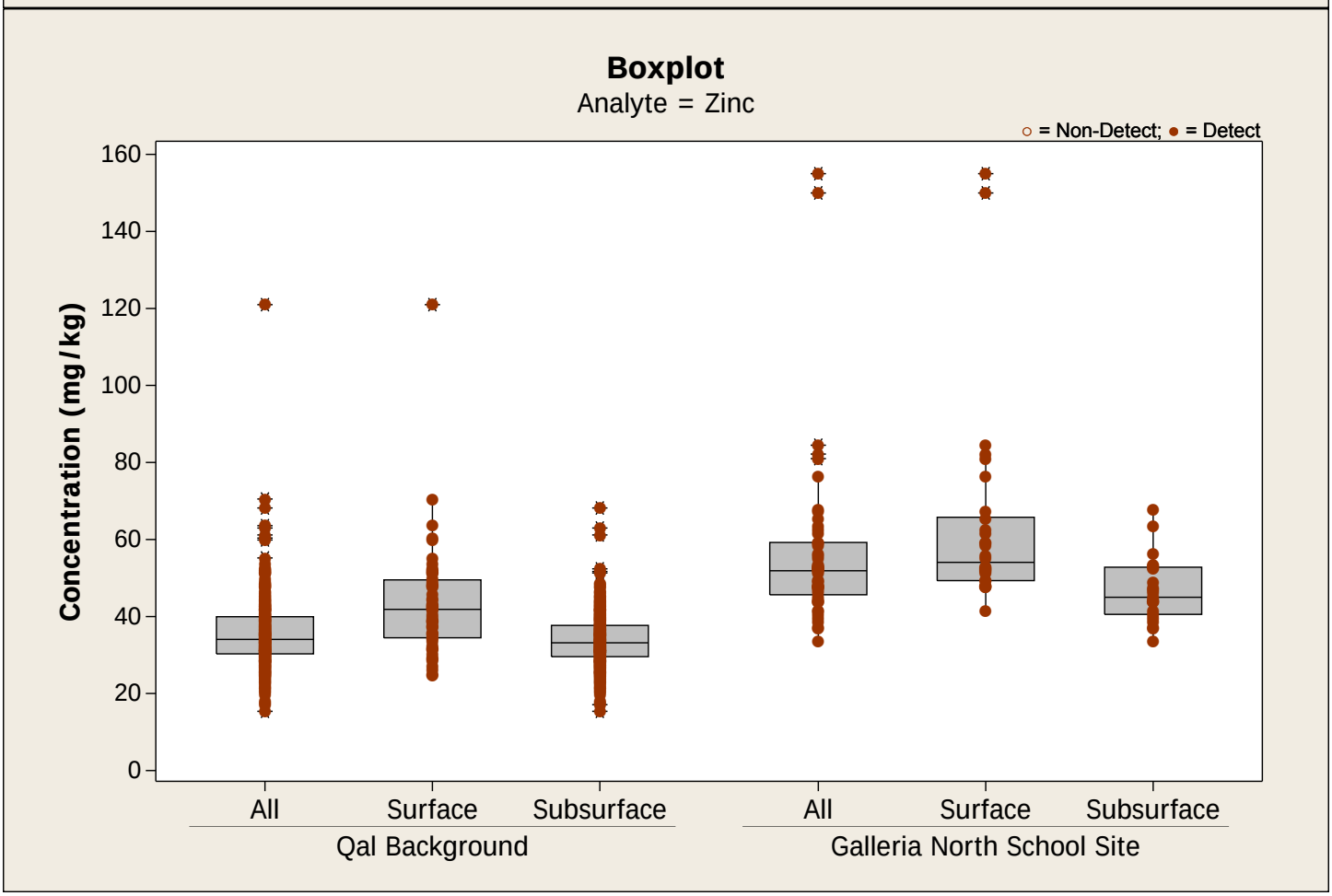

Probability Plot
Normal - 95% CI
Analyte = Tungsten
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
1
2
3
4
Concentration (mg/kg)
Qal Background
Galleria North School Site
Boxplot
Analyte = Tungsten
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
4
3
2
1
0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

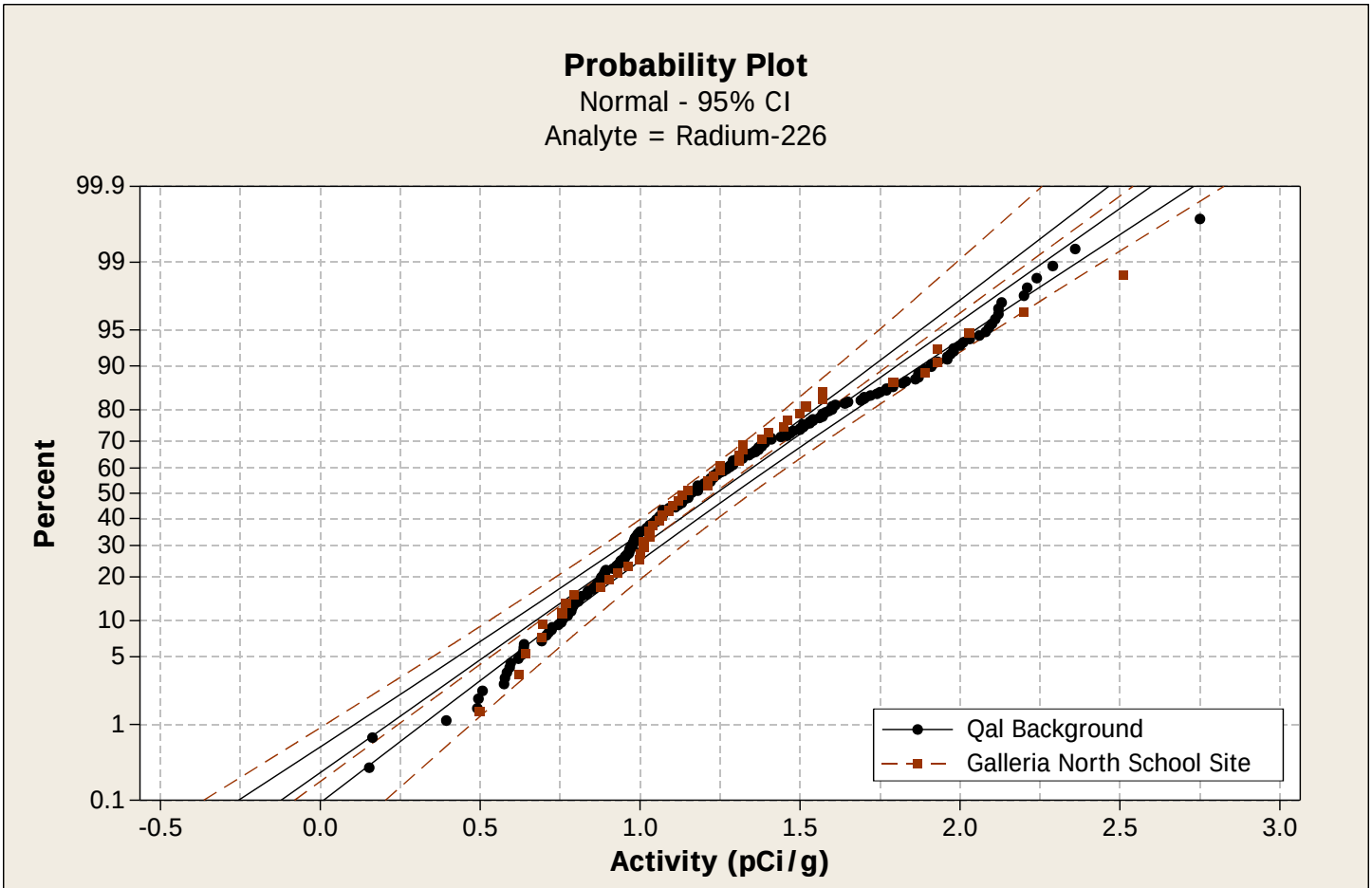

Probability Plot
Normal - 95% CI
Analyte = Uranium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
1
2
3
4
Concentration (mg/kg)
Qal Background
Galleria North School Site

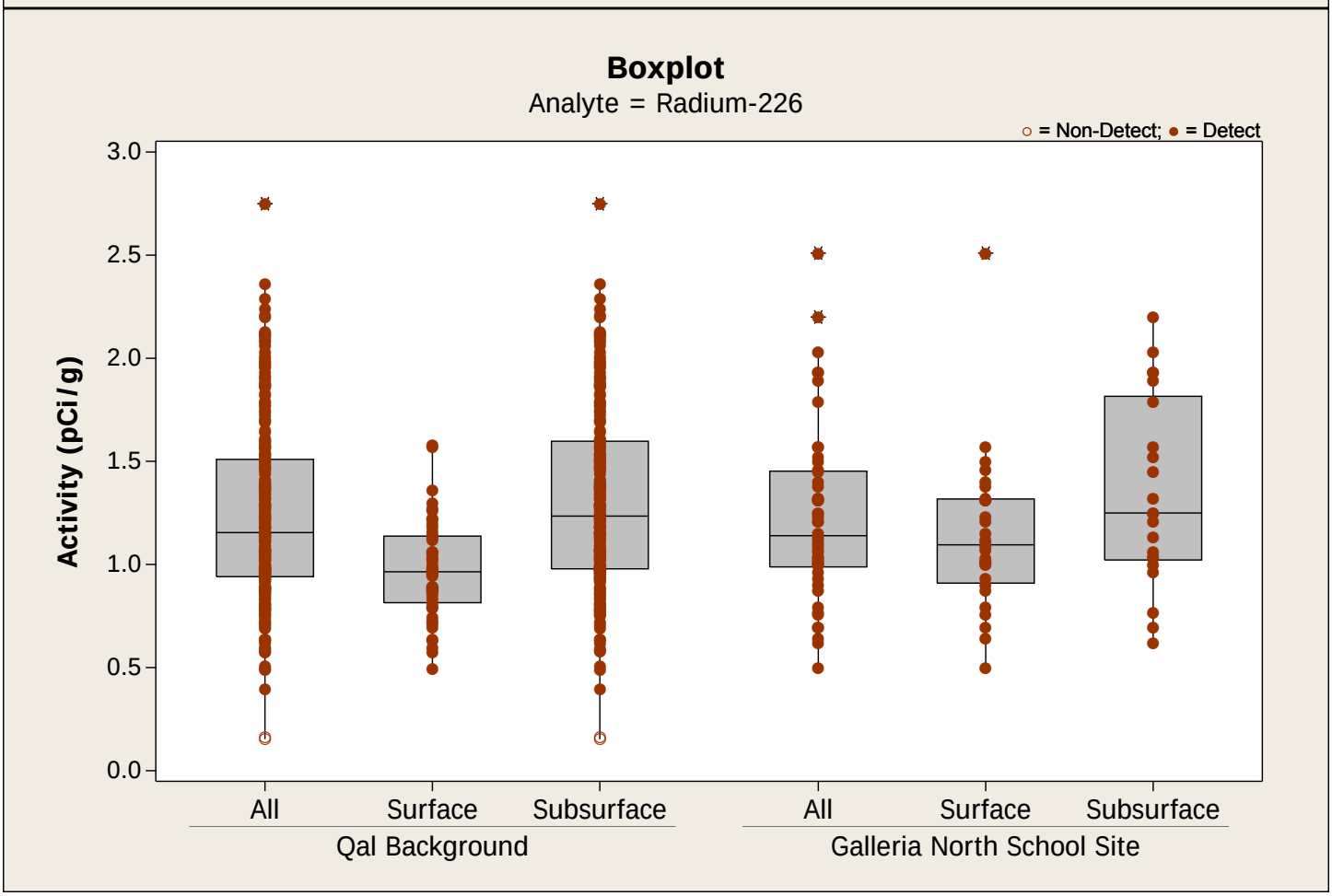

Boxplot
Analyte = Uranium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
4
3
2
1
0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

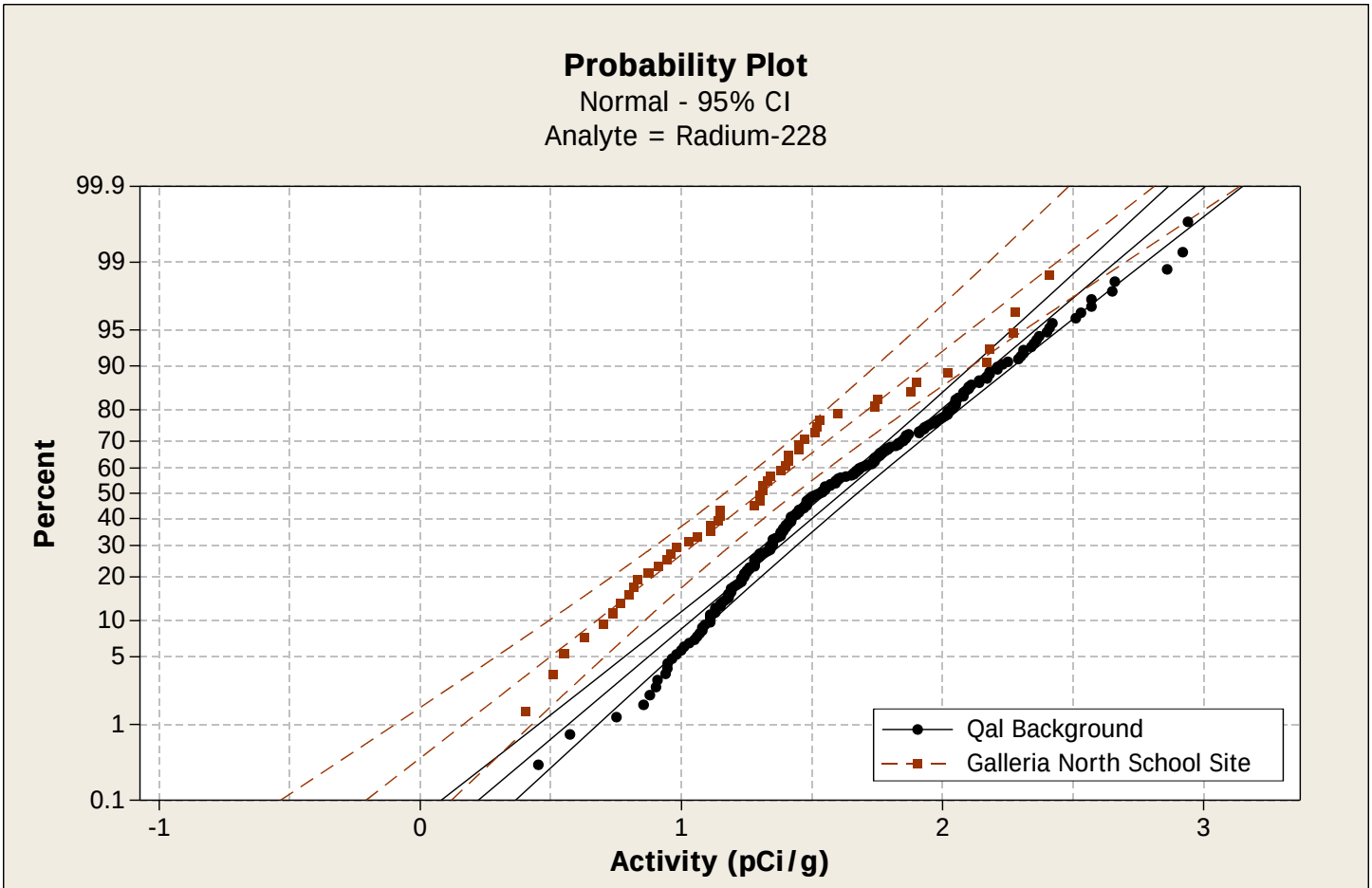

Probability Plot
Normal - 95% CI
Analyte = Vanadium
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
10
20
30
40
50
60
70
80
90
Concentration (mg/kg)
Qal Background
Galleria North School Site
Boxplot
Analyte = Vanadium
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
90
80
70
60
50
40
30
20
10
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

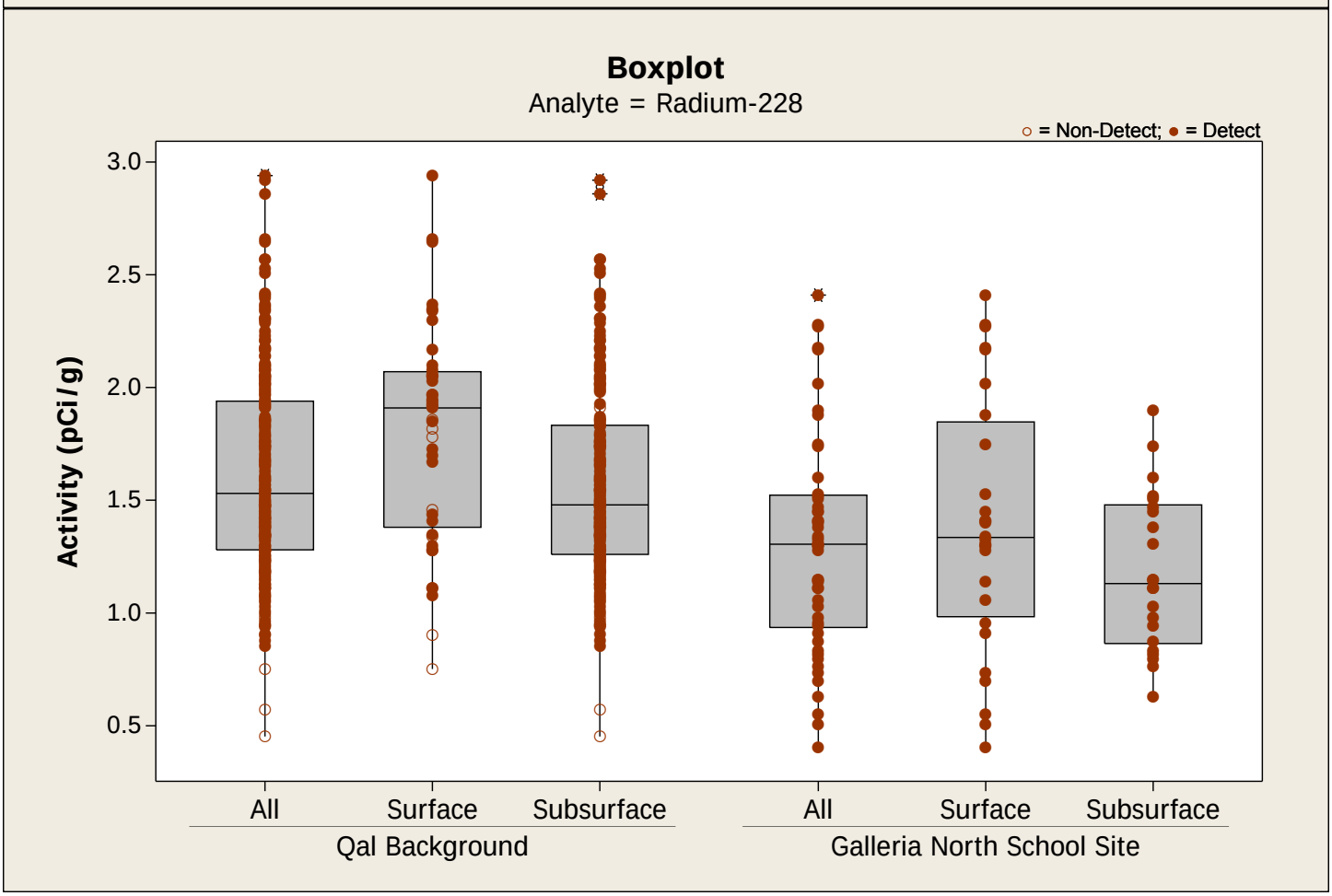

Probability Plot
Normal - 95% CI
Analyte = Zinc
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-50
0
50
100
150
Concentration (mg/kg)
Qal Background
Galleria North School Site

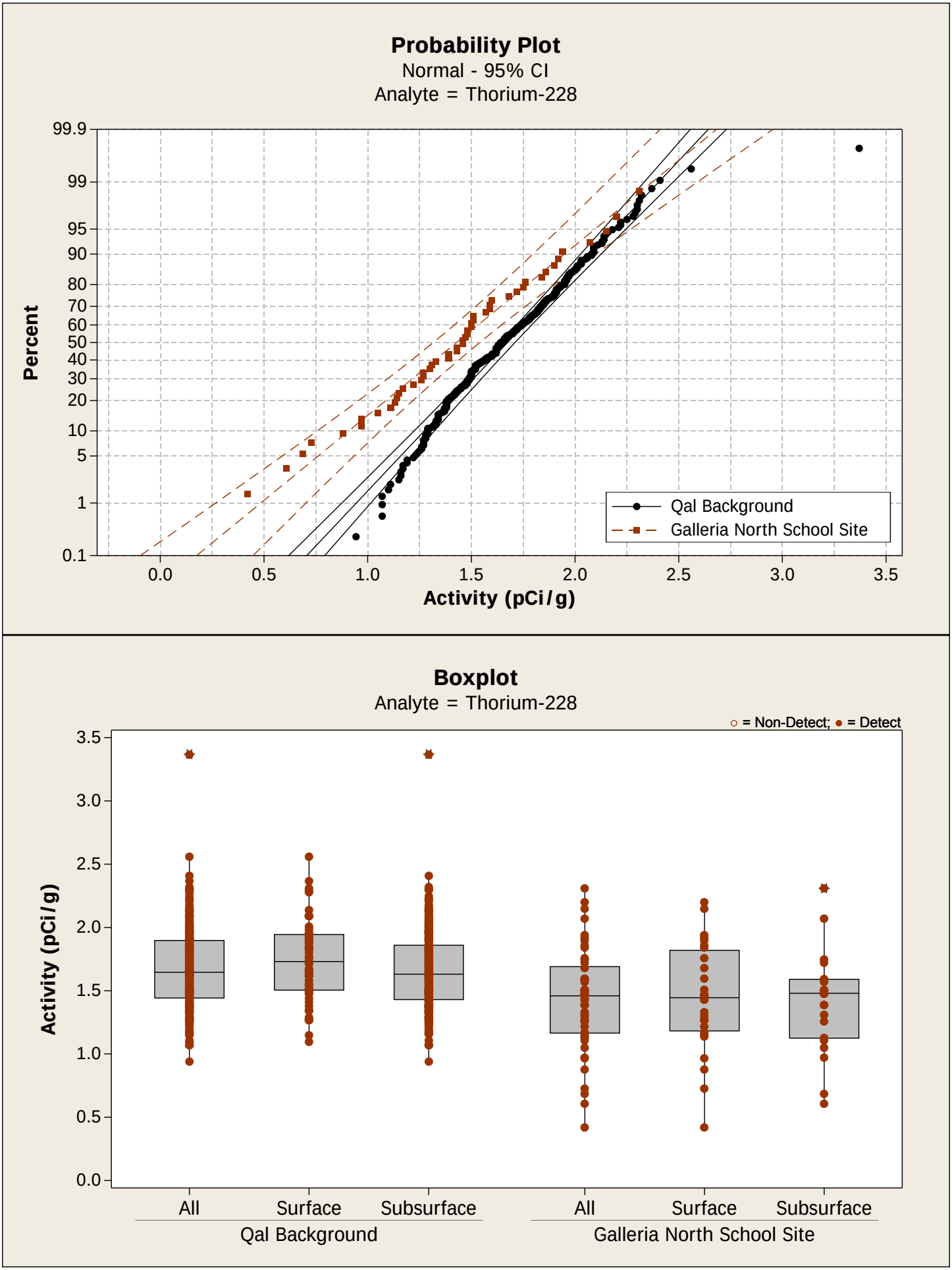

Boxplot
Analyte = Zinc
○ = Non-Detect; ● = Detect
Concentration (mg/kg)
160
140
120
100
80
60
40
20
0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

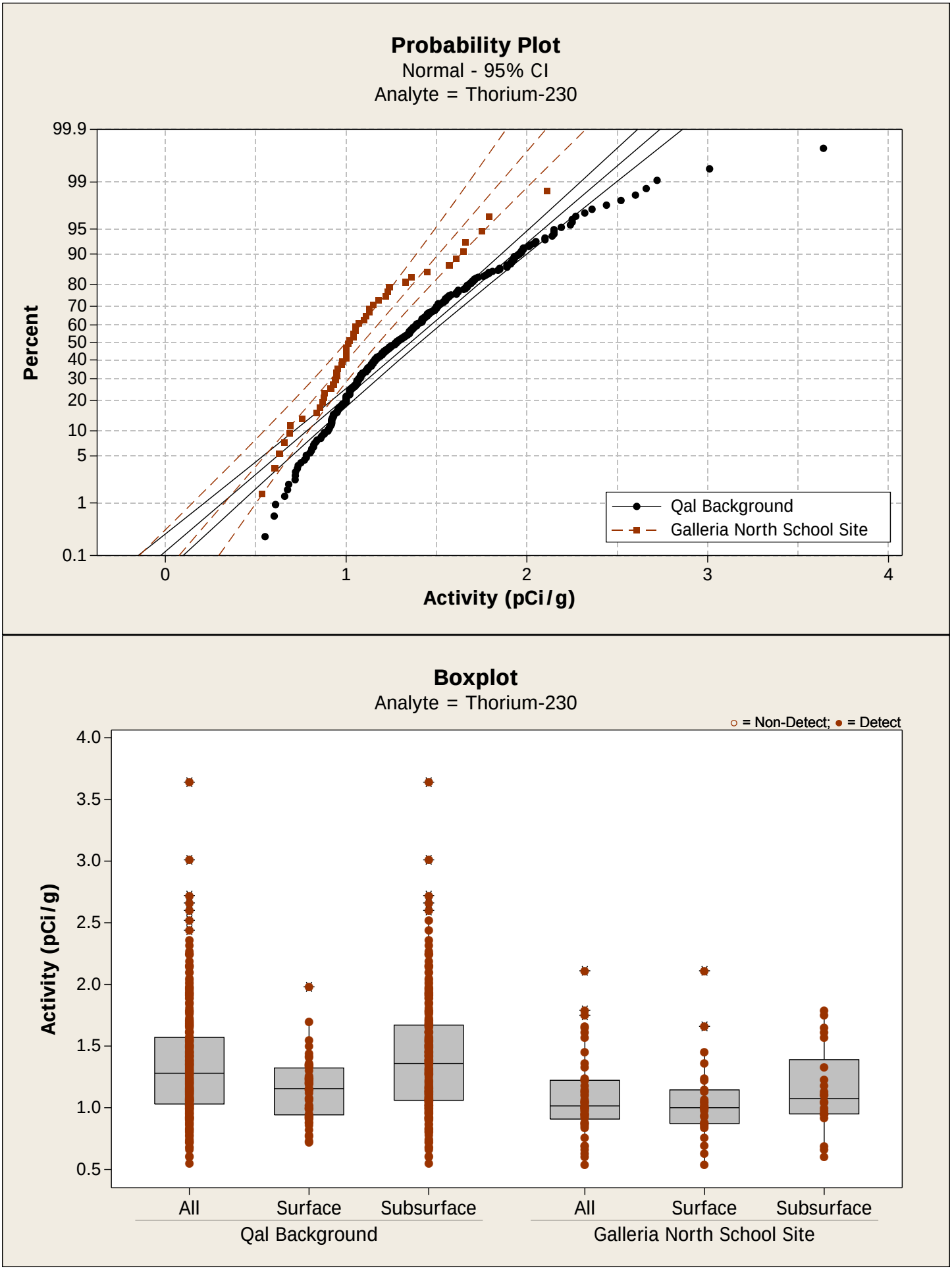

Probability Plot
Normal - 95% CI
Analyte = Radium-226
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Activity (pCi/g)
Qal Background
Galleria North School Site

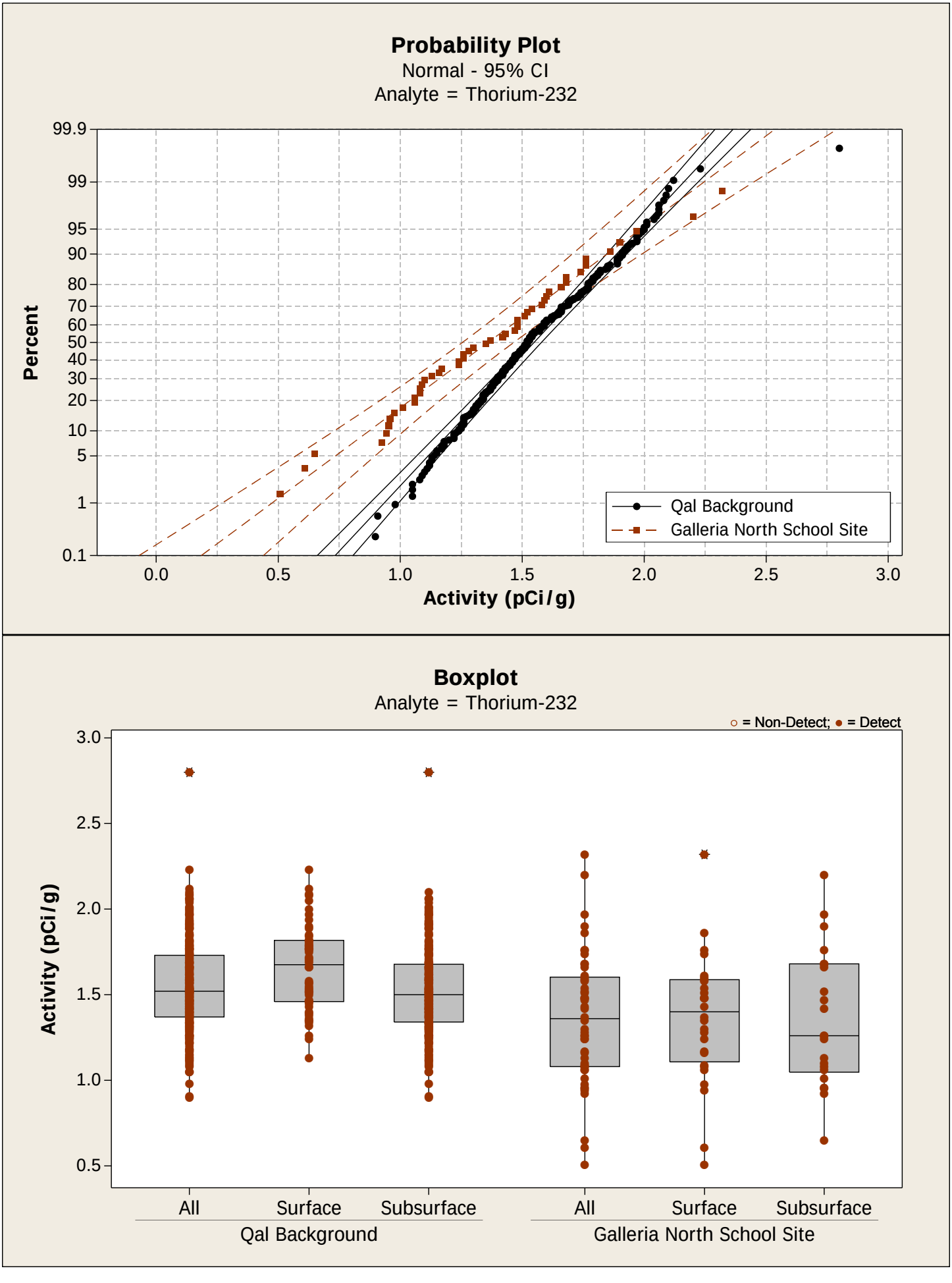

Boxplot
Analyte = Radium-226
○ = Non-Detect; ● = Detect
Activity (pCi/g)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

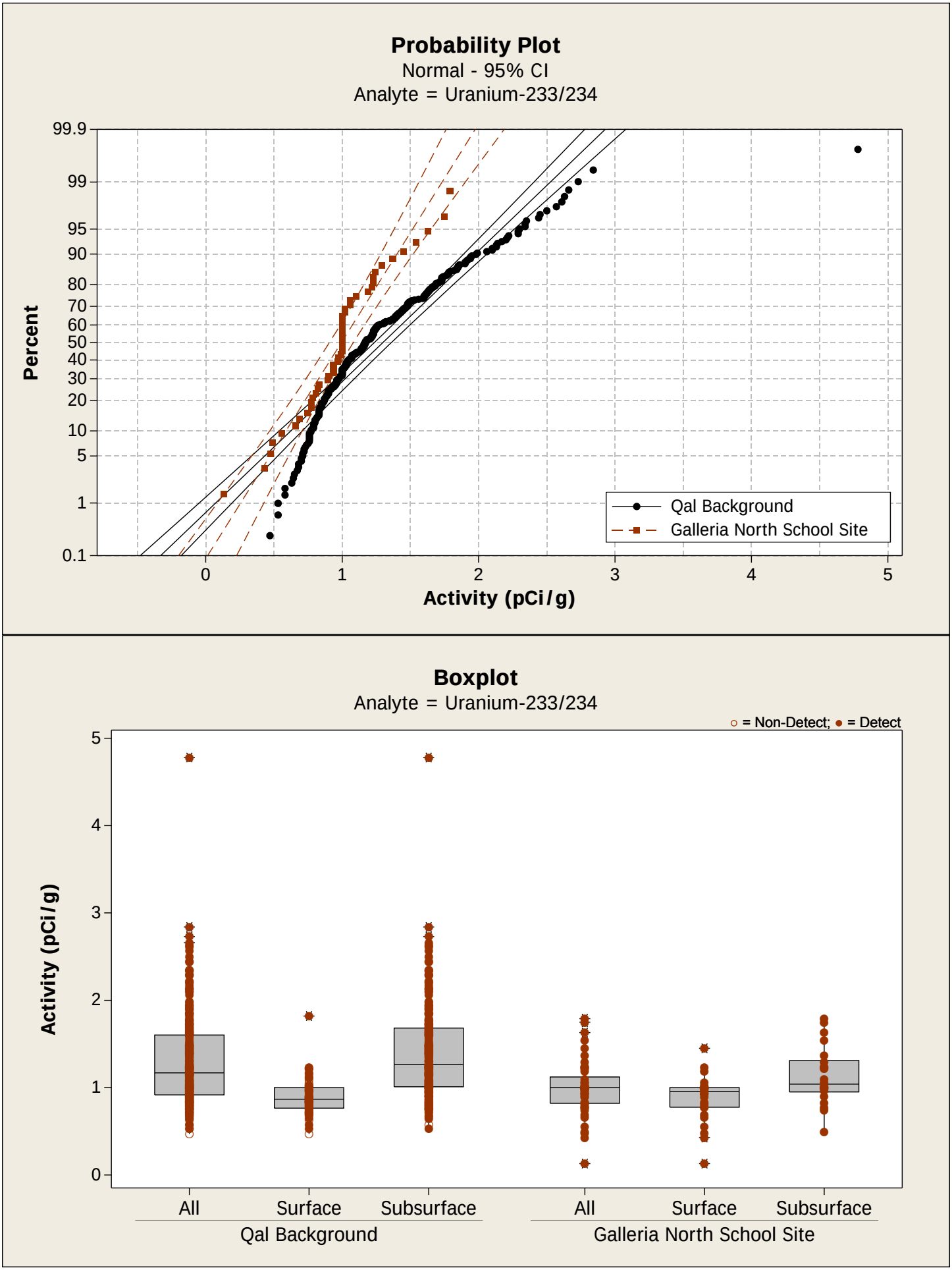

Probability Plot
Normal - 95% CI
Analyte = Radium-228
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-1
0
1
2
3
Activity (pCi/g)
Qal Background
Galleria North School Site

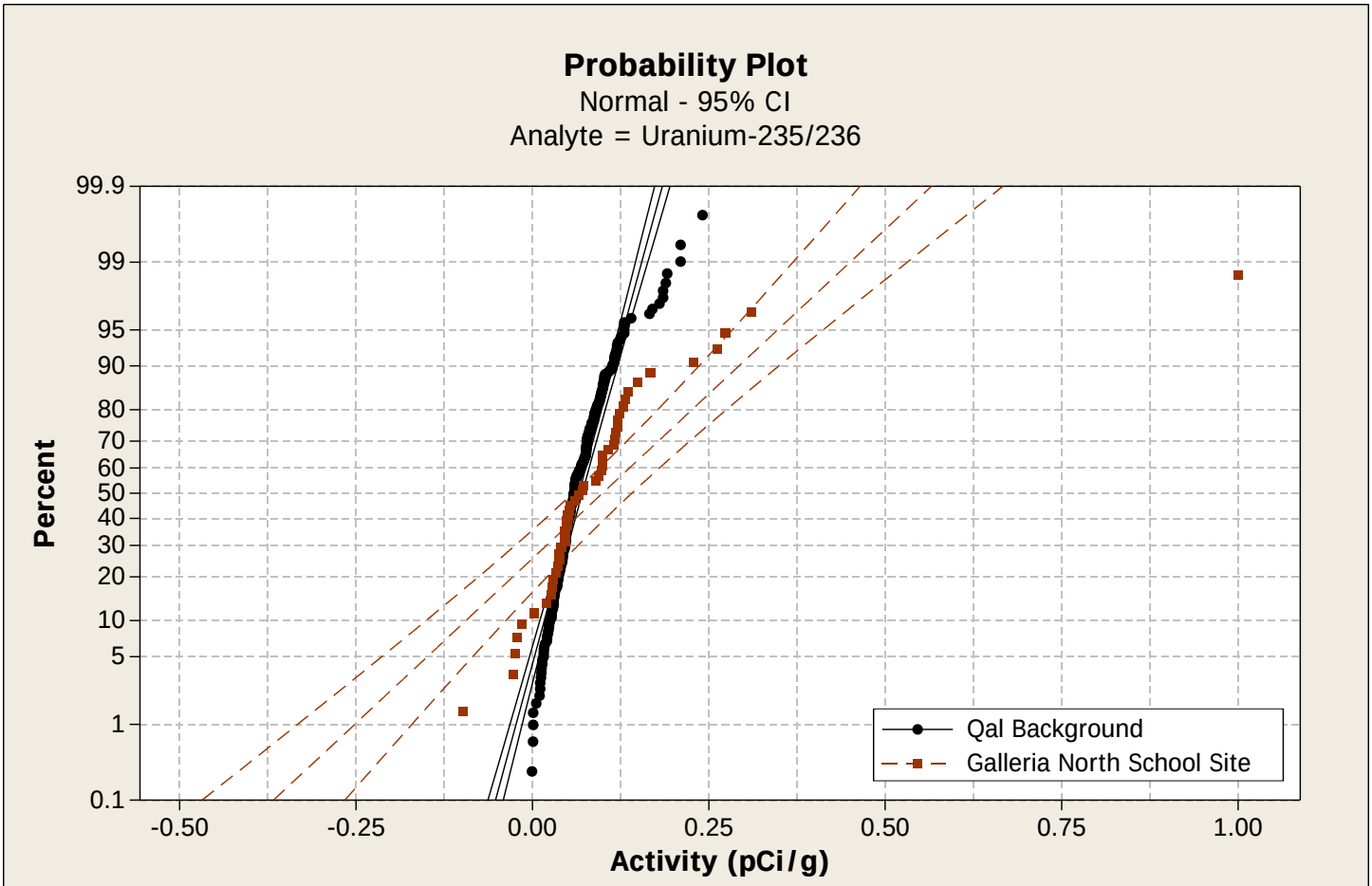

Boxplot
Analyte = Radium-228
○ = Non-Detect; ● = Detect
Activity (pCi/g)
3.0
2.5
2.0
1.5
1.0
0.5
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

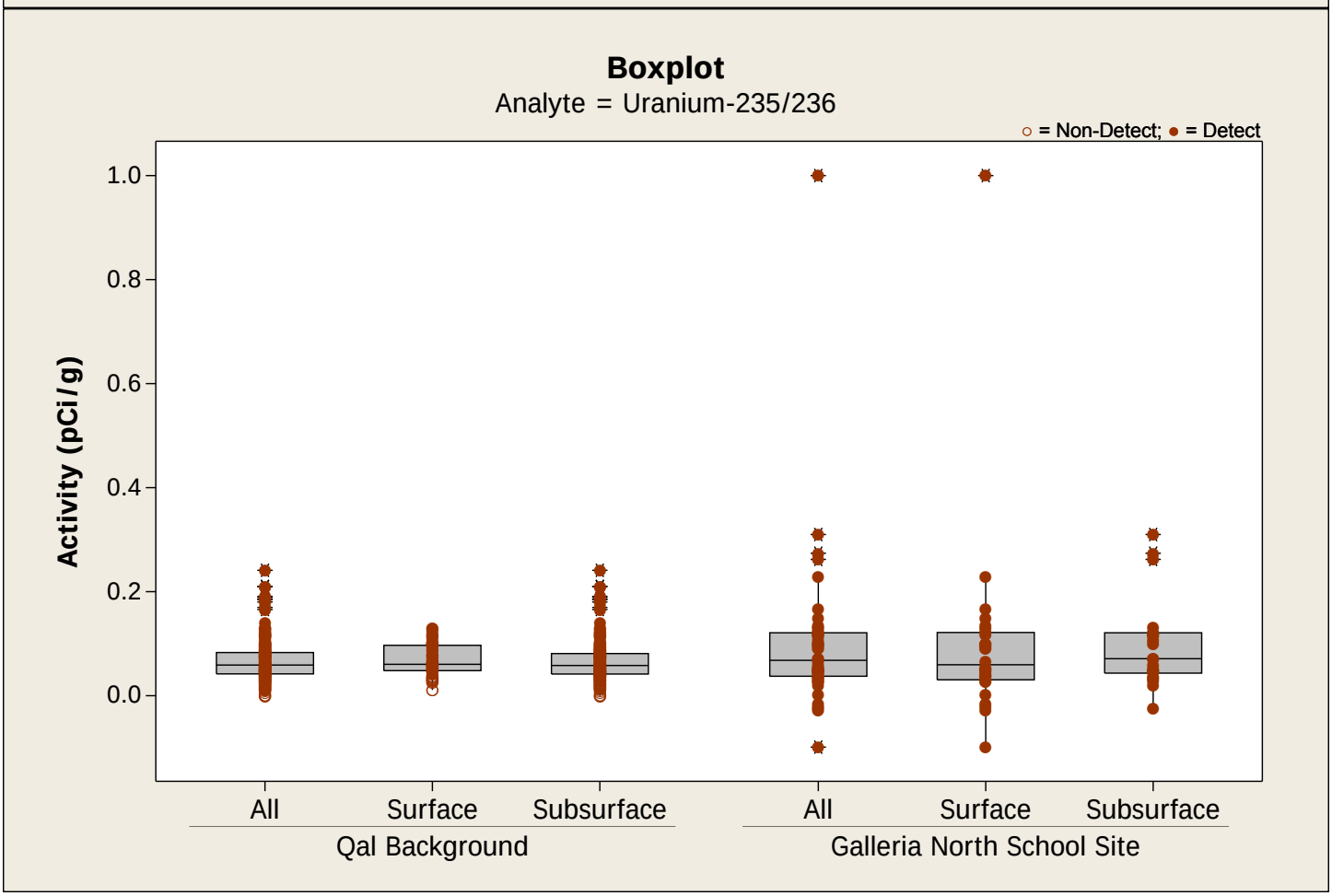

Probability Plot
Normal - 95% CI
Analyte = Thorium-228
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Activity (pCi/g)
Qal Background
Galleria North School Site
Boxplot
Analyte = Thorium-228
○ = Non-Detect; ● = Detect
Activity (pCi/g)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

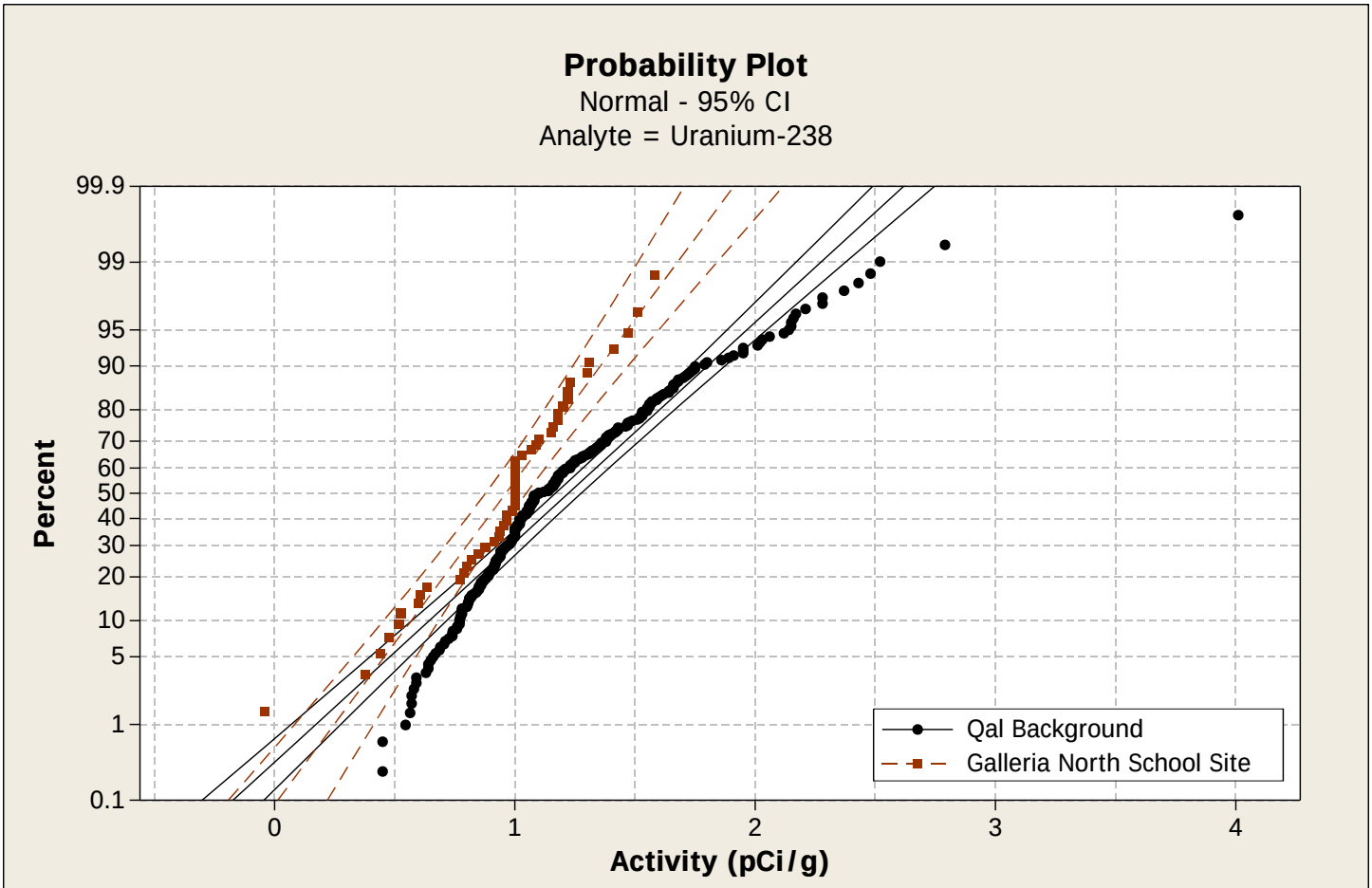

Probability Plot
Normal - 95% CI
Analyte = Thorium-230
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
1
2
3
4
Activity (pCi/g)
Qal Background
Galleria North School Site
Boxplot
Analyte = Thorium-230
○ = Non-Detect; ● = Detect
Activity (pCi/g)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site

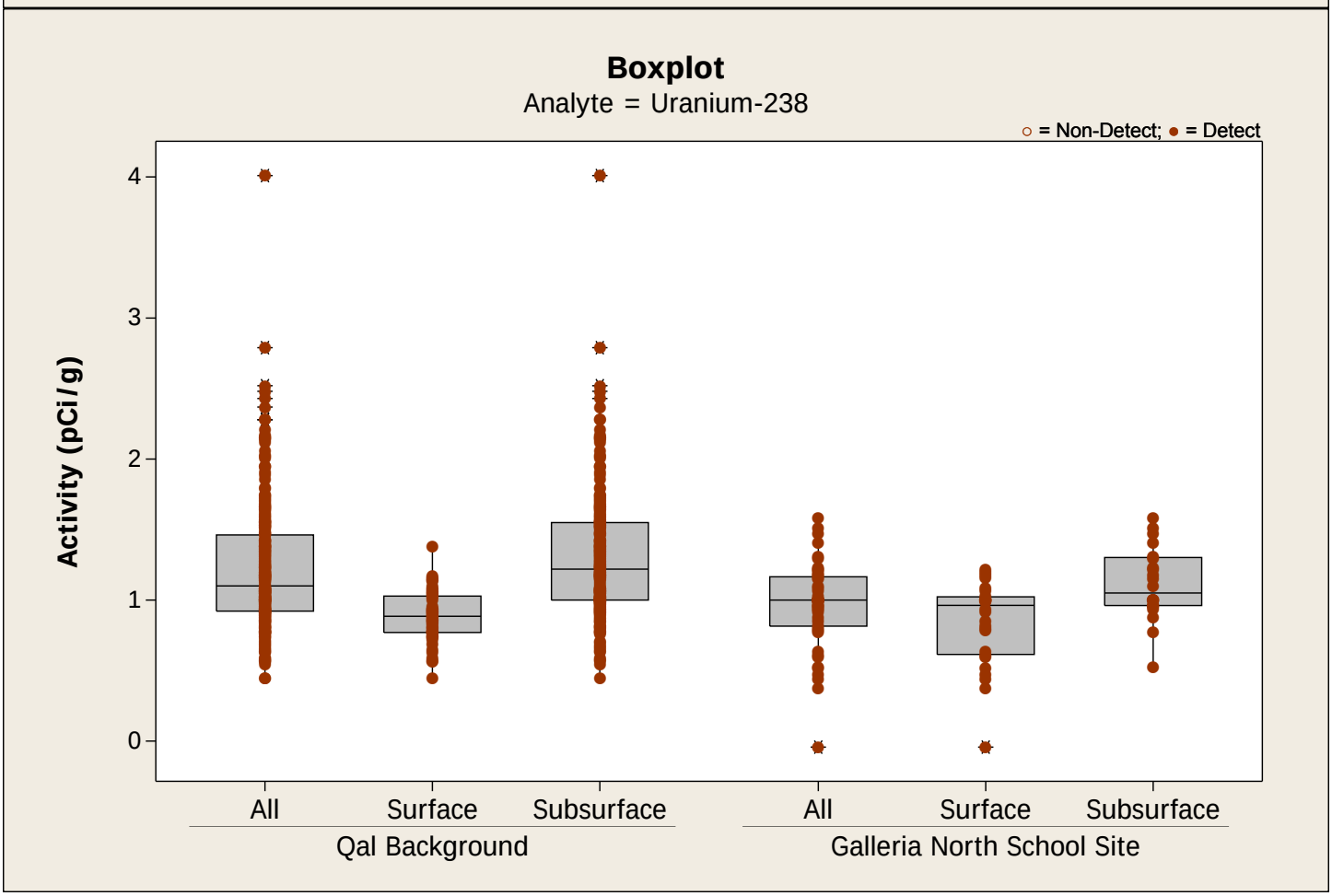

Probability Plot
Normal - 95% CI
Analyte = Thorium-232
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Activity (pCi/g)
Qal Background
Galleria North School Site
Boxplot
Analyte = Thorium-232
○ = Non-Detect; ● = Detect
Activity (pCi/g)
3.0
2.5
2.0
1.5
1.0
0.5
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site


Probability Plot
Normal - 95% CI
Analyte = Uranium-233/234
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
1
2
3
4
5
Activity (pCi/g)
Qal Background
Galleria North School Site
Boxplot
Analyte = Uranium-233/234
○ = Non-Detect; ● = Detect
Activity (pCi/g)
0
1
2
3
4
5
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site


Probability Plot
Normal - 95% CI
Analyte = Uranium-235/236
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-0.50
-0.25
0.00
0.25
0.50
0.75
1.00
Activity (pCi/g)
Qal Background
Galleria North School Site


Boxplot
Analyte = Uranium-235/236
○ = Non-Detect; ● = Detect
Activity (pCi/g)
1.0
0.8
0.6
0.4
0.2
0.0
All
Surface
Subsurface
All
Surface
Subsurface
Qal Background
Galleria North School Site


Probability Plot
Normal - 95% CI
Analyte = Uranium-238
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
1
2
3
4
Activity (pCi/g)
Qal Background
Galleria North School Site


Boxplot
Analyte = Uranium-238
○ = Non-Detect; ● = Detect
Activity (pCi/g)
4
3
2
1
0
All
Surface
Subsurface
Qal Background
All
Surface
Subsurface
Galleria North School Site

# APPENDIX H

# GEOCHEMICAL EVALUATION OF SOIL SAMPLES

# Geochemical Evaluation of Soil Samples

Revision 1.0, Date 8/22/2011

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| 2 | Concentrations and Percentiles of Site Distribution for Sample UPC1-BB26-14 |


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| 2 | Magnesium vs. Mg/Ca Ratios |
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| 5 | Vanadium vs. Iron |
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## *1.0 Introduction*

This report provides the methodology and results of a geochemical evaluation of the concentrations of selected metals in background and BMI Common Areas (Site) soil samples. The primary objective of the evaluation is to identify the source(s) of arsenic in soil at the Site. An additional objective is to identify the natural site-specific processes that are controlling trace element concentrations in soil.

The evaluation is based on analyses of 264 samples (including 23 field duplicates) from 241 locations. The samples are divided into five subgroups based on location and depth, as shown in Table 1. The locations include 55 samples obtained from the Galleria North School Site, 35 samples from the Upper Ponds (for comparison purposes), and 174 samples from background locations in Quaternary alluvium south of the Site. Shallow and deep samples were obtained at the Galleria North School Site and background locations. All of the Upper Ponds samples are sub-surface. The depth ranges of these sample groups are shown in Table 1.

The majority of samples were analyzed for 32 analytes, including the EPA 23-element Target Analyte List plus boron, hexavalent chromium, lithium, molybdenum, strontium, tin, titanium, tungsten, and uranium.

## *2.0 Geochemical Evaluation Methodology*

This section describes the geochemical evaluation techniques that were employed in the evaluation. This geochemical evaluation was performed to provide independent lines of evidence to compliment the standard statistical site-to-background comparison that was previously performed. Statistical site-to-background comparisons for trace elements in soil commonly have high false-positive and false-negative error rates for a number of reasons:

- Large numbers of background samples are required to adequately characterize the upper tails of most trace element distributions, which are typically right-skewed and span a wide range of concentrations, but it is not always feasible to obtain such a large background data set.

- Statistical comparison tests are based on an assumption that soil parameters such as mineralogy, grain size distribution, pH, cation exchange capacity, organic carbon content, etc. are the same at the Site and background locations. Such assumptions are rarely justified, especially if the background locations are not adjacent to the Site.

- Problems arise when comparing Site and background data that were obtained on different (larger or smaller) spatial scales. The standard statistical two-sample tests (Student *t*-test, Wilcoxon Rank Sum test, Gehan's test, etc.) are based on an assumption of equivalent variances in the data sets being compared, but the variance in trace element concentrations in a set of samples increases with the spatial scale over which the samples were obtained. The tests can therefore yield erroneous results if the Site and background samples are obtained over different spatial scales.

- The statistical tests work best if the numbers of Site and background samples are similar. Differences in the relative sizes of the data sets can yield erroneous results. Higher false-

positive error rates are expected when comparing different sample sizes, especially if the site sample size is greater than the background sample size.

- The presence of estimated concentrations and nondetects can yield erroneous statistical test results, especially if the proportion of nondetects is large and the reporting limits differ between samples (EPA, 2009).

More importantly, statistical tests consider only the absolute concentrations of individual elements, and they disregard the interdependence of element concentrations and the geochemical mechanisms controlling element behavior. It is well established that trace elements naturally associate with specific soil-forming minerals, and the preferential enrichment of a sample with these minerals will result in naturally elevated trace element concentrations. It is thus important to be able to identify these naturally high concentrations and distinguish them from potential contamination.

Geochemical evaluations combine the observed concentrations with knowledge of the behaviors of the elements of concern in the site-specific environment of interest to determine if the observed concentrations can be explained by natural processes or are most likely due to site-related sources. Recent publications indicate that geochemical evaluations are assuming a larger role in environmental investigations (e.g., EPA, 1995; Barclift, *et al*., 2000; U.S. Navy, 2002 and 2003; Myers and Thorbjornsen, 2004; Thorbjornsen and Myers, 2007a, 2007b, 2008). A properly executed geochemical evaluation can distinguish between naturally high element concentrations versus contamination, and can identify the specific samples that may contain some component of site-related contamination.

***2.1 Behavior of Trace Elements in Soil.*** Trace elements naturally associate with specific soil-forming minerals, and geochemical evaluations are predicated on these known associations. For example, in most uncontaminated oxic soils (soil horizons above the water table with low organic carbon content can be assumed to be oxic), vanadium (V) exhibits an almost exclusive association with iron oxide minerals. Vanadium exists in oxic soil pore fluid as oxyanions such as $HVO_4^{-2}$ and $H_2VO_4^{-}$ (Brookins, 1988). These negatively charged species have a strong affinity to adsorb on iron oxides, which tend to maintain a net positive surface charge (EPRI, 1984). (In this report, the term "iron oxide" includes oxides, hydroxides, oxyhydroxides, and hydrous oxides of iron.) This association is expressed as a positive correlation between vanadium concentrations and iron concentrations for uncontaminated samples: soil samples with a low percentage of iron oxides will contain proportionally lower vanadium concentrations, and soil samples that are naturally enriched in iron oxides will contain proportionally higher

vanadium concentrations. Although there may be a high variability in the absolute concentrations of vanadium and iron in soil samples from a site, the V/Fe ratios of the samples will be relatively constant if no contamination is present. Samples that contain excess vanadium from a site-related source will exhibit anomalously high V/Fe ratios compared to the uncontaminated samples. The V/Fe ratio is a far more accurate indicator of contamination than the absolute vanadium concentration.

To perform the geochemical evaluation, correlation plots are constructed to explore the elemental associations and identify potentially contaminated samples. The detected concentrations of the trace element of interest (dependent variable) are plotted against the detected concentrations of the reference element (independent variable), which represents the mineral to which the trace element may be adsorbed. In the case of vanadium, the vanadium concentrations for a given set of samples would be plotted on the y-axis, and the corresponding iron concentrations would be plotted on the x-axis. If no contamination is present, then the samples will exhibit a common trend indicating consistent V/Fe ratios, and the samples with the highest vanadium concentrations will lie on this trend. This indicates that the elevated vanadium is due to the preferential enrichment of iron oxides in those samples and that the vanadium has a natural source. If, however, the samples with high vanadium concentrations have low or moderate iron concentrations (anomalously high V/Fe ratios), then they will lie above the trend established by the other samples. This indicates that the anomalous samples contain excess vanadium beyond that which can be explained by the natural iron oxide content, and such samples may contain a component of contamination.

The reference elements against which trace elements are evaluated reflect the affinities that the trace elements have for specific minerals, which is a function of the specific geochemical environment. The concentrations of iron, aluminum, and manganese serve as qualitative indicators of the amounts of iron oxides, clays, and manganese oxide minerals in the soil samples. These three families of minerals have particularly strong affinities to adsorb specific trace elements on their charged surfaces.

Along with vanadium, molybdenum, selenium and uranium are present in oxic soil pore fluid as anions that have an affinity to adsorb on iron oxides, which tend to maintain a net positive surface charge. Concentrations of these trace elements in a set of samples can be evaluated through comparison to the corresponding iron concentrations. Cadmium, copper, nickel, and zinc are typically present in soil as divalent cations and have an affinity to adsorb on clay minerals, which tend to maintain a net negative surface charge. Concentrations of these elements

can be evaluated through comparison to the corresponding aluminum concentrations. Manganese oxide minerals have a strong selective affinity to adsorb cobalt and lead (Kabata-Pendias, 2001), so concentrations of these elements can be compared to the corresponding manganese concentrations, as long as there is enough manganese present in the soil to form discrete manganese oxides.

Evaluation of these trace/reference element relationships are based on an assumption that the reference elements (aluminum, iron, manganese, etc.) are not contaminants at the Site. Evaluation of the major elements are performed first to verify this assumption.

It is important to note that some trace elements have very strong affinities for a particular type of mineral, whereas other elements will partition themselves among several minerals. For instance, vanadium has a particularly strong affinity for iron oxides, so the correlation between vanadium versus iron in uncontaminated samples are usually very high, and this is expressed on a correlation plot as a consistent trend with little to no scatter. In contrast, chromium forms several coexisting aqueous species with different charges [$Cr(OH)_2^+$, $Cr(OH)_3^0$, and $Cr(OH)_4^-$] that will adsorb on several different types of minerals, including clays and iron oxides. This behavior will yield lower degrees of correlation for chromium versus iron or chromium versus aluminum relative to the coefficients observed for vanadium versus iron, and more scatter may be observed on the correlation plots. Some elements are more selective than others with respect to adsorption on specific mineral surfaces, and this selectivity is dependent on site-specific conditions, including soil pH, redox conditions, and concentrations of competing elements.

Site samples with a trace element present as a contaminant will exhibit anomalously high trace-versus-major element ratios compared to background trace-versus-major element ratios. These elevated ratios may not always be apparent in log-log correlation plots, especially at the upper range of concentrations. Therefore, ratio plots, which depict trace element concentrations on the y-axis and trace/major element ratios on the x-axis, are employed in conjunction with correlation plots in those cases where it is not immediately apparent which Site samples have anomalously high elemental ratios on the correlation plots. The ratio plots permit easy identification of samples with anomalously high elemental ratios relative to background, and they have high resolution over the entire concentration range.

It is important to note that there is natural variability, as well as analytical uncertainty, in the elemental ratios of uncontaminated soil samples. Trace/major element ratios are calculated from two uncertain analytical results, so the resulting uncertainties in the ratios can produce some

scatter in the points on a ratio plot. This is especially true when estimated ("J"-qualified) analytical results are used. This can be seen on many of the plots that show more scatter of the points at the lower end of the concentration range, where analytical uncertainties are higher and analytical results are reported with fewer significant figures.

On ratio plots, vertical trends should be expected only in those cases where the trace element adsorption is a linear process, where the trace element concentrations are controlled exclusively by adsorption on a given mineral type, and where the variances of the reference and trace element concentrations are similar (Thorbjornsen and Myers, 2007a). Nonvertical trends are much more common in ratio plots, however, because adsorption processes often are not linear, trace elements often have affinities for more than one type of sorptive surface, and the reference and trace element concentrations usually possess different variances (Thorbjornsen and Myers, 2007a). Nonlinear adsorption of a trace element on mineral surfaces will manifest itself as a curve rather than a straight line on a correlation plot and as a nonvertical trend on a ratio plot. In addition, the presence of competing ions in soil and differences in pH and redox conditions among the sample locations can add to the natural variability of elemental ratios.

# 3.0 Geochemical Evaluation Results

## 3.1 Major Element Relationships

The geochemical evaluation methodology is based on an assumption that the reference elements (aluminum, iron, manganese, calcium, and magnesium) are not contaminants at the Site. Evaluation of the major elements are performed first to verify this assumption. Major element evaluations also provide insight into the site-specific geochemical processes that are occurring. The highest average concentrations of the 32 elements that were analyzed for are calcium (2.8 weight percent [wt %]), iron (1.5 wt %), magnesium (1.0 wt %), and aluminum (0.9 wt %), in that order. The processes controlling these four elements are discussed below.

### 3.1.1 Processes Controlling Calcium and Magnesium Concentrations

High concentrations of calcium and magnesium are common in soil from arid regions due to the precipitation of evaporite minerals such as calcite [$CaCO_3$], magnesite [$MgCO_3$], huntite [$CaMg_3(CO_3)_4$] and gypsum [$CaSO_4 \bullet 2H_2O$] during wet-dry cycling that occurs on a time scale of hundreds to thousands of years. During a rain event, soluble soil constituents (calcium, magnesium, sodium, potassium, sulfate, carbonate, and chloride) dissolve in soil pore fluid. Following the rain event, as the water evaporates at the surface, the dissolved solutes in the remaining pore fluid become progressively more concentrated. Eventually, solubility limits are

reached and carbonate and sulfate minerals precipitate as a layer some distance below the surface.

These layers form slowly over geologic time. In some arid locations, these minerals concentrate in the subsurface to form a strongly cemented layer known as a *hardpan*, *calcrete*, or *caliche*. These layers are often discontinuous, and several layers may be present at different depths. If these areas are disturbed by construction or remediation activities, then the layers become mixed and the redistribution of elements resumes. Young evaporite layers may not be visually identifiable in core sections, but can be identified by their elemental relationships.

Barium and strontium have similar chemical properties as calcium and magnesium, and can substitute for these elements in the carbonate and sulfate minerals that form these layers. Pentavalent arsenic and antimony exist as arsenate and antimonate oxyanions that can also concentrate in these layers by substituting for sulfate, which has similar chemical properties. Samples that contain some of these evaporate minerals should show elevated concentrations of calcium and magnesium, and the two elements should be in fairly constant proportion. This relationship can be seen in Figure 1, which shows the correlation between calcium versus magnesium. Five different symbols are used for the five subgroups of samples listed in Table 1. Shallow background samples are shown with open triangles, deep background samples are shown with solid triangles, shallow school site samples are shown with open circles, deep school site samples are shown with solid circles, and deep upper ponds samples are shown with squares. Note that logarithmic axes are used on the correlation plots so that all of the samples can be clearly seen.

The figure shows that all of the samples fall on a consistent trend with a positive slope, indicating fairly constant Ca/Mg ratios. Another perspective on the same data is show in Figure 2 which provides the calcium concentrations versus Ca/Mg ratios. This perspective shows that the Ca/Mg ratios fall within a narrow range from 0.11 to 0.83, and there does not appear to be any differences in ratios between the five subgroups of samples.

Some of the calcium and magnesium may be associated with clay minerals, but this is a minor association because the mean calcium and magnesium concentrations are higher than the mean aluminum concentration. All clay minerals contain aluminum as a major component. Some clay minerals also contain calcium and/or magnesium, but at lower concentrations than aluminum. The high concentrations of calcium and magnesium are most likely due to the climate-related

precipitation of naturally occurring calcium-magnesium-carbonate and calcium-sulfate minerals in the soil column.

### 3.1.2 Processes Controlling Iron and Aluminum Concentrations

Iron is the second most abundant of the 32 elements analyzed in the Site soil samples (mean concentration of 15,127 mg/kg, or 1.5 wt %) and is dominantly present as iron oxides. Iron oxides are common soil-forming minerals and occur as discrete mineral grains or as coatings on silicate minerals (Cornell and Schwertmann, 2003).

Aluminum is the fourth most abundant of the analyzed elements (mean concentration of 9,171 mg/kg, or 0.9 wt %). Aluminum is a primary component of common soil-forming minerals such as clays, feldspars, and micas. Aluminum also substitutes for ferric iron in iron oxide minerals and it can adsorb on iron oxide surfaces (Cornell and Schwertmann, 2003). In alluvium, such as exists at the BMI Site, the main source of iron in the soil samples is iron oxides, and the main source of aluminum is clay minerals. Clays and iron oxides tend to exist as very fine particles, so both aluminum and iron are enriched in samples with finer grain sizes.

A plot of aluminum versus iron concentrations can be used to qualitatively assess the relative abundance of these minerals in Site soil (Figure 3). The consistent trend with a positive slope on the figure is caused by differences in grain size distributions between the samples. Samples plotting at the high end of the trend are interpreted to be enriched in finer grained minerals, including iron oxides and clays. Samples at the lower end of the trend have the same ratio of iron oxides and clays, but are diluted by coarser grained minerals such as quartz, feldspar, and unweathered rock fragments. This conclusion is broadly consistent with the background and Site sample locations: background soil samples that were collected upslope along the regional alluvial fan system in the Site area (proximal to the fan source) would be expected to have a larger mean particle size compared to the Site soil samples that were collected downslope (distal to the fan source) where mean grain size is smaller.

The ratio plot of the same data, shown as Figure 4, confirms that the Al/Fe ratios are quite consistent in all of the samples. Figures 3 and 4 also show that the School Site and Deep Upper Ponds samples are shifted higher on the trend relative to the background samples, suggesting that the Site samples are, on average, finer grained than the background samples. As noted above, this is consistent with the proximal/distal sample locations within the regional fan system of the Site area.

As discussed previously, clays and iron oxides have an affinity to adsorb specific trace elements, so the samples that are enriched in these minerals (and which plot on the upper end of the trend in Figure 3) are expected to contain naturally higher concentrations of trace elements. Due to higher cation exchange capacity, finer textured soils are expected to contain higher concentrations whether from a natural or anthropogenic source. Also note that these differences in grain size distributions between the Site and background samples can cause statistical comparison tests to conclude that the Site samples have elevated trace element concentrations relative to background.

These observations indicate that the aluminum and iron concentrations are controlled by differences in grain size distributions and are naturally occurring. An additional line of evidence is provided by the correlation between vanadium (V) and iron. As noted in Section 2.1, vanadium is present in oxic soil pore fluid as oxyanions ($H_2VO_4^-$, $HVO_4^{2-}$) that have a strong affinity to adsorb on iron oxides, which tend to maintain a net positive surface charge (EPRI, 1984).

Positive correlations between iron and vanadium concentrations are thus expected for uncontaminated samples. Among the trace elements that have an affinity to adsorb on iron oxides, vanadium has been shown to have an almost exclusive association with iron in various soils across the United States (Myers and Thorbjornsen, 2004). This makes the identification of iron contamination unambiguous in soils that are not contaminated with both elements.

Figure 5 provides the correlation between vanadium and iron. Samples from all five subgroups form a common trend with a positive slope. The site samples with the highest vanadium concentrations have proportionally higher iron, indicating relatively constant V/Fe ratios in all the samples. This is verified in the ratio plot of the same data as shown in Figure 6. These observations suggest a natural source for vanadium and iron. The figures also show that the School Site and Deep Upper Ponds samples fall on the upper end of the trends in Figures 5 and 6, as they also did in Figures 3 and 4. This is most likely due to the natural enrichment of trace elements in finer grained soil samples that have higher proportions of iron oxides and clay minerals.

The evaluation of the four major elements (Ca, Mg, Fe, Al) concludes that calcium and magnesium are naturally concentrated in all of the samples due to the precipitation of carbonate and sulfate minerals and that the concentrations of aluminum and iron are naturally occurring. This allows the use of these four elements as reference elements for the evaluation of trace

elements. An additional finding is that the Site samples tend, on average, to have higher aluminum and iron concentrations, while maintaining fairly constant Al/Fe ratios. This is most likely due to finer-grained soil at the Site locations relative to background locations. As a result of these differences, Site samples are expected to have naturally higher trace element concentrations relative to the background samples.

## *3.2 Trace Element Evaluations*

Six selected trace elements (cobalt, lead, zinc, barium, strontium and arsenic) are evaluated in this section to gain an understanding of the site-specific processes that control trace element concentrations. Arsenic is also evaluated because some concentrations exceed regulatory limits so it is important to determine if the higher concentrations are due to natural processes or are caused by contamination.

### 3.2.1 Cobalt

Cobalt (Co) exists in soil pore fluid as the divalent cation $Co^{2+}$ which, along with lead, has a strong affinity to adsorb on the surfaces of manganese oxides (EPRI, 1984). A correlation between cobalt and manganese is thus expected in samples that are not contaminated with either metal. Figure 7 shows the correlation between cobalt versus manganese, and Figure 8 shows the ratio plot of the same data. The consistent Co/Mn ratio in all of the samples indicates that the observed cobalt and manganese concentrations are naturally occurring. There is no evidence of cobalt or manganese contamination in any of the samples.

### 3.2.2 Lead

Lead (Pb) has similar behavior as cobalt in that it exists in soil pore fluid as the divalent cation $Pb^{2+}$, and has a strong affinity to adsorb on the surfaces of manganese oxides (EPRI, 1984). A correlation between lead and manganese is thus expected in samples that are not contaminated with lead. Figure 9 shows the correlation between lead and manganese. The majority of the samples fall on a consistent trend with a positive slope, indicating naturally occurring lead concentrations. There are, however, a few samples that fall above the trend established by the majority of the samples. These samples have more lead than expected based on their manganese concentrations, suggesting that they contain some component of lead contamination. The ratio plot of the same data (Figure 10) more clearly shows the samples with anomalously high Pb/Mn ratios, which includes six Shallow School Site samples, two deep Upper Ponds samples, and two shallow background samples. The maximum lead concentration of 272 mg/kg in these

anomalous samples is well below the Nevada Division of Environmental Protection (NDEP) residential soil Basic Comparison Level (BCL) of 400 mg/kg.

An additional observation is that all of the Deep Upper Ponds samples form a positive trend that falls slightly above the trend established by the background samples on Figure 9, and are slightly to the right of the vertical background trend on Figure 10. It is doubtful that all of the Deep Upper Ponds samples have a small component of contamination because these 35 samples were obtained at depths of 3 to 16 feet below the surface in undisturbed soil. In addition, if they were all contaminated to varying degrees, then they would not maintain a consistent correlation with manganese. It is more likely that the Deep Upper Ponds samples have naturally higher lead content.

### 3.2.3 Zinc

Zinc (Zn) exists in soil pore fluid as the divalent cation $Zn^{2+}$, and has a strong affinity to adsorb on the positively charged surfaces of aluminum-bearing clay minerals (EPRI, 1984). A correlation between zinc and aluminum (a proxy for clay content) is thus expected in samples that are not contaminated with zinc. Figure 11 shows the correlation between zinc and aluminum. The majority of the samples fall on a consistent trend with a positive slope, indicating naturally occurring zinc concentrations. There are, however, three samples that fall above the trend established by the majority of the samples. These samples have more zinc than expected based on their aluminum concentrations, suggesting that they contain some component of zinc contamination. The ratio plot of the same data (Figure 12) more clearly shows the three samples with anomalously high Zn/Al ratios, which includes two Shallow School Site samples and one shallow background sample. (Note that the two Shallow School Site samples also have anomalously high Pb/Mn ratios.) The maximum zinc concentration of 155 mg/kg in these anomalous samples is well below the NDEP residential soil BCL of 23,500 mg/kg.

### 3.2.4 Barium

Barium, calcium, magnesium, and strontium are alkaline earth elements that have similar geochemical behaviors. Barium exists in soil pore fluid as the divalent cation $Ba^{2+}$(EPRI, 1984). In this form, it has the same charge and similar ionic radius as calcium and magnesium, so it tends to follow these two elements in the soil column. Barium will also react with dissolved sulfate or carbonate in soil pore fluid to precipitate as the minerals barite ($BaSO_4$) or witherite ($BaCO_3$) which have very low solubilities. These properties cause barium to concentrate along with calcium and magnesium in subsurface evaporite (caliche) layers in arid regions. As a result

of these processes, barium is expected to be correlated with calcium and/or magnesium if no contamination is present.

Figure 13 shows the correlation between barium versus the sum of calcium and magnesium. Two parallel trends can be seen. A lower trend is defined by the background samples and an upper trend is defined by the Site (School Site and Deep Upper Ponds) samples. These trends can also be seen on the ratio plot of the same data (Figure 14) which shows that the ratios in the Site samples are displaced to the right of the background samples.

Barium undergoes vertical redistribution in the soil column due to the processes discussed above, so natural differences in concentration versus depth are expected. Although the samples are categorized as either "shallow" or 'deep," the definitions of these depths vary in each of the five subgroups. Figure 15 shows barium concentrations versus depth below ground surface (depths are defined as the mid-point of the sampled intervals as shown in Table 1). These differences in sampled intervals between the Site and background samples may be a contributing factor in explaining the different trends seen on Figure 13.

It is unlikely that all of the Site samples have the same component of barium contamination. The most likely reason for the two parallel trends is natural differences in barium content with depth in the background versus Site locations. All detected barium concentrations fall below the NDEP residential soil BCL of 15,300 mg/kg.

### 3.2.5 Strontium

Strontium (Sr) has similar chemical behavior as barium in an arid soil environment. Strontium exists in soil pore fluid as the divalent cation $Sr^{2+}$. In this form, it has the same charge and similar ionic radius as calcium and magnesium, so it tends to follow these two elements in the soil column. Strontium will also react with dissolved sulfate or carbonate in soil pore fluid to precipitate as the minerals celestite ($SrSO_4$) or strontianite ($SrCO_3$) which have low solubilities. These properties cause strontium to concentrate along with calcium and magnesium in subsurface caliche layers in arid regions. As a result of these processes, strontium is expected to be correlated with calcium and/or magnesium if no contamination is present.

Figure 16 shows the correlation between strontium versus the sum of calcium and magnesium. The samples define a trend with a positive slope but most of the Site samples have somewhat higher strontium concentrations relative to background. These differences can also be seen on the

ratio plot of the same data (Figure 17), which shows that the ratio of most of the Site samples are displaced to the right of the background samples.

As in the case of barium, it is unlikely that the Site samples contain strontium contamination because of the consistent trend defined by the Site samples on the correlation plot, and the consistent Sr/(Ca+Mg) ratios on the ratio plot. The observed strontium concentrations are most likely naturally occurring, and are well below the NDEP residential soil BCL of 46,900 mg/kg.

### 3.2.6 Arsenic

Arsenic exists in oxic soil pore fluid as the arsenate oxyanions $H_2AsO_4^-$ or $HAsO_4^{2-}$, depending on the local pH. In humid climates, these arsenate species usually adsorb on iron oxide surfaces that maintain a net positive surface charge (EPRI, 1986). However, in arid climates, these arsenate species tend to substitute for sulfate ($SO_4^{2-}$) which precipitates as gypsum, anhydrite, and to a lesser extent, celestite and barite. As a result of this process, arsenic is expected to show a correlation with calcium or magnesium if no arsenic contamination is present.

Figure 18 shows the correlation between arsenic versus the sum of calcium and magnesium concentrations. The figure displays a correlation between the two parameters with the Deep Upper Ponds samples and Deep Background samples forming an upper bound to the trend.

The one exception is the Deep Upper Ponds sample with the maximum arsenic concentration of 18.5 mg/kg. This sample (UPC1-BB26-14) has relatively low calcium and magnesium, so high arsenic is not expected. The accompanying ratio plot (Figure 19) also shows that the Deep Upper Ponds samples and some of the Deep Background samples have somewhat higher arsenic concentrations as well as higher As/(Ca+Mg) ratios. The one anomalous sample with the maximum arsenic concentration also has an As/(Ca+Mg) ratio of 0.0008 that is higher than the maximum background ratio of 0.00031.

Figure 20 shows arsenic concentrations as a function of sample depth. This perspective indicates that arsenic concentrations in the Deep Upper Ponds samples are shifted upward relative to the other subgroups of samples, although some of the Deep Background samples also have elevated arsenic. This upward shift in the Deep Upper Ponds samples may be due to arsenic reported in regional groundwater (DBS&A, 2010).

As was the case for lead, zinc, barium, and strontium, it is doubtful that all of the Deep Upper Ponds samples have some component of arsenic contamination because the trace/major element

ratios in these samples are fairly consistent, albeit higher than the ratios in the other sample subgroups. It is more likely that these samples have naturally higher concentrations of arsenic. A possible exception is arsenic in sample UPC1-BB26-14 which has the maximum arsenic concentration of 18.5 mg/kg. The occurrence of arsenic in this sample is discussed in the following section.

### *3.3 Arsenic Discussion*

Sample UPC1-BB26-14 has the maximum arsenic concentration of 18.5 mg/kg and an anomalously high As/(Ca+Mg) ratio of 0.0008 that is higher than the maximum background ratio of 0.00031. Although the As/(Ca+Mg) ratio in this sample is anomalously high, it was obtained from a depth of 14 feet in undisturbed material.

If the source of elevated arsenic in this sample was residual site-related material (or site-related material leached downward in the soil column), then other site-related elements would be expected to be elevated along with arsenic. Additionally, arsenic (and other elements) would be expected to be found at higher concentrations in more shallow samples from the same location (arsenic concentrations at surface and four feet bgs are 6 and 5.6 mg/kg, respectively). However, other elements, such as chromium, cobalt lead, vanadium, and zinc, have low concentrations in sample UPC1-BB26-14. For instance, Table 2 provides the concentrations of 22 elements in sample UPC1-BB26-14 (the 10 elements not shown were not detectable in the sample). The third column shows the concentrations of each detectable element in the sample expressed as the percentile of the distribution of concentrations in the 90 Site samples (Shallow School Site, Deep School Site, and Deep Upper Ponds). That is, the barium concentration of 314 mg/kg in the sample, when ranked among the barium concentrations in the 90 Site samples, falls as the 33$^{rd}$ percentile of the distribution. The low percentiles shown in Table 2 for the majority of the elements demonstrate that sample UPC1-BB26-14 does not have a source-related signature. In addition, this sample is located at the eastern portion of the Deep Upper Pond samples, with groundwater elevations between 50 to 60 feet bgs. Therefore, impacts from groundwater at this location are unlikely. Thus, the elevated arsenic in sample UPC1-BB26-14 is likely simply an anomalously high natural concentration.

## *4.0 Summary*

A geochemical evaluation was performed for the major elements calcium, magnesium, aluminum, and iron; and for the trace elements vanadium, cobalt, lead, zinc, barium, strontium,

and arsenic. The evaluation was based on analyses of the concentrations of 32 elements in a set of 264 samples.

The major and trace element evaluations identified two key site-specific processes controlling local trace element concentrations. One process is the presence of subsurface evaporite layers that naturally concentrate the alkaline earth elements calcium, magnesium, barium and strontium. A second key process is natural differences in grain size distributions between samples. Finer-grained samples have higher proportions of iron oxide, manganese oxide, and clay minerals that adsorb specific trace elements including cobalt, lead, vanadium, and zinc. Sample-to-sample variations in grain size distributions lead to variances in aluminum, iron, and manganese concentrations; which in turn control the variances of cobalt, lead, vanadium, and zinc.

The concentrations of calcium, magnesium, aluminum, iron, vanadium, cobalt, barium, and strontium were found to be naturally occurring. Eight Site samples had lead/manganese ratios that were elevated, and two of those samples also had zinc/manganese ratios that were elevated, suggesting that these samples contain some component of lead or zinc contamination. The lead and zinc concentrations in these samples, are well below NDEP residential soil BCLs.

Sample UPC1-BB26-14 has the maximum arsenic concentration of 18.5 mg/kg and an anomalously high As/(Ca+Mg) ratio that cannot be explained by the natural processes that were considered in this evaluation. Although the As/(Ca+Mg) ratio in this sample is anomalously high, it was obtained from a depth of 14 feet bgs in undisturbed material. In addition, the concentrations of elements known to be present in site-related sources (chromium, cobalt, lead, vanadium, zinc, etc.) are low, indicating that arsenic in this sample is unlikely to be due to site-related sources.

## *5.0 References*

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## Table 1. Samples Used in the Evaluation

| Sample Group | Number of Samples | Depth of Samples |
|---|---|---|
| Shallow Background | 79 | 20 to 160 ft. |
| Deep Background | 95 | Surface to 10 ft. |
| Shallow School Site | 32 | Surface |
| Deep School Site | 23 | 10 to 11 ft. |
| Deep Upper Ponds | 35 | 3 to 16 ft. |

## Table 2. Concentrations and Percentiles of Site Distribution for Sample UPC1-BB26-14

| Element | Concentration (mg/kg) | Percentile of Distribution* |
|---|---|---|
| Aluminum | 7,290 | 19 |
| Arsenic | 18.5 | 100 |
| Barium | 314 | 33 |
| Beryllium | 0.53 | 12 |
| Cadmium | 0.084 | 4 |
| Calcium | 16,400 | 6 |
| Chromium | 11.7 | 27 |
| Cobalt | 8.3 | 28 |
| Copper | 16.4 | 21 |
| Iron | 15,700 | 34 |
| Lead | 19.2 | 76 |
| Lithium | 17.9 | 75 |
| Magnesium | 6,870 | 2 |
| Manganese | 714 | 96 |
| Nickel | 16.4 | 52 |
| Silver | 0.048 | 6 |
| Sodium | 371 | 10 |
| Strontium | 215 | 12 |
| Titanium | 497 | 18 |
| Uranium | 1.2 | 48 |
| Vanadium | 51.8 | 48 |
| Zinc | 37 | 16 |

** Concentrations of each detectable element in the sample expressed as the percentile of the distribution of concentrations in the 90 Site samples (Shallow School Site, Deep School Site, and Deep Upper Ponds).*

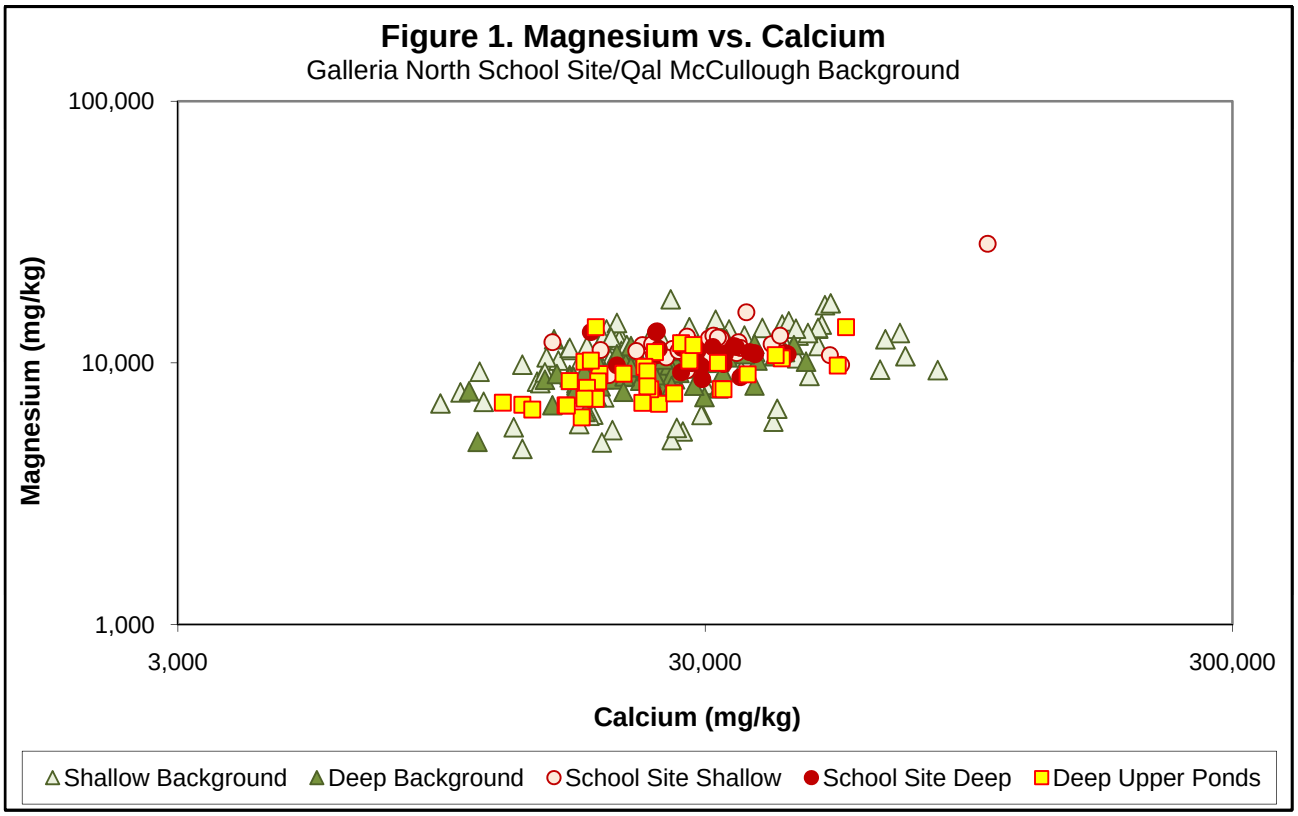
Figure 1. Magnesium vs. Calcium
Galleria North School Site/Qal McCullough Background
100,000
10,000
1,000
Magnesium (mg/kg)
3,000
30,000
300,000
Calcium (mg/kg)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

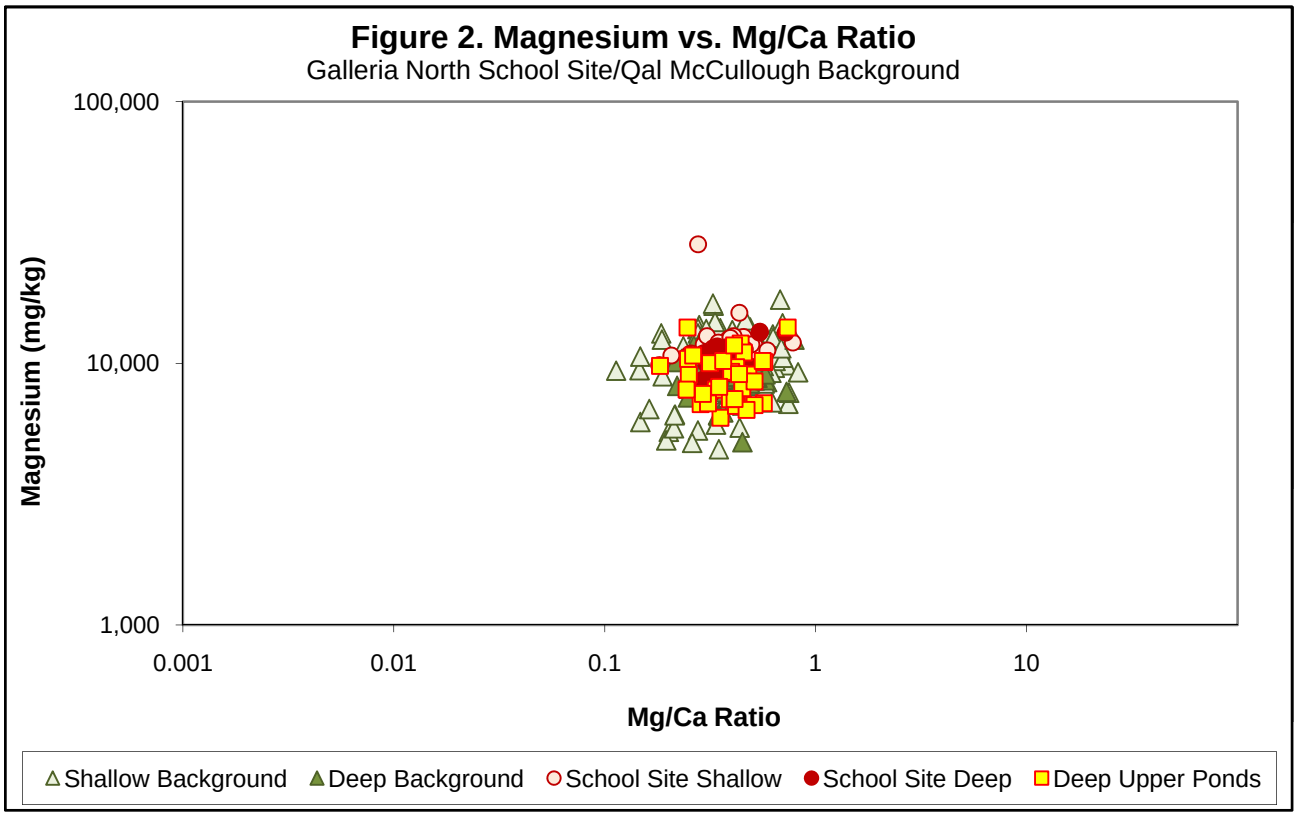
Figure 2. Magnesium vs. Mg/Ca Ratio
Galleria North School Site/Qal McCullough Background
100,000
10,000
1,000
Magnesium (mg/kg)
0.001
0.01
0.1
1
10
Mg/Ca Ratio
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

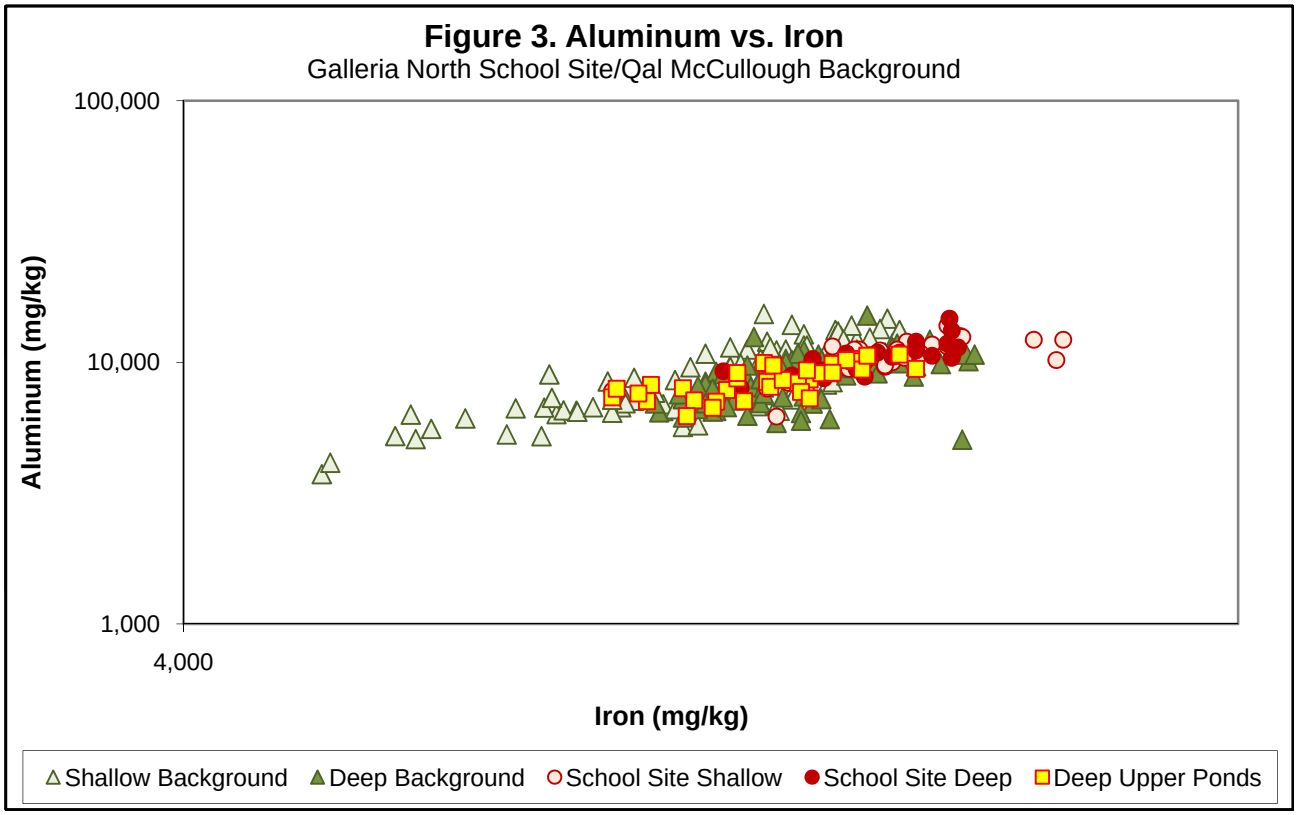
Figure 3. Aluminum vs. Iron
Galleria North School Site/Qal McCullough Background
100,000
10,000
1,000
4,000
Aluminum (mg/kg)
Iron (mg/kg)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

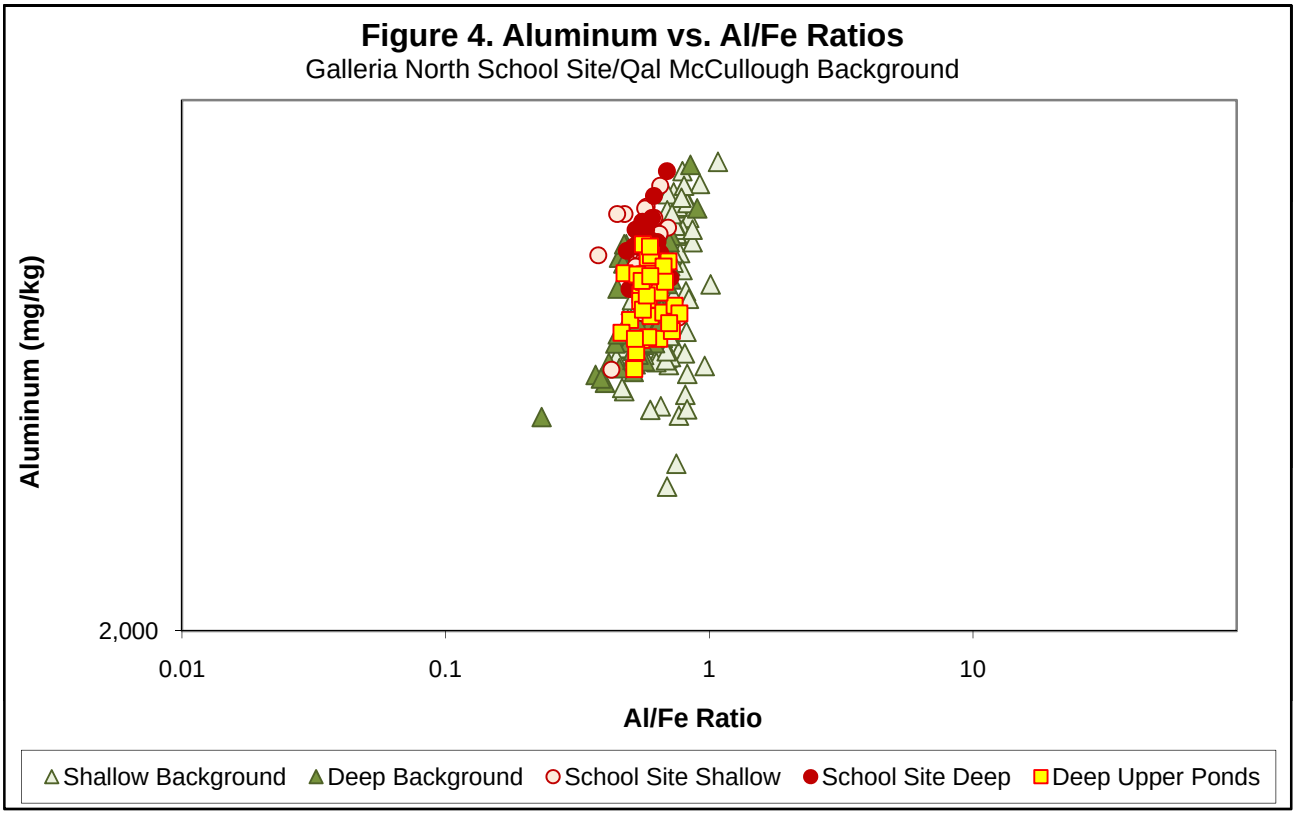
Figure 4. Aluminum vs. Al/Fe Ratios
Galleria North School Site/Qal McCullough Background
2,000
0.01
0.1
1
10
Aluminum (mg/kg)
Al/Fe Ratio
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

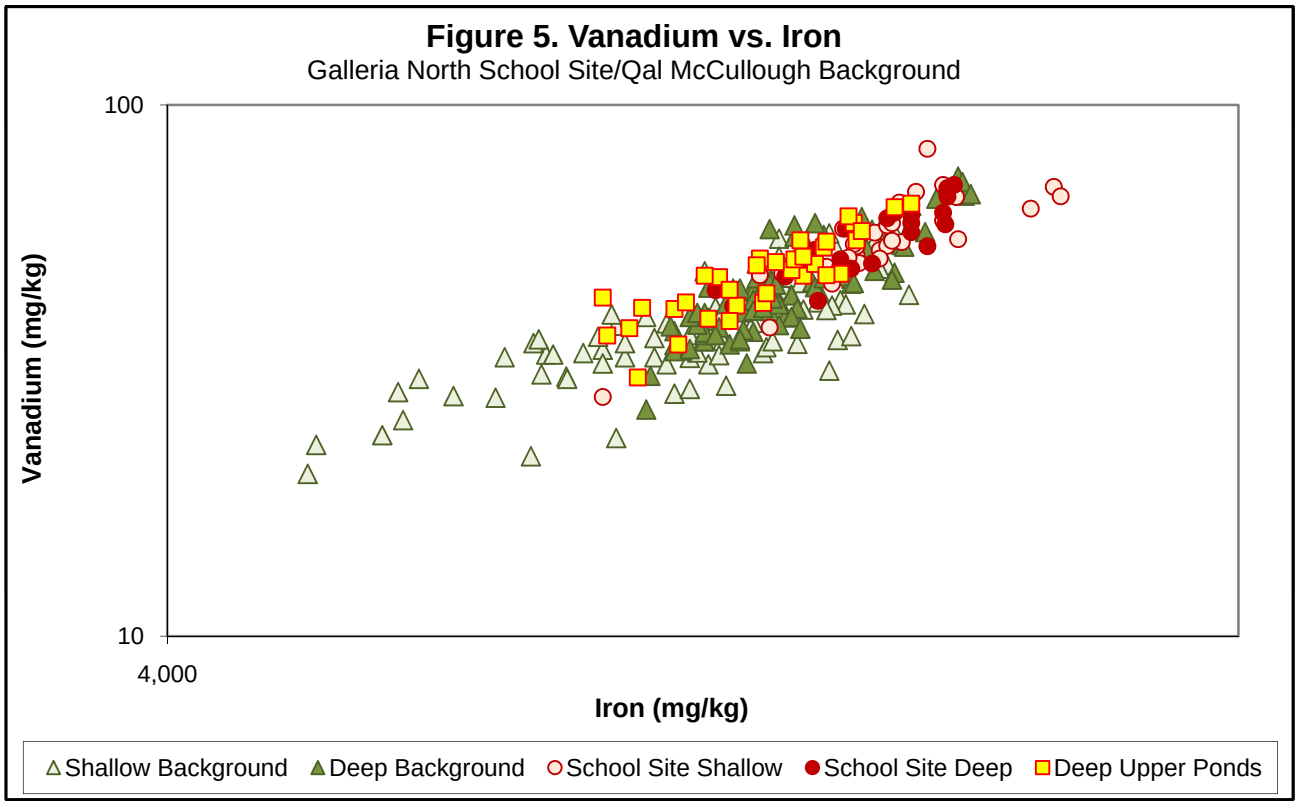
Figure 5. Vanadium vs. Iron
Galleria North School Site/Qal McCullough Background
100
10
4,000
Vanadium (mg/kg)
Iron (mg/kg)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

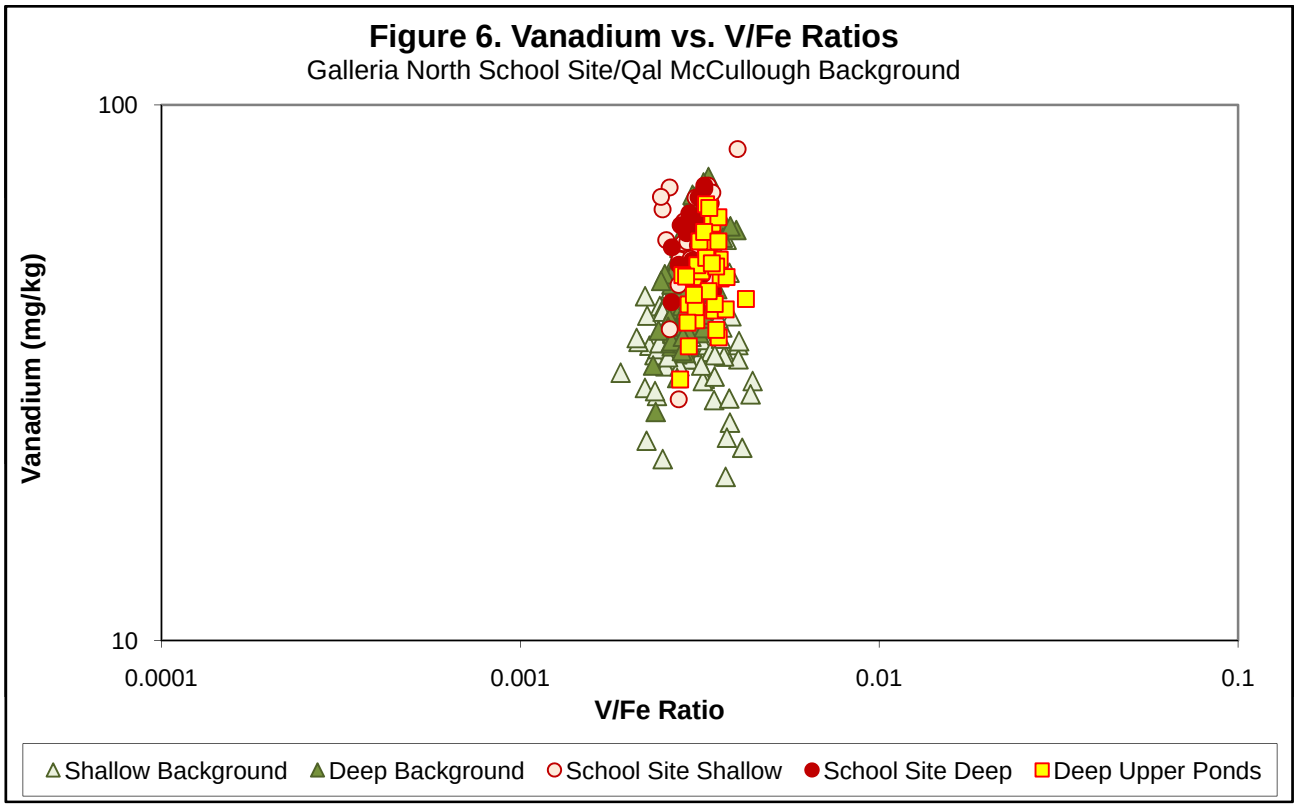
Figure 6. Vanadium vs. V/Fe Ratios
Galleria North School Site/Qal McCullough Background
100
10
0.0001
0.001
0.01
0.1
Vanadium (mg/kg)
V/Fe Ratio
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

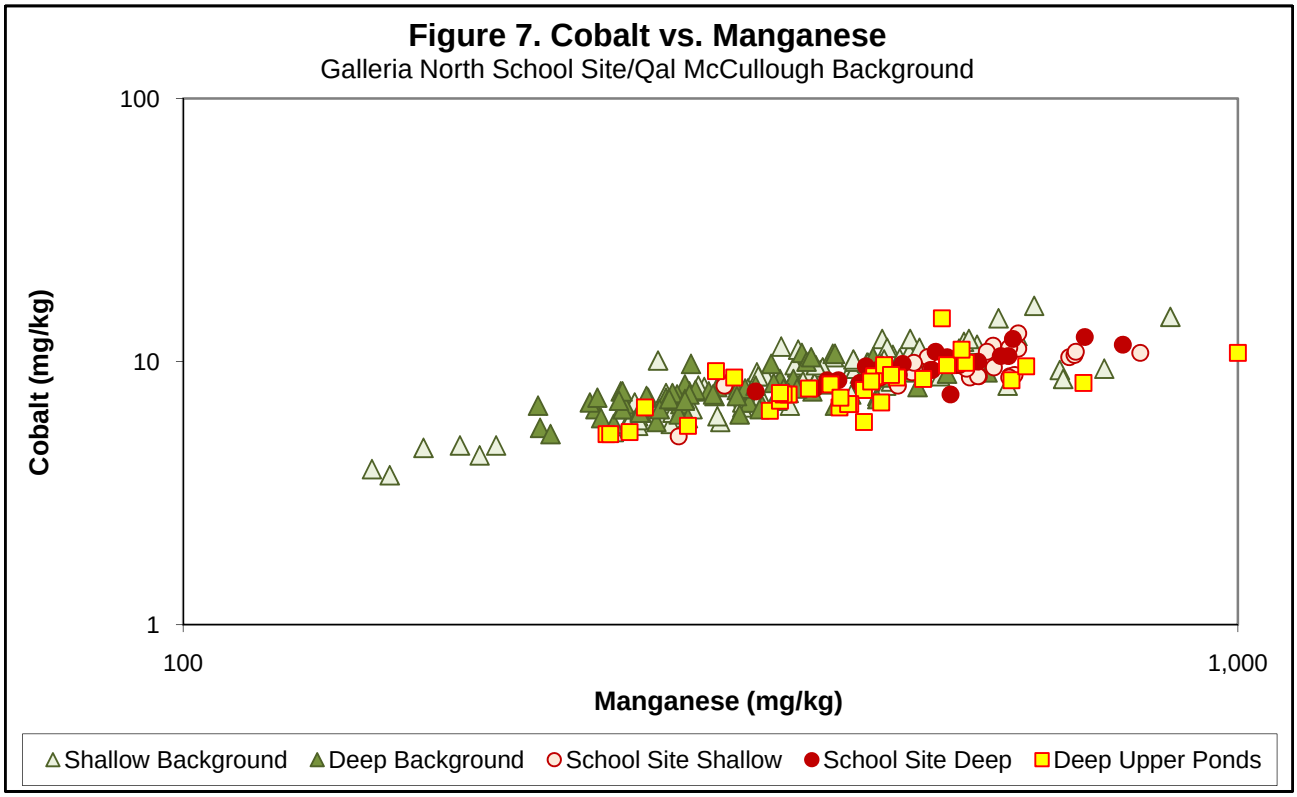
Figure 7. Cobalt vs. Manganese
Galleria North School Site/Qal McCullough Background
100
10
1
Cobalt (mg/kg)
100
1,000
Manganese (mg/kg)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

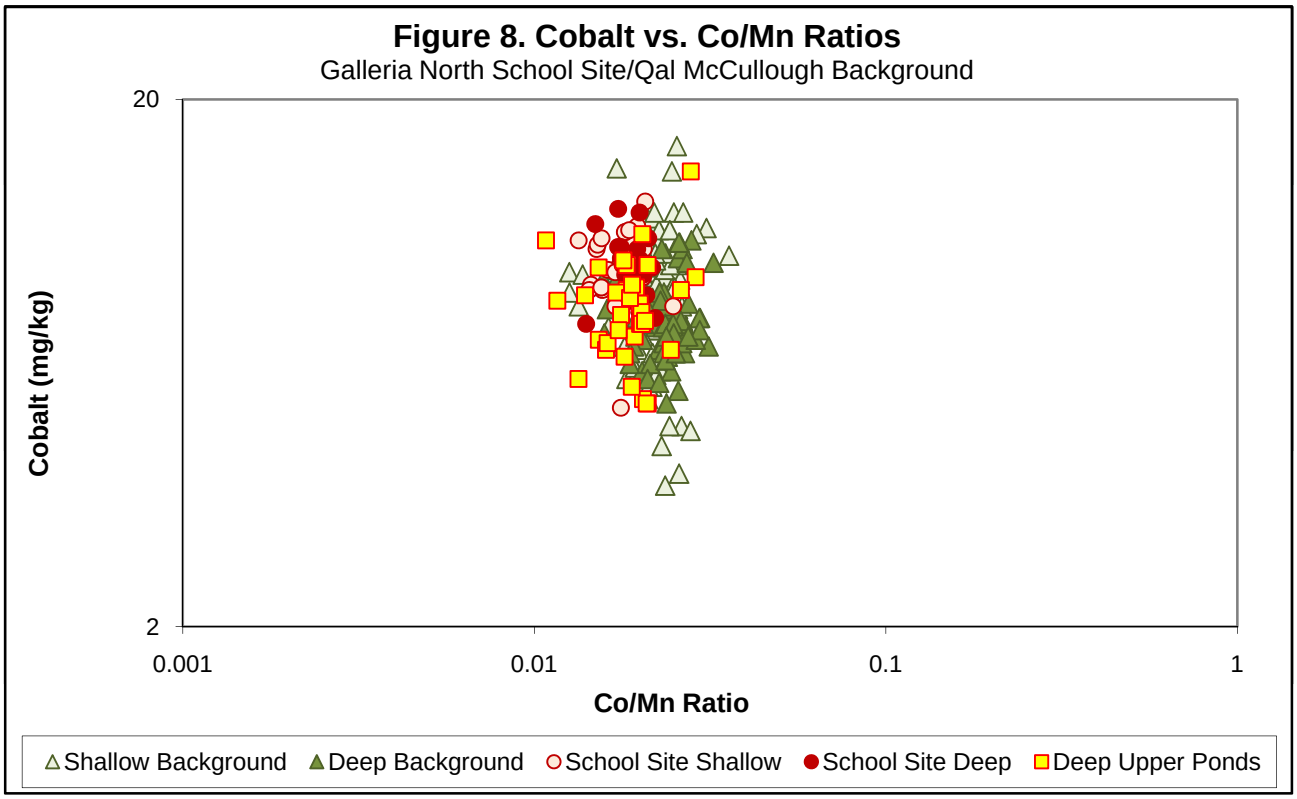
Figure 8. Cobalt vs. Co/Mn Ratios
Galleria North School Site/Qal McCullough Background
20
2
Cobalt (mg/kg)
0.001
0.01
0.1
1
Co/Mn Ratio
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

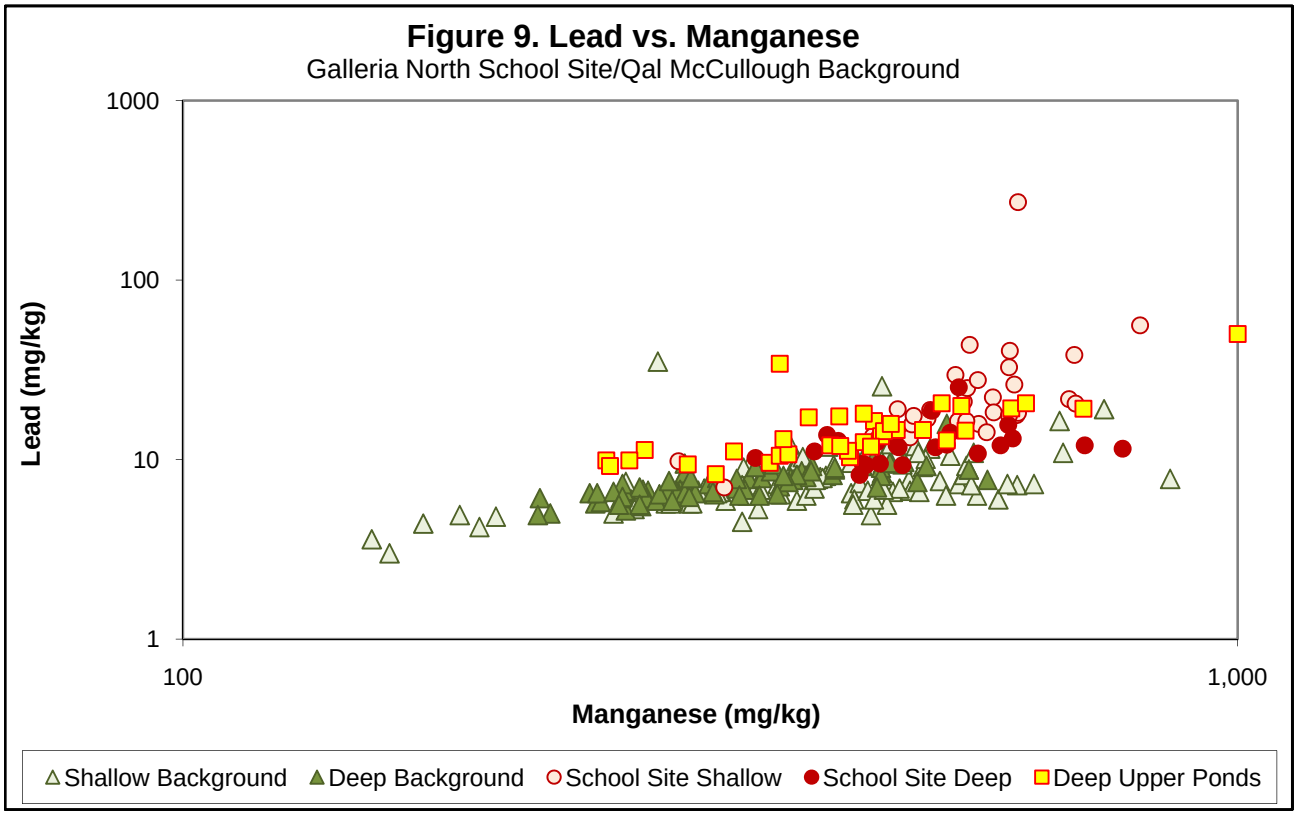
Figure 9. Lead vs. Manganese
Galleria North School Site/Qal McCullough Background
1000
100
10
1
Lead (mg/kg)
100
1,000
Manganese (mg/kg)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

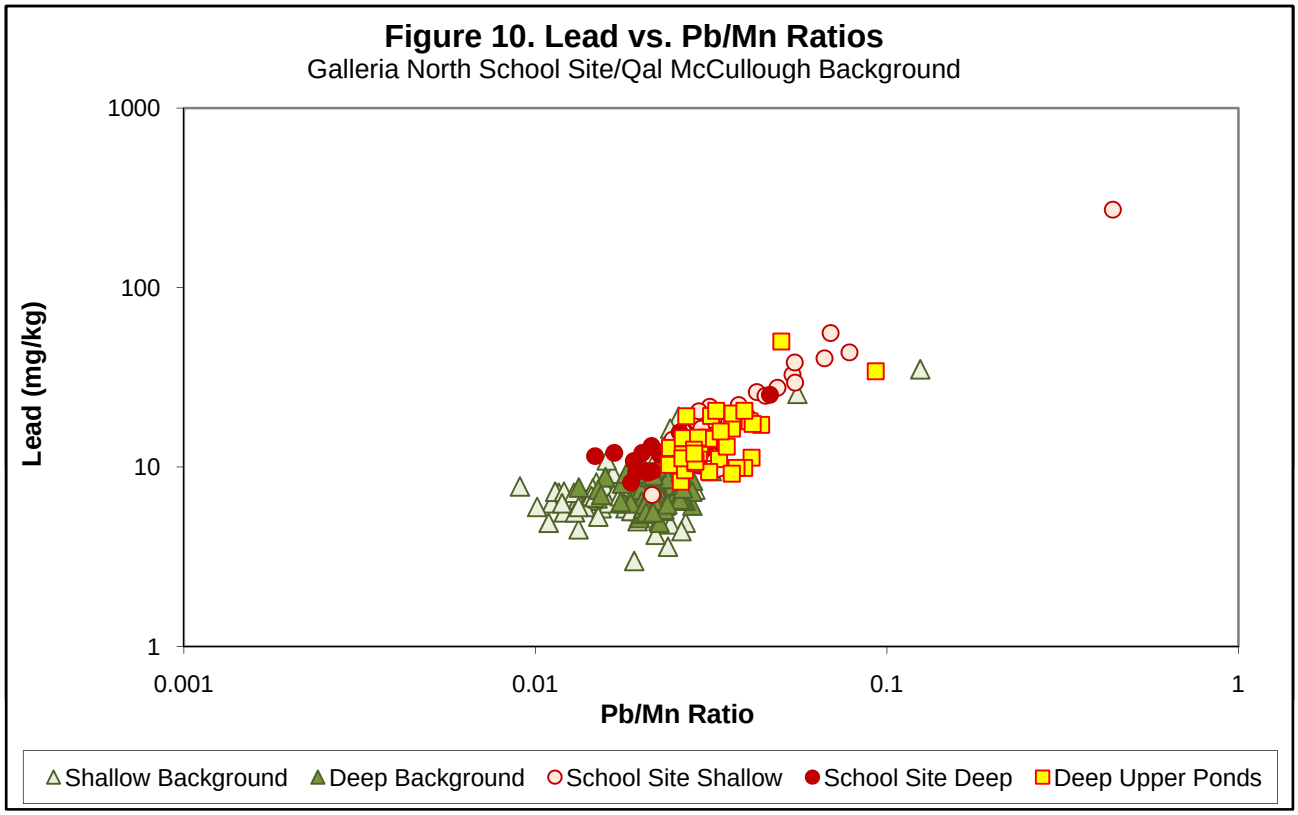
Figure 10. Lead vs. Pb/Mn Ratios
Galleria North School Site/Qal McCullough Background
1000
100
10
1
Lead (mg/kg)
0.001
0.01
0.1
1
Pb/Mn Ratio
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

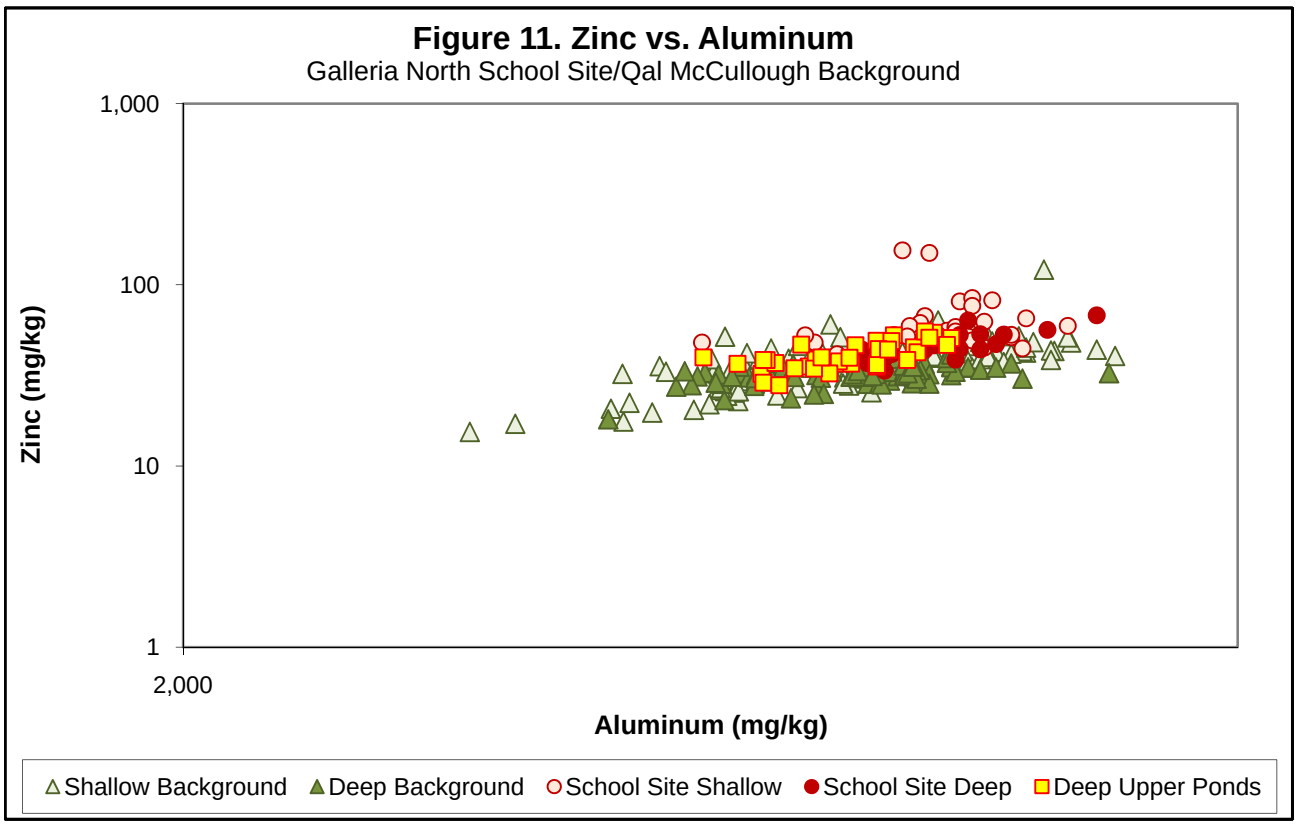
Figure 11. Zinc vs. Aluminum
Galleria North School Site/Qal McCullough Background
1,000
100
10
1
Zinc (mg/kg)
2,000
Aluminum (mg/kg)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

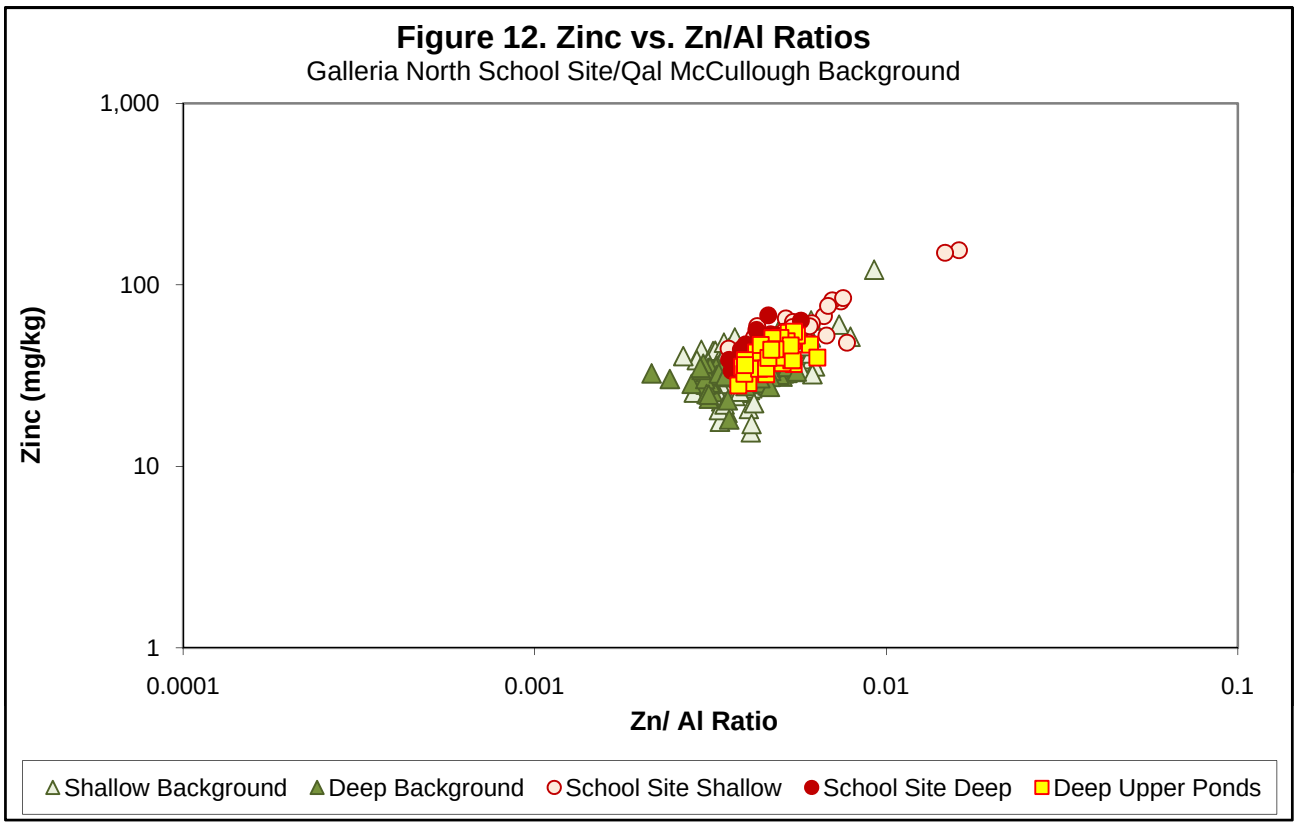
Figure 12. Zinc vs. Zn/Al Ratios
Galleria North School Site/Qal McCullough Background
1,000
100
10
1
Zinc (mg/kg)
0.0001
0.001
0.01
0.1
Zn/ Al Ratio
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

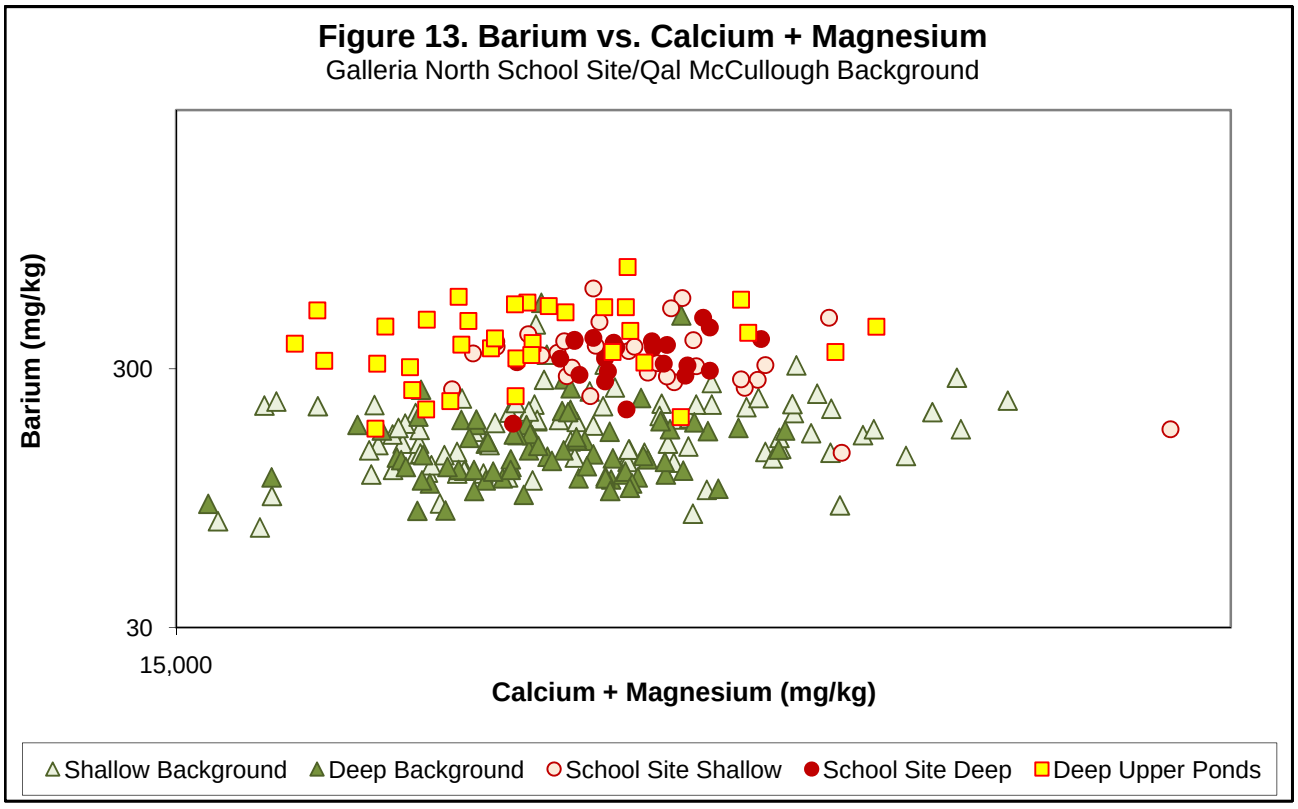
Figure 13. Barium vs. Calcium + Magnesium
Galleria North School Site/Qal McCullough Background
Barium (mg/kg)
300
30
15,000
Calcium + Magnesium (mg/kg)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

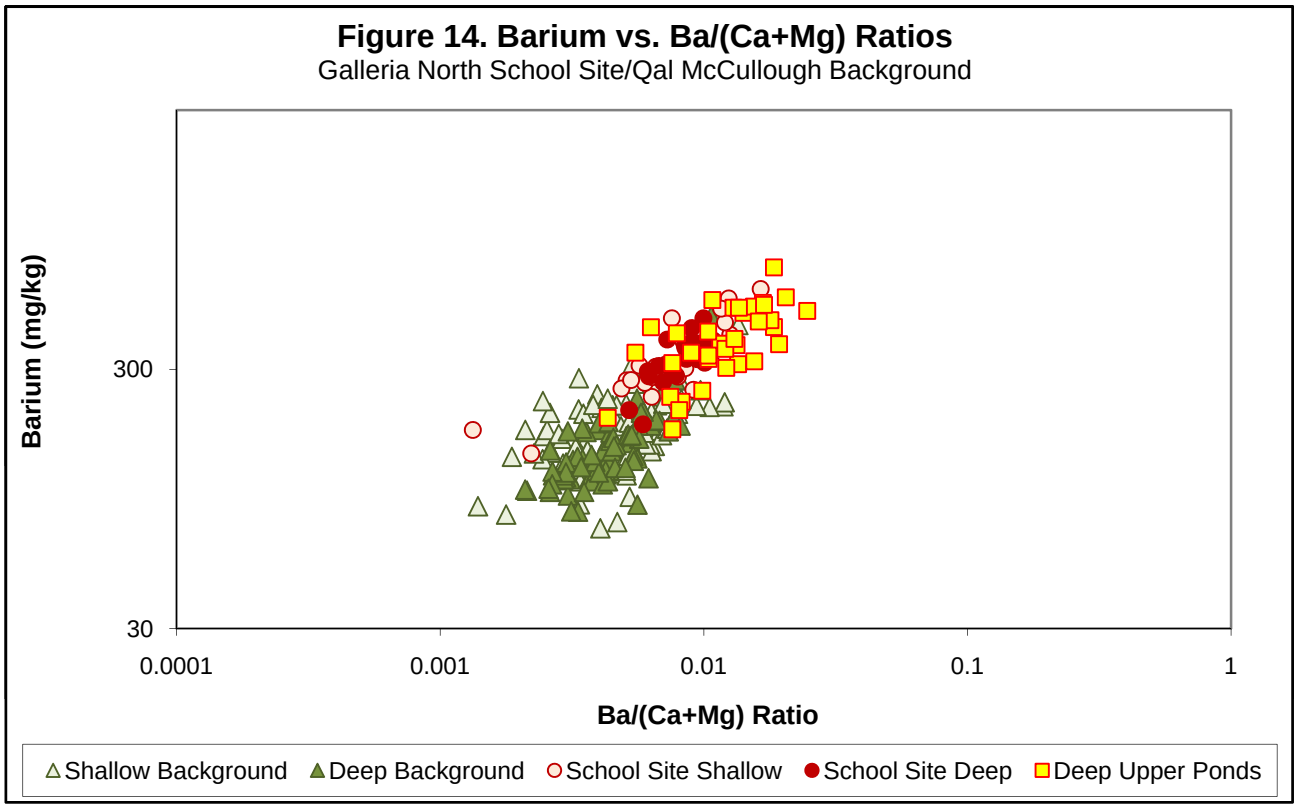
Figure 14. Barium vs. Ba/(Ca+Mg) Ratios
Galleria North School Site/Qal McCullough Background
Barium (mg/kg)
300
30
0.0001
0.001
0.01
0.1
1
Ba/(Ca+Mg) Ratio
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

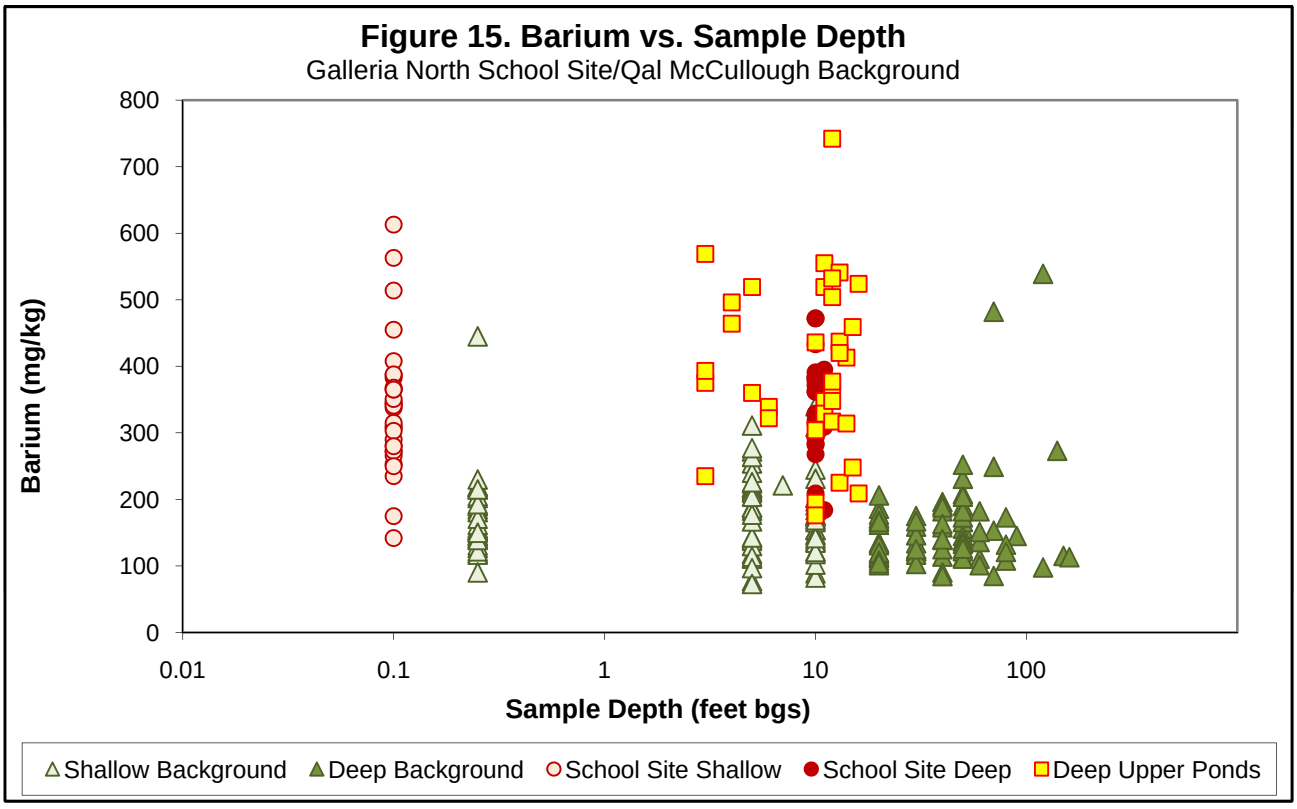
Figure 15. Barium vs. Sample Depth
Galleria North School Site/Qal McCullough Background
Barium (mg/kg)
800
700
600
500
400
300
200
100
0
0.01
0.1
1
10
100
Sample Depth (feet bgs)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

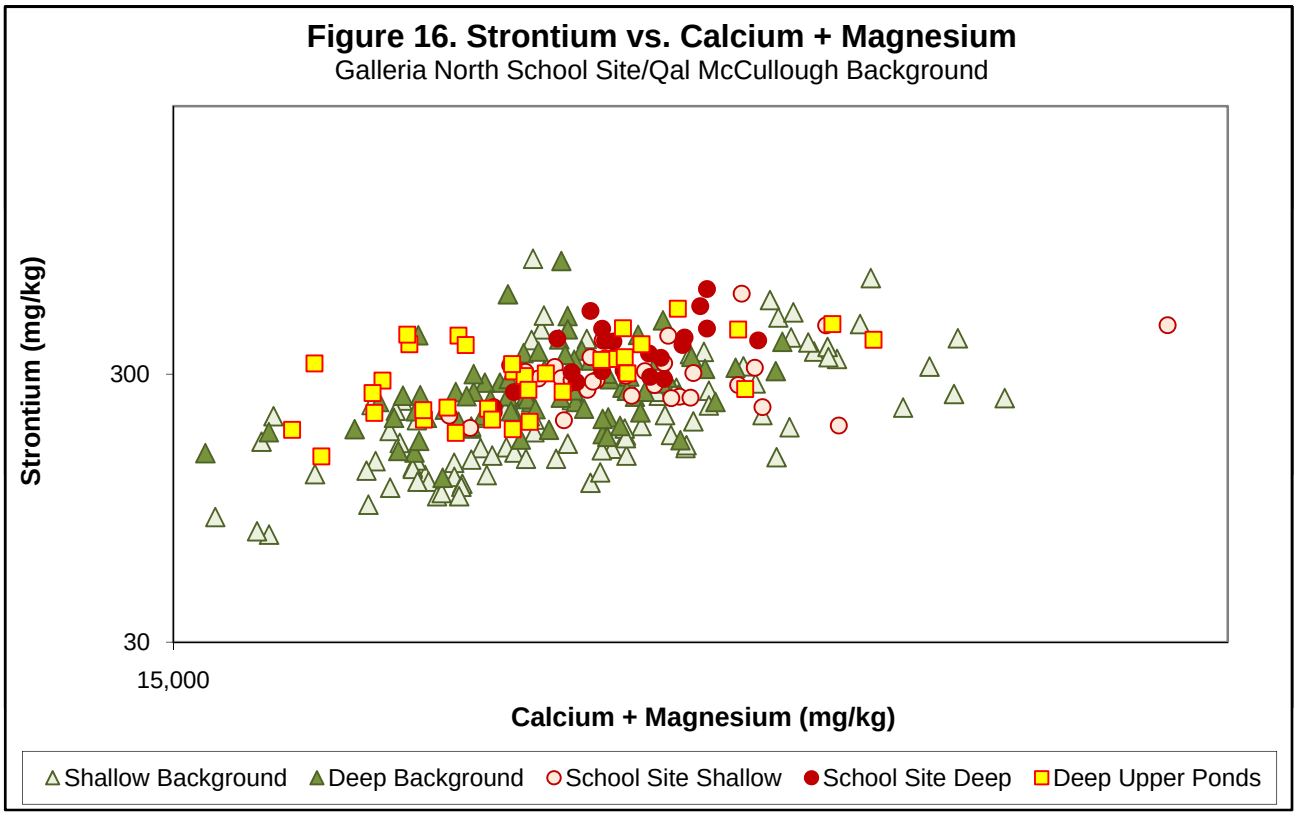
Figure 16. Strontium vs. Calcium + Magnesium
Galleria North School Site/Qal McCullough Background
Strontium (mg/kg)
300
30
15,000
Calcium + Magnesium (mg/kg)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

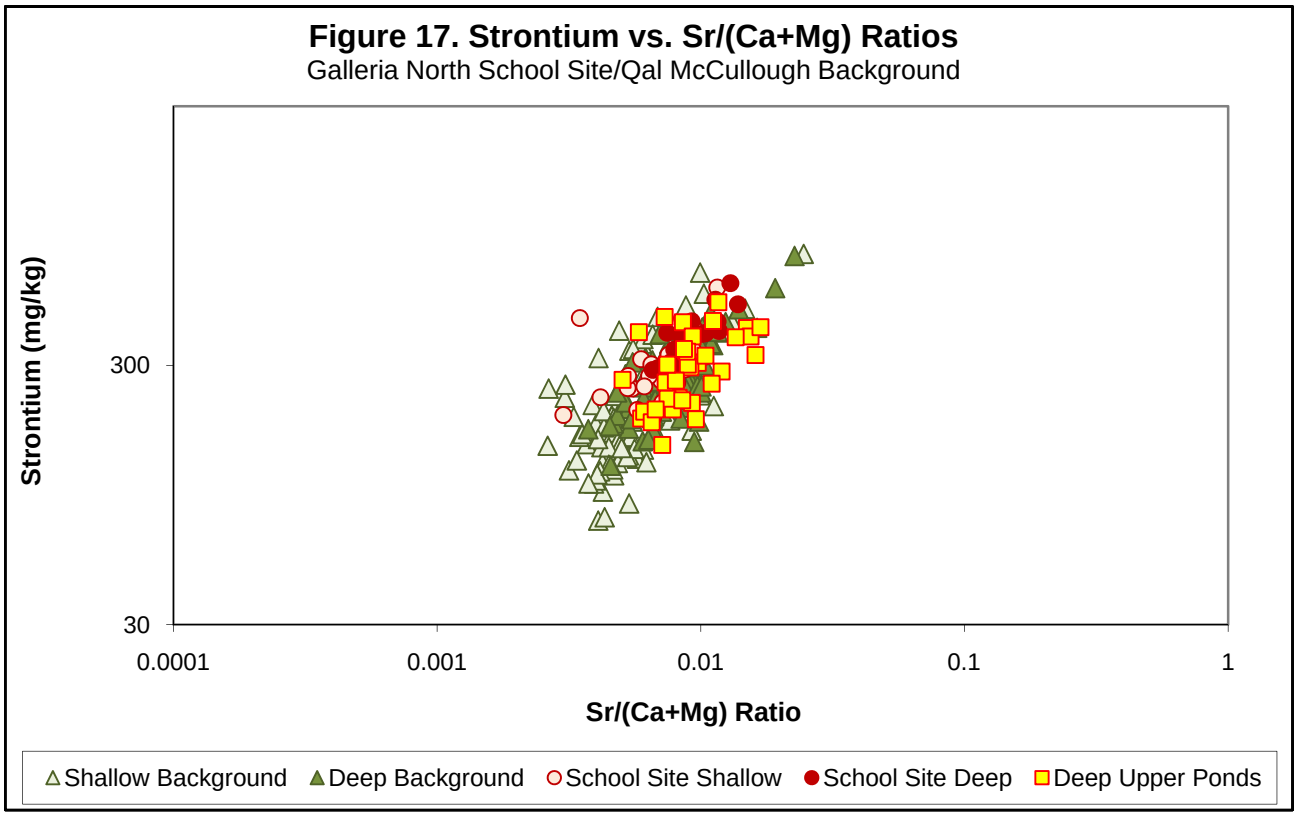
Figure 17. Strontium vs. Sr/(Ca+Mg) Ratios
Galleria North School Site/Qal McCullough Background
Strontium (mg/kg)
300
30
0.0001
0.001
0.01
0.1
1
Sr/(Ca+Mg) Ratio
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

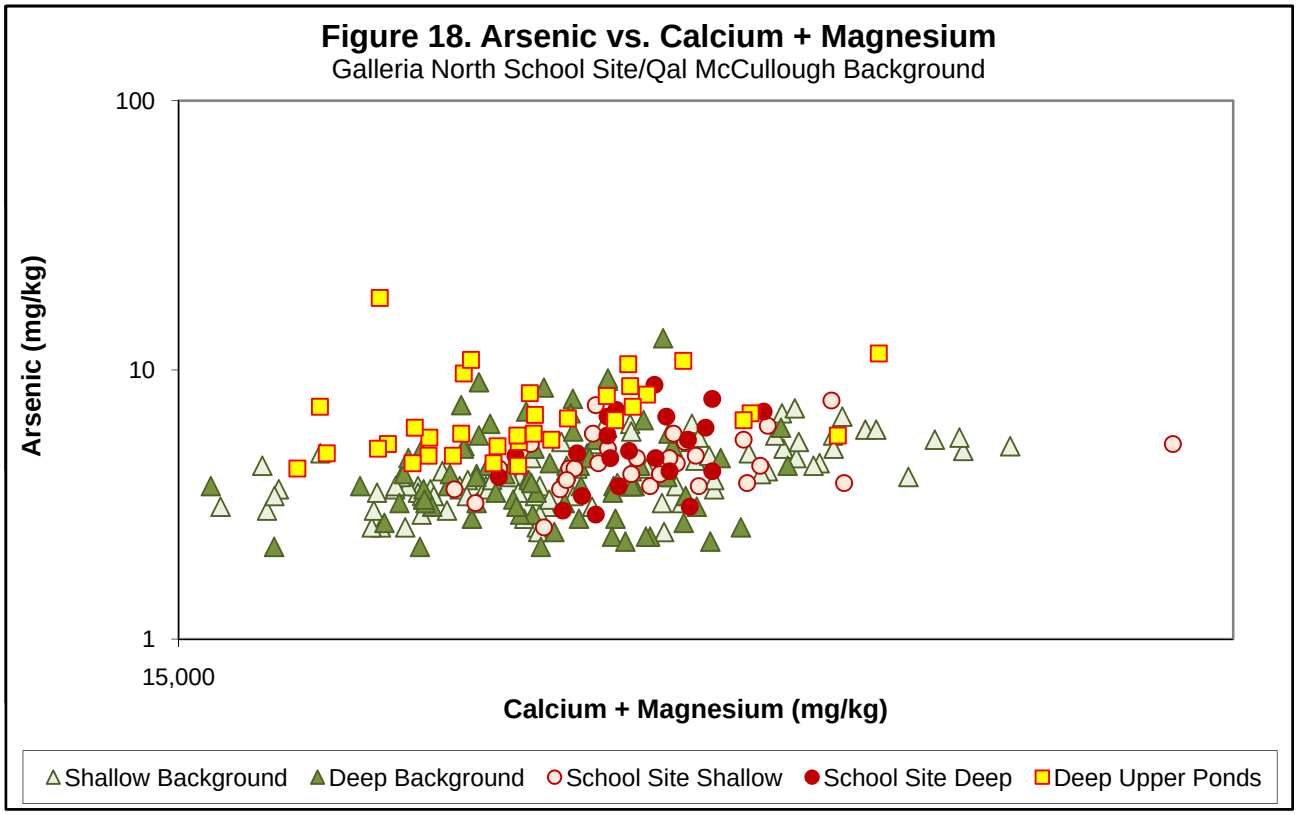
Figure 18. Arsenic vs. Calcium + Magnesium
Galleria North School Site/Qal McCullough Background
Arsenic (mg/kg)
100
10
1
15,000
Calcium + Magnesium (mg/kg)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

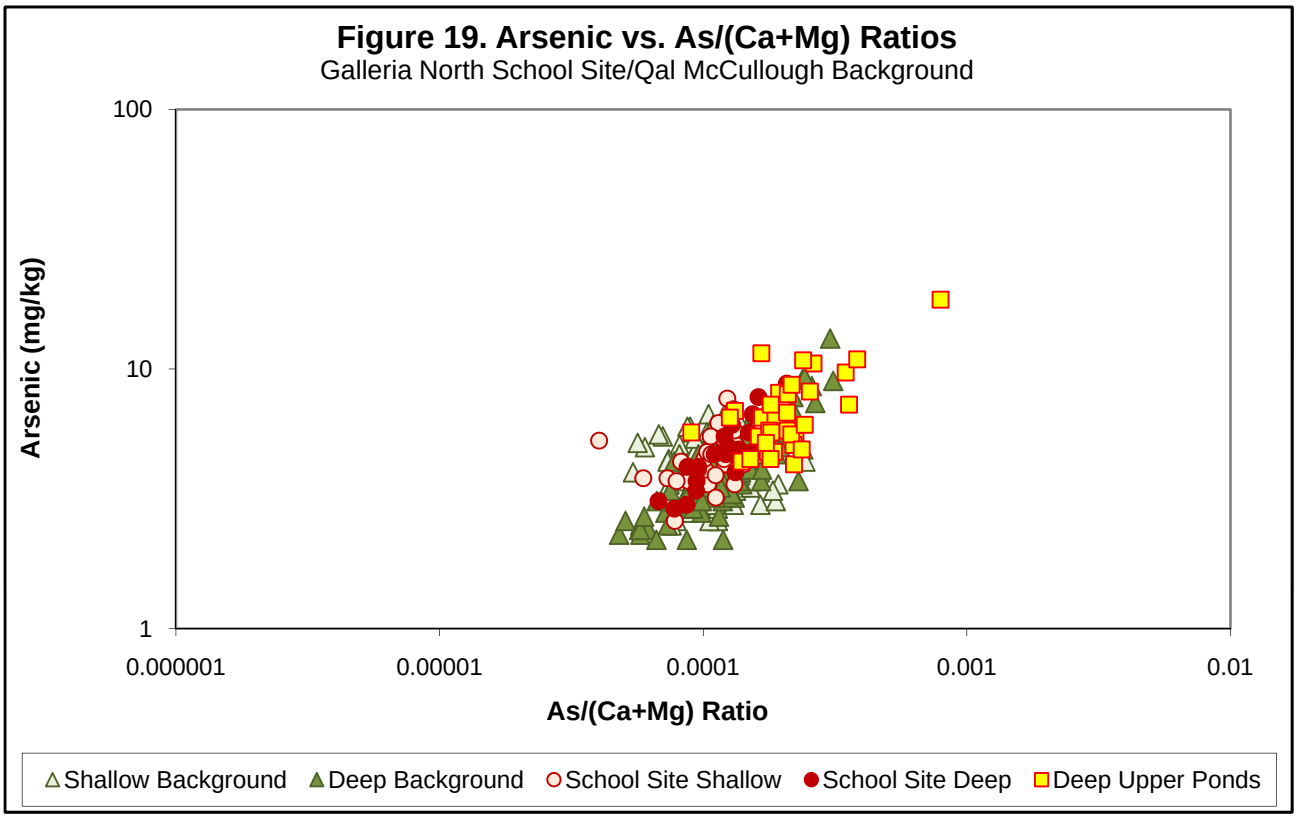
Figure 19. Arsenic vs. As/(Ca+Mg) Ratios
Galleria North School Site/Qal McCullough Background
100
10
1
Arsenic (mg/kg)
0.000001
0.00001
0.0001
0.001
0.01
As/(Ca+Mg) Ratio
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

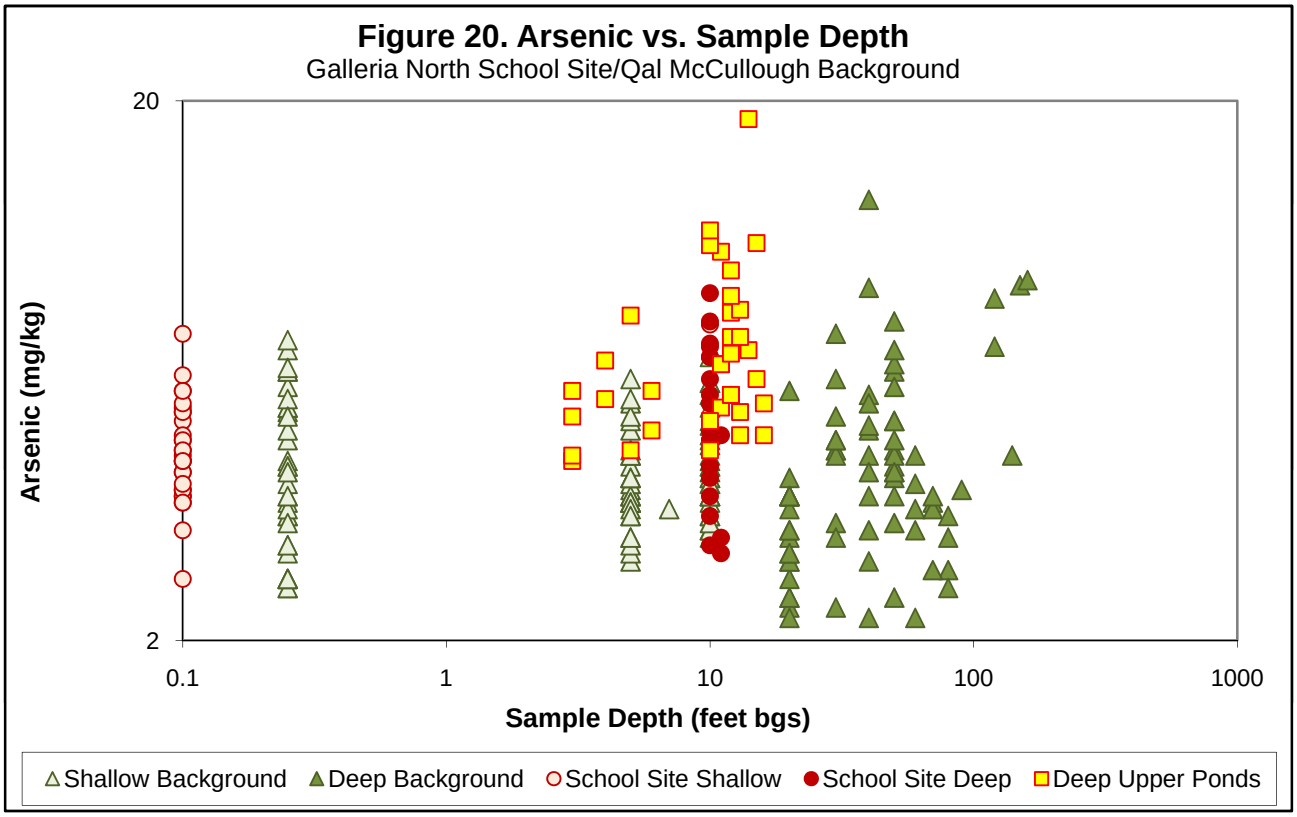
Figure 20. Arsenic vs. Sample Depth
Galleria North School Site/Qal McCullough Background
20
2
Arsenic (mg/kg)
0.1
1
10
100
1000
Sample Depth (feet bgs)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

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# Memorandum

**Date:** **September 20, 2011**

**To:** **Ron Sahu**

**From:** **Jonathan Myers**

**RE:** **The use of Magnesium as a Reference Element for the Geochemical Evaluation of Trace Elements in Soil at the BMI Site, Clark County, Nevada**

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This memo discusses the validity of using magnesium (Mg) as a reference element for the geochemical evaluation of selected trace elements at the BMI Site, Clark County, Nevada. The geochemical evaluation methodology is based on an assumption that the reference element concentrations in the samples are naturally occurring and are not affected by Site activities. Historical activities at the Site involved extensive processing of magnesium ore, so the use of Mg as a reference element should be carefully considered.

Determining the validity of using Mg as a reference element was performed as the first step in the *Geochemical Evaluation of Soil Samples* report that was provided to NDEP. Figure 1 of the Report (reproduced below) shows the correlations between Mg and calcium (Ca) concentrations in the five groups of samples. This figure shows that all of the samples fall on a consistent trend with a positive slope, indicating fairly constant Ca/Mg ratios. Another perspective on the same data is show in Figure 2 of the report (also reproduced below) which provides the calcium concentrations versus Ca/Mg ratios. This perspective shows that the Ca/Mg ratios fall within a narrow range from 0.11 to 0.83, and there does not appear to be any differences in ratios between the five subgroups of samples.

Samples containing excess Mg from site operations would be apparent on these figures by plotting above the positive Mg vs. Ca trend on Figure 1, and plotting to the right of the vertical Mg vs. Mg/Ca trend on Figure 2, however, no such anomalous samples appear on either figure. Even the shallow School Site sample with the highest Mg concentration of 28,500 mg/kg also has the highest Ca concentration (103,000 mg/kg), and has a Mg/Ca ratio that is well within the range of the other samples. In fact, the Mg/Ca ratio of 0.227 in this sample is below the median ratio of 0.39.

As explained in the Section 3.1.1 of the Report, some of the magnesium may be associated with clay minerals, but this is a minor association because the mean

magnesium concentrations are higher than the mean aluminum (Al) concentrations in the five sample groups. All clay minerals contain aluminum as a major component. Some clay minerals also contain calcium and/or magnesium, but at lower concentrations than aluminum. The correlation between Mg versus Al concentrations provides an independent line of evidence for identifying any Mg contamination that may be present. Figure 3 below (not provided in the Report) shows the correlation between Mg versus Al in the five groups of samples. The strong correlation argues against any Mg contamination. The only notable exception to the trend is the shallow School Site sample with the maximum Mg concentration of 28,500 mg/L which plots above the trend established by the other samples. This sample however, is also clearly visible on Figure 1 because it also has the maximum Ca concentration of 103,000 mg/kg (10.3 wt. percent) so it obviously contains non-Al-bearing evaporite minerals. The only other samples that fall slightly above the positive trend on Figure 3 are shallow background samples which are most likely not contaminated.

A plot of Mg concentrations versus Mg/Al ratios, shown as Figure 4 below (not provided in the Report), provides a different perspective on the same data. The Mg/Al ratios are quite constant in all of the samples except the School Site sample with the maximum Ca concentration and a few of the background samples.

In summary, the observed correlations between Mg versus Ca and Mg versus Al concentrations argue against the presence of any Mg contamination in the samples, indicating that Mg is a suitable reference element for use in the geochemical evaluation of trace elements in Site samples.

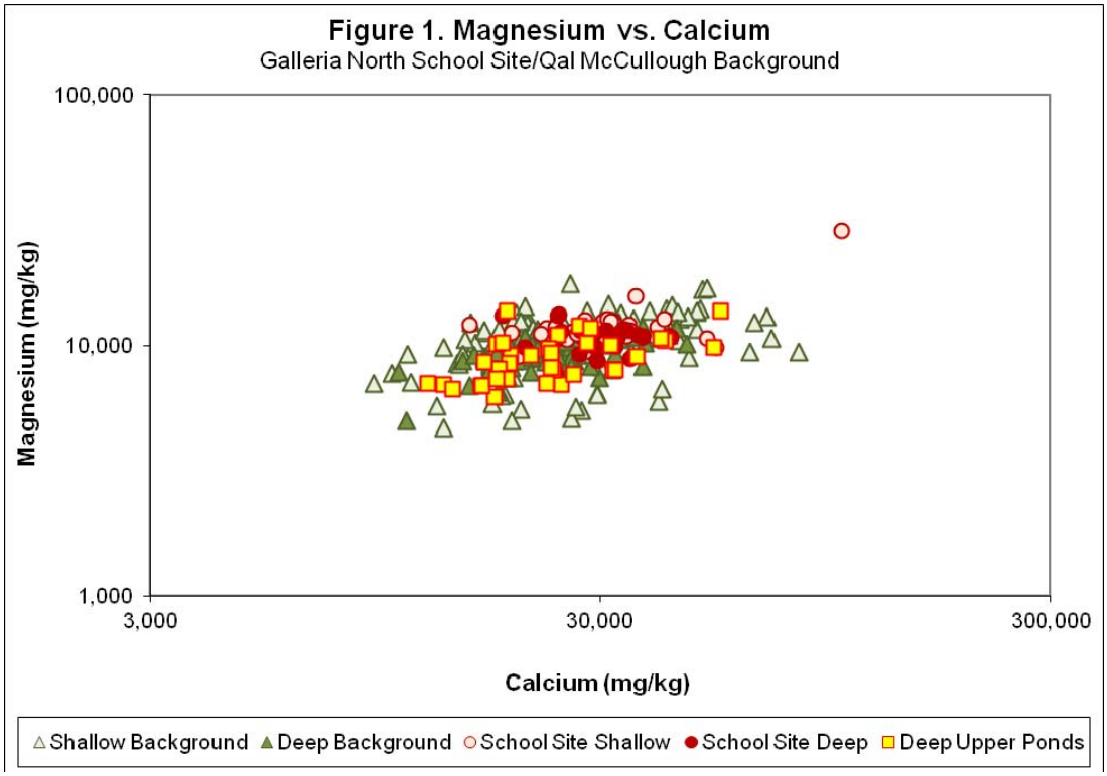
Figure 1. Magnesium vs. Calcium
Galleria North School Site/Qal McCullough Background
100,000
10,000
1,000
Magnesium (mg/kg)
3,000
30,000
300,000
Calcium (mg/kg)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

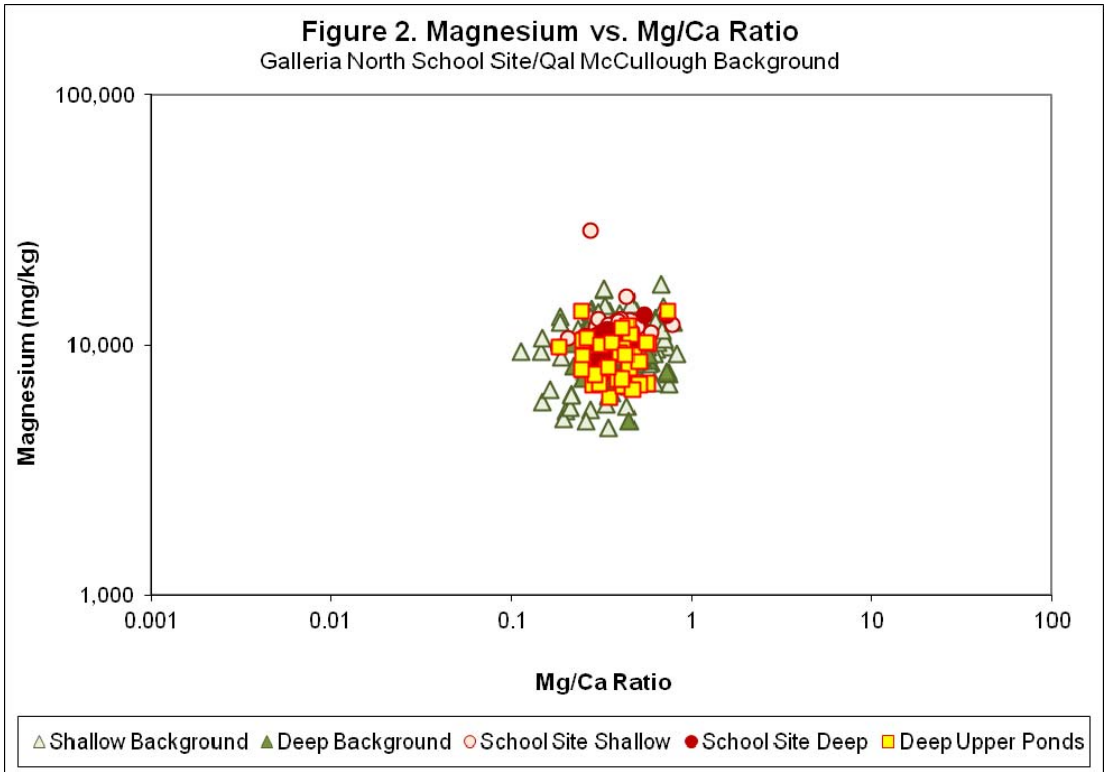
Figure 2. Magnesium vs. Mg/Ca Ratio
Galleria North School Site/Qal McCullough Background
100,000
10,000
1,000
Magnesium (mg/kg)
0.001
0.01
0.1
1
10
100
Mg/Ca Ratio
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

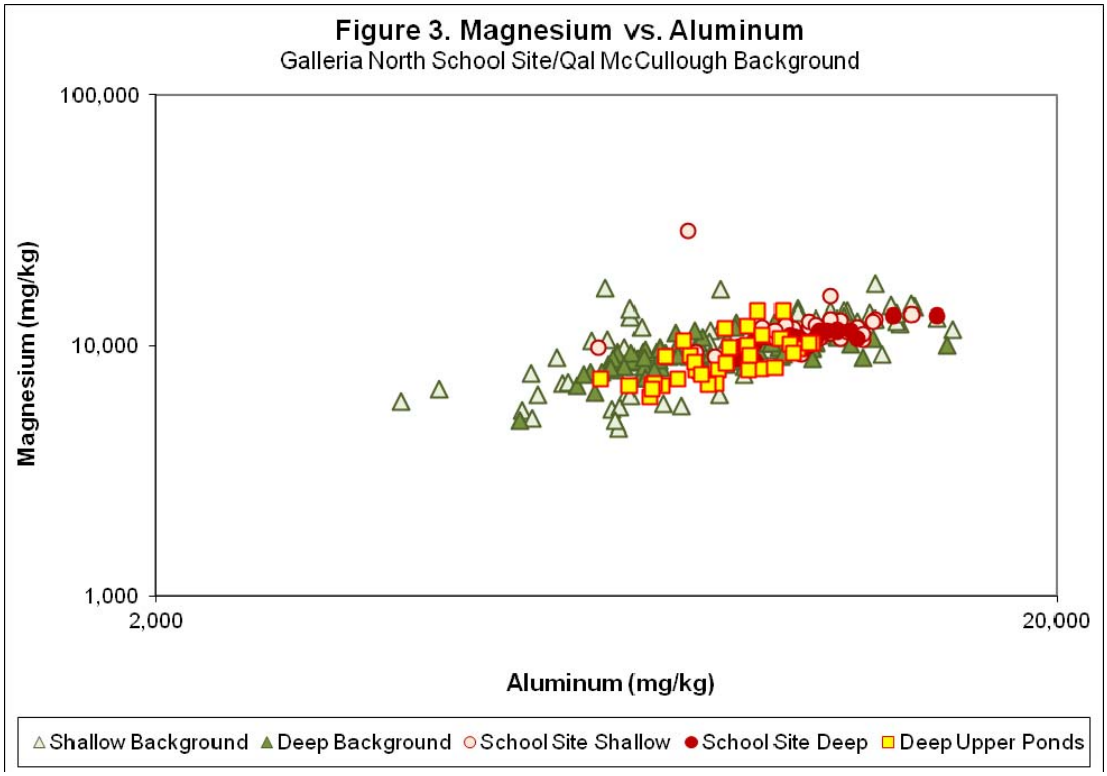
Figure 3. Magnesium vs. Aluminum
Galleria North School Site/Qal McCullough Background
100,000
10,000
1,000
Magnesium (mg/kg)
2,000
20,000
Aluminum (mg/kg)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

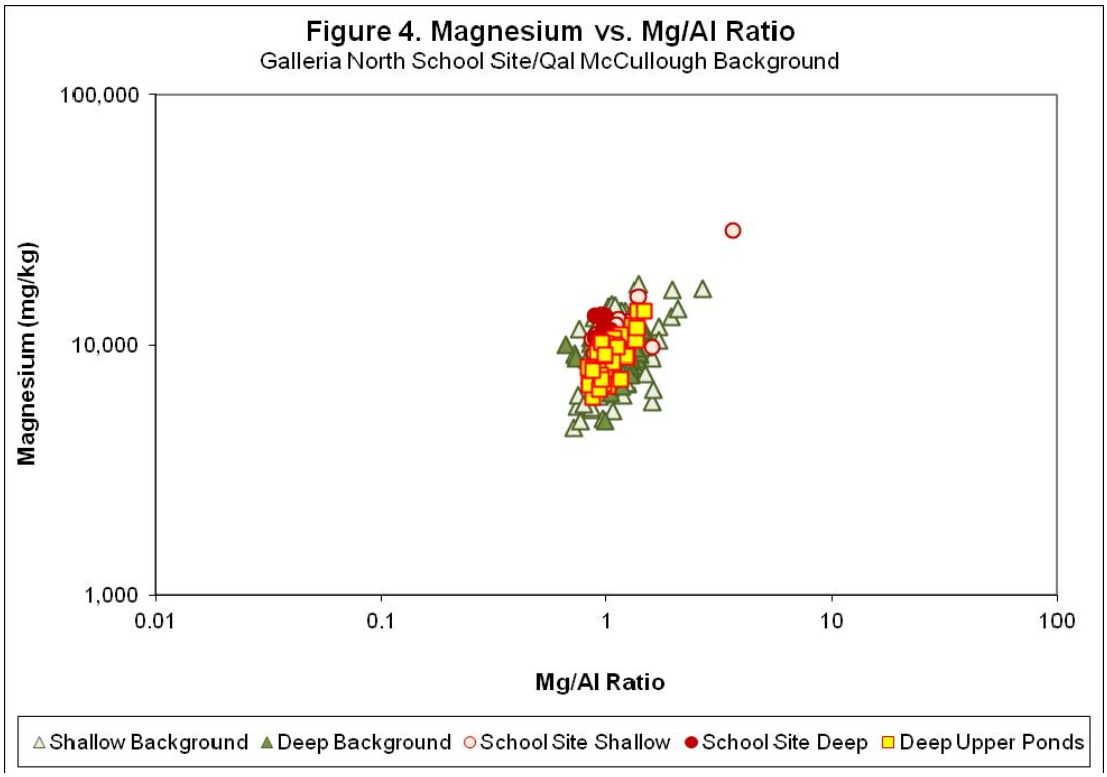
Figure 4. Magnesium vs. Mg/Al Ratio
Galleria North School Site/Qal McCullough Background
100,000
10,000
1,000
Magnesium (mg/kg)
0.01
0.1
1
10
100
Mg/Al Ratio
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

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# Memorandum

**Date:** **October 13, 2011**

**To:** **Lee Farris and Ron Sahu**

**From:** **Jonathan Myers**

**RE:** **Technical Note on the Use of Elemental Ratios for Identifying Soil Contamination at the BMI Site, Clark County, Nevada**

---

This memo addresses some issues that were raised on the conference call and subsequent e-mails with representatives of BRC and NDEP that was held on October 3rd, 2011.

***Constancy of Elemental Ratios***

The vast majority of environmental (as well as criminal) forensic methods are based on evaluation of the ratios of elements, compounds, or isotopes. If one or more potential sources of contamination have distinct ratios which differ from the background ratios, and those ratios do not change over time as a result of chemical or biological processes, then those ratios can be used to identify the presence of contamination in samples, and can trace the migration of the contamination along environmental flow paths.

In the case of major elements in soil at the BMI site, natural geochemical processes that occur in weathered soil result in fairly consistent aluminum/iron (Al/Fe) and magnesium/calcium (Mg/Ca) ratios in samples. If a sample is contaminated with aluminum or magnesium, then those impacted samples can be identified by their anomalously high Al/Fe or Mg/Ca ratios.

The specific issue of concern on the conference call was the Mg/Ca ratio. The magnesium versus calcium plot and the magnesium versus Mg/Ca ratio plot are reproduced at the end of this memo as Figures 1 and 2. The interpretation that I provided on the call was that the shallow and deep School Site samples (red circles) fall on the trend established by the shallow and deep background samples (green triangles) on Figure 1. In addition, the Mg/Ca ratios of the School Site and background samples are coincident and fall within a range of “one order of magnitude” on Figure 2 (the ratios of the 264 samples actually have a narrower range of 0.11 to 0.83).

The qualitative interpretation of these figures is that the School Site samples have the same ratios as the background samples; therefore it is doubtful that any of the samples had additional Mg added as a contaminant. Samples containing additional Mg from site activities should plot above the trend on Figure 1, and to the right of the cluster on Figure 2, but no such samples exist.

Since there is analytical uncertainty as well as natural variability in the elemental concentration data, a reasonable question is how high or low does a ratio need to be before it is classified as anomalous. A ratio of two uncertain numbers will have its own uncertainty which is a function of the uncertainties of the values in the numerator and denominator.

The component of variability in Mg/Ca ratios that is due to analytical uncertainty in the reported Mg and Ca concentrations was estimated by simulation using a Monte Carlo approach. With this method, uncertain input parameters (Mg and Ca concentrations) are randomly and independently varied over their expected range of values. Calculations are performed multiple times (2,000 simulations were used here). Each time, a Mg/Ca ratio is calculated based on Mg and Ca values that are independently varied about their means. The range of resulting ratios reflects the variability in the ratios that is due to the uncertainties of the input parameters.

The mean Mg and Ca concentrations in the 264 soil samples are equal to 10,129 and 27,766 mg/kg, respectively. These two mean values were randomly and independently sampled multiple times assuming a normal distribution with a standard deviation of 15 percent of the mean. This approach was selected because analytical errors are known to be normally distributed, and the accuracy of metals analyses are commonly in the range of ± 15 percent or more. Note that on most projects, recoveries on laboratory control standards, matrix spikes, and matrix spike duplicates of 80 to 120 percent (± 20 percent), or even 75 to 125 percent (± 25 percent) is considered acceptable. Likewise, relative percent differences in this range for analyses of laboratory duplicates are acceptable and expected.

A histogram of the 2,000 simulated Mg/Ca ratios are provided in Figure 3. These ratios range from 0.18 to 0.78 which is quite similar to the actual ratio range of 0.11 to 0.83 exhibited by the 264 soil samples from the Site. These results suggest that if a well-mixed pile of soil from the Site was repeatedly sampled and analyzed, then the analytical uncertainty alone (assumed to be ± 15 percent) would yield a similar range of ratios as observed in the Site samples. This is why ratios that span a range of up to an order of magnitude in a set of samples are considered to be fairly consistent.

***Shapes of Trace-to-Major Element Trends***

An additional issue was raised on the call regarding the shapes of the trends shown in the report figures. Trace element concentrations in soil are dominantly controlled by adsorption-desorption ("sorption") reactions on the surfaces of reactive minerals such as iron oxides, manganese oxides and clays. At equilibrium, the fraction of the total mass of a trace element that is in an adsorbed state divided by the fraction of that trace element dissolved in soil pore fluid is a constant, which is referred to as a *sorption coefficient* or $K_d$. Trace-to-major element plots provided in the report such as vanadium vs. iron (Report Figure 5) and cobalt vs. manganese (Report Figure 7) show fairly strong correlations over the full range of concentrations due to this sorption process. In the case of cobalt, the majority of cobalt is preferentially adsorbed on the surfaces of manganese oxide minerals. Natural sample-to-sample variations in the manganese oxide content drive the variations in the cobalt content, yielding a correlation between the two elements.

Due to the nature of sorption processes, these correlations are usually not linear. Nonlinear sorption occurs for a few reasons:

1. There are a finite number of sorption sites on the reactive mineral surfaces. Once most of these sorption sites become occupied, then the effective $K_d$ decreases.

2. Minerals with reactive surfaces have more than one type of sorption site, and these different types of sites have different binding energies. Sites with the highest binding energies will preferentially fill with selected trace elements first, and the sites with lower binding energies will fill later. The presence of different types of sites with different binding energies results in effective $K_d$s that vary as the sites are filled.

3. Several different trace elements with similar properties (charge and ionic radii) can compete with specific sorption sites on mineral surfaces. The effective $K_d$ for one trace element is thus affected by the concentrations of other trace elements that compete for the same site. A multi-dimensional system such as this is not expected to yield linear correlations on a simple x-y plot.

4. Adjacency effects also contribute to nonlinear sorption. The binding energy for a vacant sorption site on a mineral surface is highest if adjacent sites are vacant, and are lower if adjacent sites are filled. This effect acts to lower the effective $K_d$ as the fraction of occupied sites increases.

These four processes act in concert to lower the effective $K_d$ as the total concentration of the sorbing element increases. These effects cause a curvature of the trend on a trace-to-major element concentration plot, as well as a deviation to the vertical trend on a ratio plot. The degree of linearity of the trace-to-major element trends differ by element. For instance,

the relationship between vanadium and iron is usually quite linear, whereas the relationship between cobalt versus manganese usually has some curvature. In addition, nonlinear trends are more noticeable on the figures if the range of concentrations in the samples is large so that the curvature can be seen.

Associations between major elements such as aluminum versus iron and magnesium versus calcium occur as a result of different processes. The association between aluminum versus iron occurs due to physical grain size effects. Aluminum in weathered alluvial soil is mostly present as clay minerals, and the iron is mostly present as oxide minerals. Clays and oxides tend to be finer grained than other minerals such as quartz and unweathered pieces of feldspar and pyroxene. Samples composed of finer grained material will have higher Al and Fe concentrations, and samples with coarser grained material will have lower Al and Fe concentrations. The Al/Fe ratios of all of the samples tend to be fairly consistent, but not necessarily linear over a wide range of Al and Fe concentrations.

Associations between magnesium versus calcium and barium versus calcium in arid regions occur due to coprecipitation processes, as explained in the report. These processes yield strong associations between certain element pairs, but those associations are not necessarily linear due to the complexities of element substitutions in minerals.

***Quantification of Correlations***

A key difference of opinion that I have with the Navy and Army guidance documents cited in the comments is that they are focused on methods to quantify correlations between elements, thus turning a chemical method into a purely statistical method. The Navy document has a chapter entitled “Geochemical Method” and the Army document has an appendix entitled “Geochemical Trend Analysis”, but neither document contains even one sentence that actually discusses anything related to chemistry.

The geochemical evaluations presented in the Report were performed because previous purely statistical site-to-background comparison tests identified several elements in site samples that had elevated concentrations relative to background. These statistical tests are prone to high rates of false-positive errors (erroneously identifying contamination where none exists) for a number of reasons. The tests have definable false-positive and false-negative error rates when working with perfect data, but real environmental data are far from perfect. Common characteristics of real data include broad distributions (several orders of magnitude are not uncommon), skewed distributions (most trace element data are highly right-skewed), analytical uncertainty, estimated (J-qualified) results, nondetect results, variable detection limits, unequal sample sizes, differences in the variance of background data obtained over a broad area versus closely spaced site samples, insufficient numbers of background samples; and site and background samples obtained by different sampling techniques, and analyzed by different laboratories using different methods. All of these factors result in high error rates when statistical comparison tests are

applied to such data. Geochemical evaluations, which are based on elemental ratios rather than absolute concentrations, can in most cases distinguish between a naturally high background concentration versus contamination and are not prone to these problems that are inherent in purely statistical approaches.

Quantitative statistical techniques used to identify outliers or to develop pass-fail criteria for the presence of contamination are commonly applied in environmental investigations, but we do not recommend them for geochemical evaluations that employ correlation plots. The value of the geochemical evaluation technique lies in its examination of the interrelationships between the elements for the purpose of identifying the processes (both natural and anthropogenic) controlling the observed concentrations. Statistical tests, while useful as a screening tool, are inadequate for explaining high trace element concentrations. These tests can tell you that a concentration is high, but they cannot tell you why. For these reasons, after the initial outliers are identified and statistical comparisons to background are completed, investigators should depart from quantitative statistics and consider geochemistry.

There are a number of standard statistical parameters that are used to quantify the degree of correlation between two parameters, including the correlation coefficient ($R^2$), standard error of the slope, and significance of the slope. In addition, different types of error bands surrounding the fitted line can be constructed based on the uncertainties of the slope and intercept, such as confidence intervals and prediction intervals. Some of these techniques are recommended in the Navy and Army guidance that was cited in our discussions.

One could establish rules such as "pairs of elements with an $R^2$ below 0.78 are not correlated", or "samples that plot above a ± 2-sigma error band (or above a $95^{th}$ confidence or prediction interval) about the regressed line are considered contaminated," but such a rule is not justified for elements that exhibit natural differences in correlation, or data sets that contain nondetect or estimated results. A 1-sigma or 2.5-sigma rule would yield different results, and there is no technical basis for establishing such arbitrary pass-fail criteria. One could also perform many different kinds of regressions based on generalized linear models or nonparametric correlations, and each would most likely yield different results. There are several additional reasons why quantitative techniques should be avoided for outlier identification on correlation plots:

1 - Each element has varying degrees of correlation with the major element(s) with which it is associated. Some elements have very strong affinities for a particular type of mineral whereas other elements will partition themselves between several minerals. For instance, vanadium has a particularly strong affinity for iron oxides, so $R^2$ values for V/Fe are usually very high, significance of the slope is high, and confidence intervals are narrow. Correlations of As/Fe are also high at most sites, but not as high as V/Fe. In contrast, Cr will form several co-existing aqueous

species with different charges [$Cr(OH)_2^+$, $Cr(OH)_3^o$, $Cr(OH)_4^-$] which will adsorb on several different types of minerals including iron oxides and clays. This will yield a lower $R^2$ for Cr/Fe or Cr/Al relative to the $R^2$ values observed for V/Fe. Correlations of Ag, Hg, and Tl versus any major element are usually not very strong (although Hg is often correlated with TOC). Some elements are obviously more selective than others with respect to adsorption on specific mineral surfaces, and this selectivity is further modified by local site conditions, (especially soil pH, redox, and concentrations of competing species). We have observed these trends on many projects where these techniques were applied.

2 – The elemental associations and degree of correlation in soils are dependent on climate and soil mineralogy, and are hence site-specific. We have performed many site-to-background comparisons for the 23-element TAL suite in soils at sites in the southeastern US that have high proportions of manganese oxides. Where these Mn-oxides are present at high concentrations, we see very strong correlations between Ba, Cd, Co, Ni, and Pb versus manganese. However, in low-Mn soils in humid climates where discrete Mn-oxides are not present, these elements apportion themselves on clays and/or iron oxides instead. In arid climates where caliche is present, these divalent cations often coprecipitate in evaporite minerals, yielding correlations with calcium and/or magnesium. Different reference elements need to be used at different sites, and these different reference elements will yield different degrees of correlation with trace elements at each site.

3 - The $R^2$ values, confidence limits, and prediction limits are highly influenced in a non-linear manner by outliers. One sample that is far off of the trend will lower the $R^2$ and widen the confidence limits to a much greater extent than several samples that are slightly off of the trend. The removal of a single point that is far from the regression line can greatly increase the $R^2$ and tighten the confidence intervals, even in a large data set. The strong dependence of the fit parameters on outliers makes the significance of those parameters questionable.

4 – Some elements have concentrations that are well above the detection limits, whereas other elements contain many estimated (J-flag) concentrations at or below the detection limits that are more uncertain. The higher uncertainty in estimated concentrations will yield more scatter in the plots, wider prediction intervals, and lower $R^2$ values. These analytical uncertainties will affect the confidence and prediction limits in unique ways for each element. This effect can be seen in many of the correlation plots where there is more scatter in the data points at the lower concentration ranges, which is due to greater analytical uncertainty as well as laboratory reporting to fewer significant figures at lower concentrations that are near the reporting limit. A poor fit of the data to a regression line is expected if estimated results are present in the data set.

5 – Only detected concentrations can be included in the correlation plots because surrogate values such as ½ the reporting limit are an artifact of the analysis and will cause errors in the correlation parameters. If an element has a high percentage of nondetects, then only a partial segment of the actual trend can be quantified, resulting in lower confidence in any statistical fit parameters. Statistical parameters describing a curve that is limited to the upper range of values does not capture the true correlation. As an example, silver and thallium usually have high percentages of nondetect results, so detectable concentrations often have a narrow range of less than an order of magnitude. As a consequence, the correlations between these elements and major elements are usually poor, and error bands are wide. This is because there are many different ways to pass a line through points that are close together, but points that are spread over a broad range will tend to anchor regression lines and create error bands with limited degrees of freedom. In other words, the percentage of nondetects, which is a function of a laboratory process rather than a natural process, has an undue influence on the apparent degree of correlation that is observed.

6 – Evaluation of a set of geochemical data is not always a simple two-dimensional problem. All relevant data are examined before a conclusion is reached. Different elemental relationships can exist in different soil samples. For instance, lead in soil developed on weathered limestone will usually be correlated with aluminum because the lead released from the limestone during the weathering process adsorbs on aluminum-bearing clay minerals. The result of this process is a good correlation between lead and aluminum. However, samples containing unweathered clasts of limestone will show a correlation between lead versus calcium instead of aluminum. Barium in soils is usually associated with aluminum in low-Mn soil, and with manganese in high-Mn soil. However, in arid regions, barium is frequently associated with calcium in caliche horizons. Different samples from the same site may show correlations with different reference elements, so a multi-dimensional evaluation must be performed. This complexity cannot be adequately captured by the use of correlation coefficients or confidence limits on two-dimensional figures.

7 – The trace-versus-major element correlations are often assumed to be linear (as was done in the Navy and Army guidance documents), but there is no justification for this assumption. The associations of trace elements with specific minerals in weathered soil are dominantly a result of adsorption processes as discussed above. The adsorption of a trace element on a mineral surface can sometimes be described by a linear isotherm over a limited range of concentrations, but a two-parameter curved fit (such as a Freundlich or Langmuir isotherm) is usually more appropriate for trace elements over a broader range of concentrations. Fitting a

linear regression model to a highly correlated but naturally curved relationship will yield a low $R^2$ and wide confidence limits because a best-fit straight line crosses a curve at only two points. A linear $R^2$ is calculated for the specific purpose of determining the extent to which two variables are linearly correlated. Even perfect correlations that deviate from linearity may yield poor results for this specific test.

Keep in mind that the geochemical evaluation presented in the report was performed after statistical tests had identified element concentrations that appeared to exceed "background", as it is locally defined. Elements that failed statistical site-to-background tests, usually performed at a 95 percent confidence level, need to be evaluated from a chemical perspective to determine if the statistical exceedances are due to contamination or are naturally high concentrations. The geochemical evaluation is intended to be a rigorous multi-dimensional examination of all available geochemical data in a mechanistic context, avoiding blind adherence to presumptive quantitative analysis and pass-fail criteria. In light of all of the uncertainties listed above, it is not clear how one would define an "acceptable" $R^2$ or define an acceptable significance of the slope or width of a confidence or prediction band around the trend. Attempts to define a statistically-based "pass-fail" criteria would be practically guaranteed to generate additional false-positive results, which would then need to be evaluated by some other means. For the reasons listed above, quantitative techniques for evaluation of element correlations are best avoided.

***Regulatory Approvals of Methodology***

Shaw Environmental Inc. has been performing these geochemical evaluations for over 14 years at numerous government and commercial sites across the US, including Guam, Puerto Rico, and Hawaii. We have received regulatory approval for the use of these methods and have successfully obtained No Further Action Records of Decision at multiple facilites including: Redstone Arsenal (AL), Fort McClellan (Al), Wright Patterson AFB (OH), Longhorn Army Ammunition Plant (TX), Yosemite National Park (CA), Anderson AFB (Guam), Myrtle Beach AFB (SC), Dugway Proving Ground (UT), Sunrise Mountain Landfill (NV), and mine sites in Arizona, California and Oklahoma.

We are also currently applying these techniques as a contractor for the US EPA and the Arizona Department of Environmental Quality at the Motorola Superfund Site in Phoenix to identify contaminants of concern and to identify potentially responsible parties.

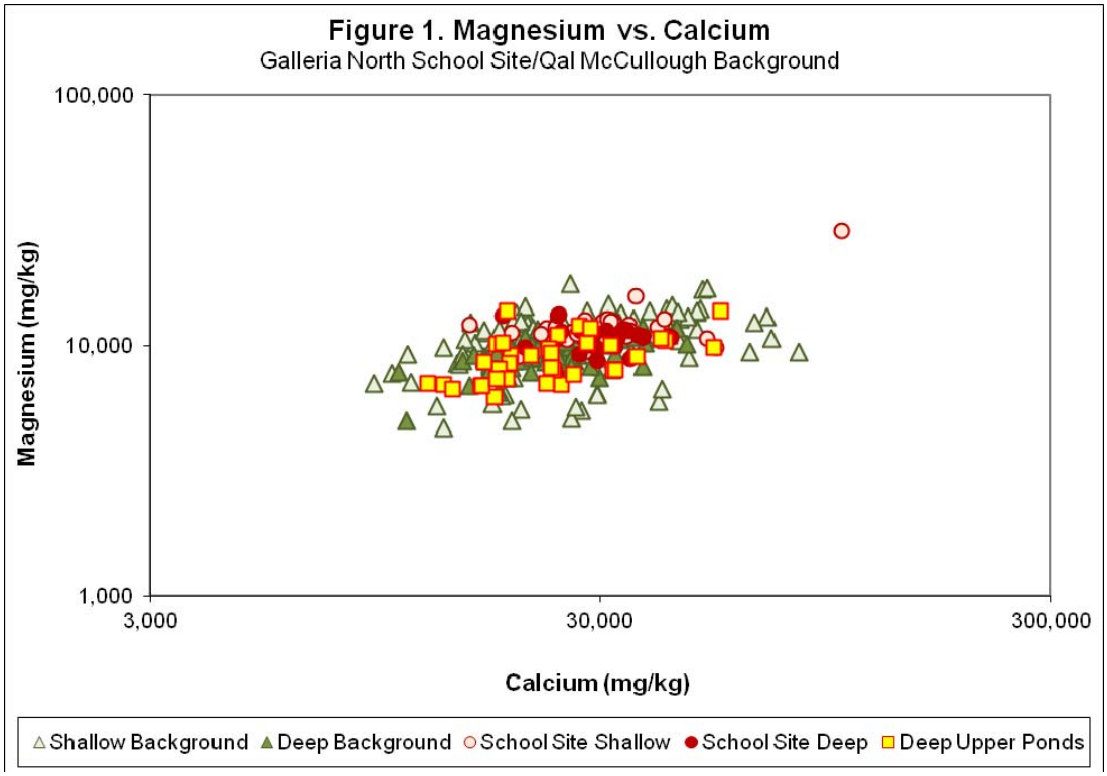


Figure 1. Magnesium vs. Calcium
Galleria North School Site/Qal McCullough Background
100,000
10,000
1,000
Magnesium (mg/kg)
3,000
30,000
300,000
Calcium (mg/kg)
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

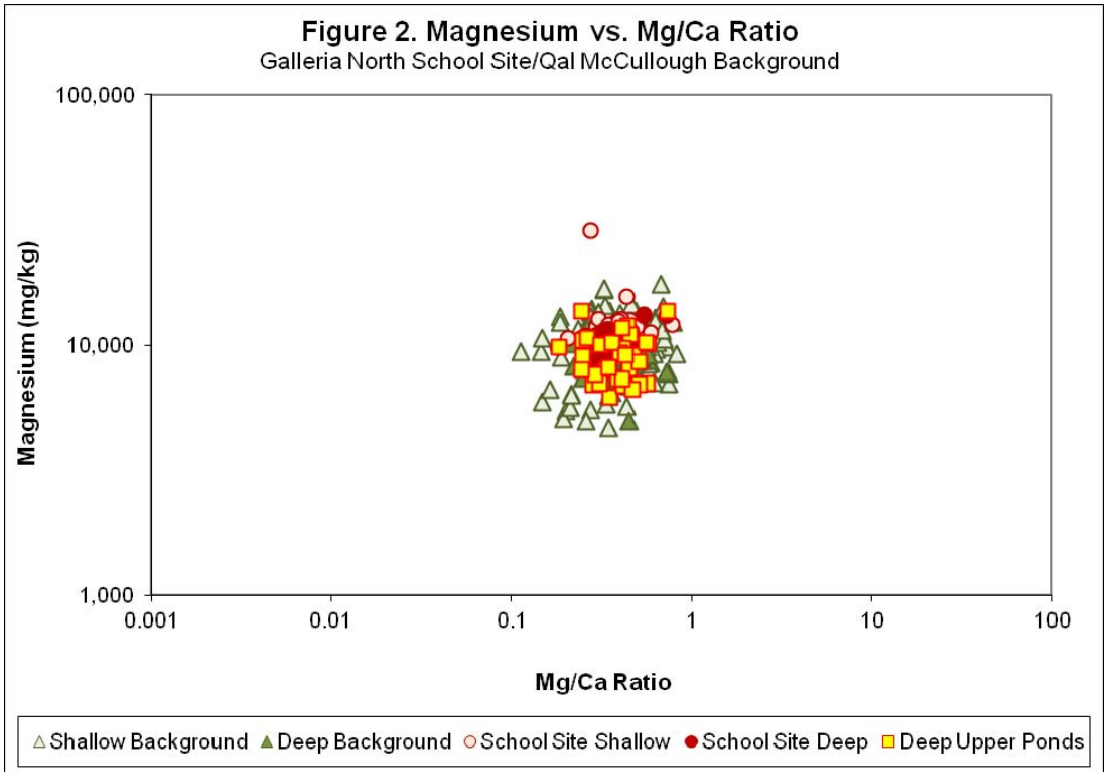
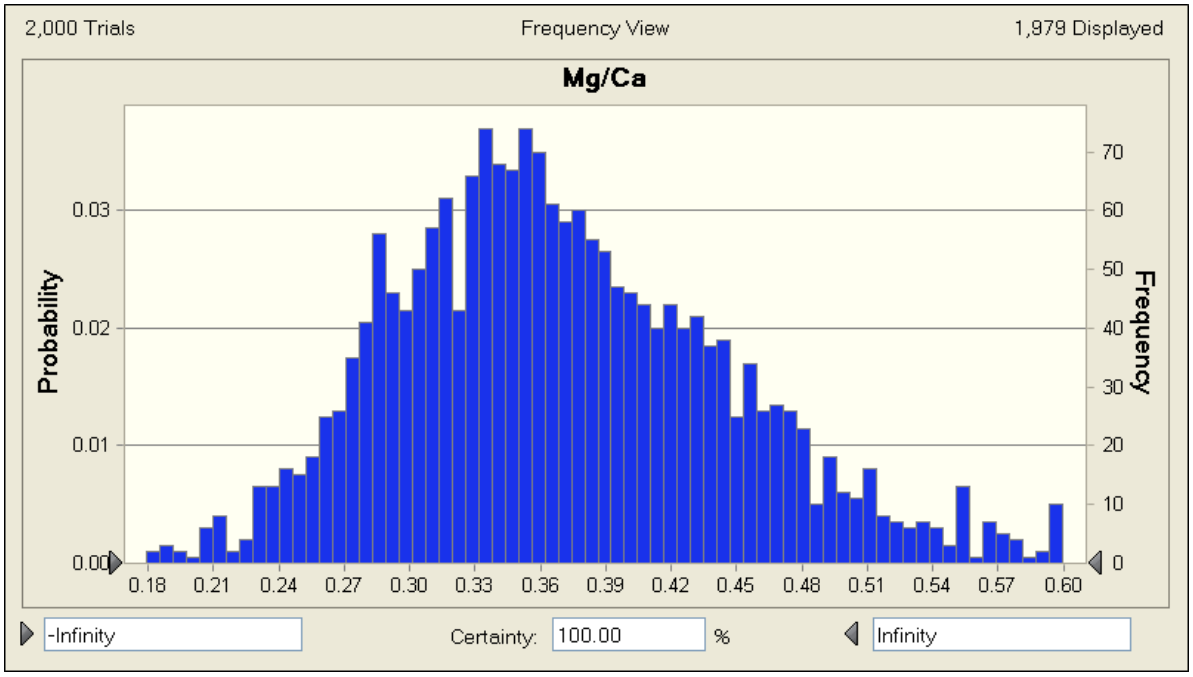


Figure 2. Magnesium vs. Mg/Ca Ratio
Galleria North School Site/Qal McCullough Background
100,000
10,000
1,000
Magnesium (mg/kg)
0.001
0.01
0.1
1
10
100
Mg/Ca Ratio
Shallow Background
Deep Background
School Site Shallow
School Site Deep
Deep Upper Ponds

**Figure 3. Histogram of Monte Carlo Mg/Ca Ratio Simulation Results Assuming ± 15 Percent Analytical Uncertainties in Mg and Ca Concentrations**



# APPENDIX I

# HUMAN HEALTH RISK ASSESSMENT CALCULATION SPREADSHEETS
(on the report CD in Appendix B)

# APPENDIX J

# METALS AND CHEMICALS OF POTENTIAL CONCERN INTENSITY PLOTS

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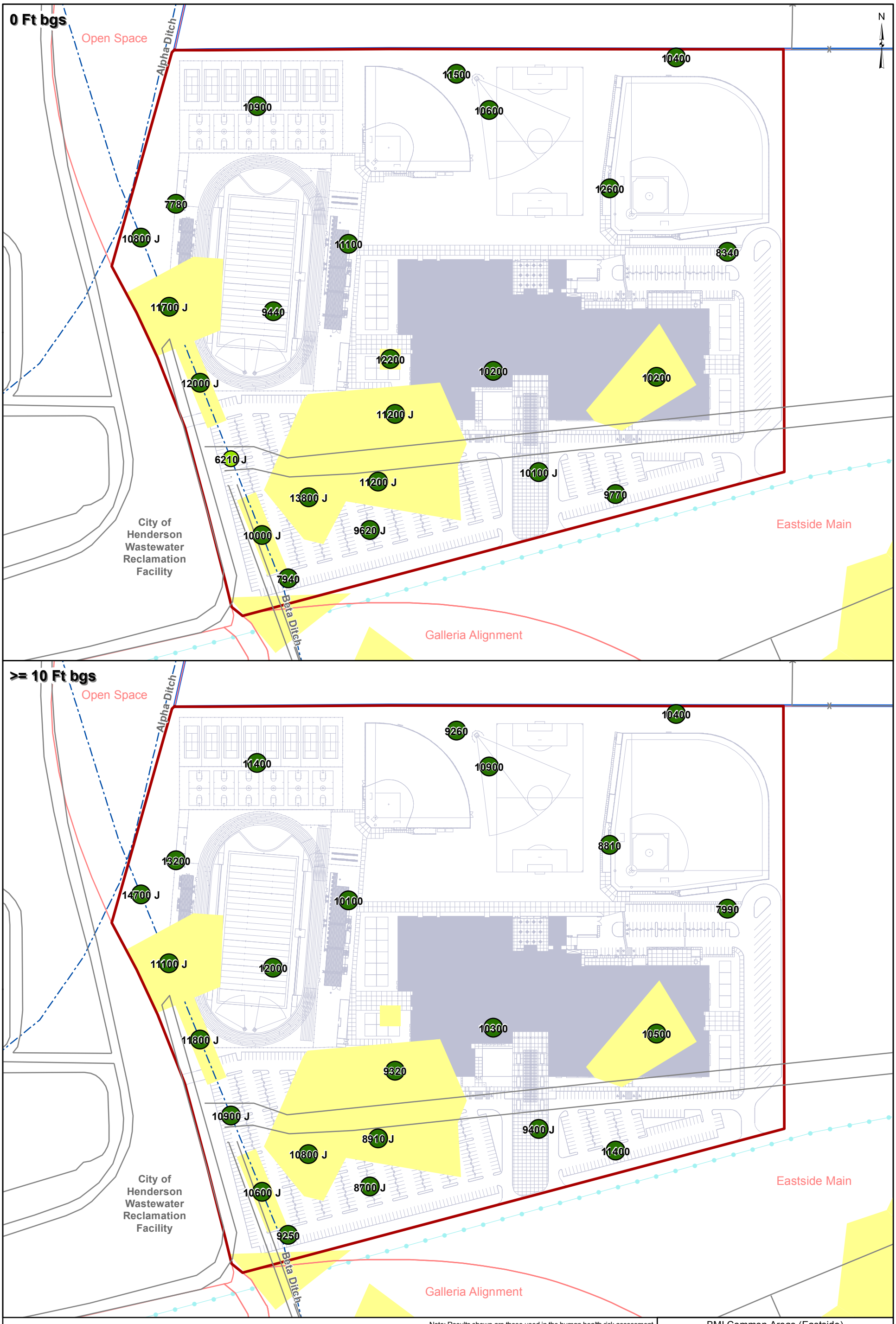
Table J-37 Asbestos Soil Results in Galleria North-School Site Sub-Area
Table J-38 TCDD TEQ Soil Results in Galleria North-School Site Sub-Area


0 Ft bgs
Open Space
Alpha Ditch
10400
11500
10900
10600
12600
7780
10800 J
11100
8340
11700 J
9440
12200
10200
10200
12000 J
11200 J
6210 J
10100 J
11200 J
13800 J
9770
City of Henderson Wastewater Reclamation Facility
10000 J
9620 J
7940
Beta Ditch
Eastside Main
Galleria Alignment
>= 10 Ft bgs
Open Space
Alpha Ditch
10400
9260
11400
10900
8810
13200
14700 J
10100
7990
11100 J
12000
10300
10500
11800 J
9320
10900 J
9400 J
8910 J
11400
10800 J
8700 J
10600 J
9250
City of Henderson Wastewater Reclamation Facility
Beta Ditch
Eastside Main
Galleria Alignment
N
Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas
Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Max. Shallow Background (15,500 mg/kg)
>= Max. Shallow Background and < Residential BCL (77,200 mg/kg)
>= Residential BCL
Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.
BMI Common Areas (Eastside)
Clark County, Nevada
FIGURE J-1
ALUMINUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA
Basic Remediation Company
Prepared by MKJ (ERM)
ERM
Date 09/06/11
JOB No. 0064276
FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

**0 Ft bgs**

Open Space

Alpha Ditch

< 0.315 UJ

< 2.6 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 2.7 UJ

< 0.315 UJ

< 0.83 UJ

< 0.315 UJ

< 2.6 UJ

< 0.315 UJ

< 0.225 UJ

< 0.315 UJ

< 0.225 UJ

< 0.315 UJ

< 0.225 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Galleria Alignment

Eastside Main

N

**>= 10 Ft bgs**

Open Space

Alpha Ditch

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

< 0.315 UJ

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Galleria Alignment

Eastside Main

Galleria North School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Recent Soil Removal Areas

Non-Detect

Detect < 1/10-Residential BCL

>= 1/10-Residential BCL and < Residential BCL (31.3 mg/kg)

>= Residential BCL and < 10x Residential BCL

>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-2

ANTIMONY SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | ERM | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

**0 Ft bgs**

Open Space

Alpha Ditch

N

5.3
4.5 J
5.1 J
3.7 J
6.2
5.3
3.9 J
2.6 J
3.2 J
7.4
3.8 J
< 5.1 U
3.6 J
5.4
4.3 J
5.5 J+
3.8 J
4.3 J+
4.4 J
4.5 J+
4.8 J
3.7 J
4.3 J
5.8

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Eastside Main

Galleria Alignment

**>= 10 Ft bgs**

Open Space

Alpha Ditch

4 J
5.7
4.9 J
4.7 J
4.2 J
2.9 J
4.8 J
6.1
5.5
3.1 J
3 J
4.2 J
3.7 J
4.7 J
7.8
5 J
7
8.8
5.5
6.7
3.4 J
6.7
7.1

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Eastside Main

Galleria Alignment

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < Residential BCL (0.39 mg/kg)
>= Residential BCL and < Max. Qal McCullough Background (7.2 mg/kg)
>= Max. Qal McCullough Background and < Max. Qal (All) Background
>= Max. Qal (All) Background (27.6 mg/kg)

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-3

ARSENIC SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

**0 Ft bgs**

Open Space

Alpha Ditch

N

408 J
351 J
341 J
290 J
310 J
175 J
383 J-
338 J
344 J
613 J-
253 J
455 J+
346 J
563 J
315
280 J
142
272
365 J
368 J
387 J+
281
307
235 J+
Beta Ditch

City of Henderson Wastewater Reclamation Facility

Eastside Main

Galleria Alignment

**>= 10 Ft bgs**

Open Space

Alpha Ditch

382 J
268 J
384 J
362 J
371 J
395 J
184 J-
472 J
318 J
309 J-
328 J
433 J
362 J
293
295 J
209
391
383
314
282 J+
329
284
378 J+

Beta Ditch

City of Henderson Wastewater Reclamation Facility

Eastside Main

Galleria Alignment

- Galleria North School Site Sub-Area
- Site AOC3 Boundary
- Eastside Soil Sub-Areas
- Recent Soil Removal Areas

- Non-Detect
- Detect < 1/10-Residential BCL
- >= 1/10-Residential BCL and < Residential BCL (15,300 mg/kg)
- >= Residential BCL and < 10x Residential BCL
- >= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-4

BARIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | ERM | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

## 0 Ft bgs

## >= 10 Ft bgs

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (155 mg/kg)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-5

BERYLLIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | ERM | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

0 Ft bgs

Open Space

Alpha Ditch

< 16.5 U

23 J

18.6 J

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

17.2 J

< 16.5 U

47.1 J

< 16.9 U

38.9 J

< 16.5 U

< 16.5 U

< 52.2 U

< 16.5 U

< 16.5 U

< 53 U

< 51.3 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Galleria Alignment

Eastside Main

N

>= 10 Ft bgs

Open Space

Alpha Ditch

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

18.3 J

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

< 16.5 U

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Galleria Alignment

Eastside Main

Galleria North School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Recent Soil Removal Areas

Non-Detect

Detect < 1/10-Residential BCL

>= 1/10-Residential BCL and < Residential BCL (15,600 mg/kg)

>= Residential BCL and < 10x Residential BCL

>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-6

BORON SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

**0 Ft bgs**

Open Space

Alpha Ditch

N

0.14 J
0.21 J
0.3
0.16 J
0.19 J
0.3
0.15 J
0.14 J
0.13 J
0.18 J
0.17 J
0.17 J
0.12 J
0.44
0.13 J
0.29 J+
0.13 J
0.28
< 0.27 UJ
< 0.26 UJ
0.21 J
0.13 J
0.23 J
< 0.1 U

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Eastside Main

Galleria Alignment

**>= 10 Ft bgs**

Open Space

Alpha Ditch

0.14 J
0.14 J
0.15 J
0.15 J
0.11 J
0.13 J
< 0.1 U
0.12 J
< 0.1 U
0.12 J
0.12 J
< 0.1 U
0.14 J
0.11 J
< 0.1 U
< 0.1 U
0.12 J
< 0.1 U
0.11 J
< 0.1 U
< 0.1 U
0.11 J

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Eastside Main

Galleria Alignment

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (38.9 mg/kg)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

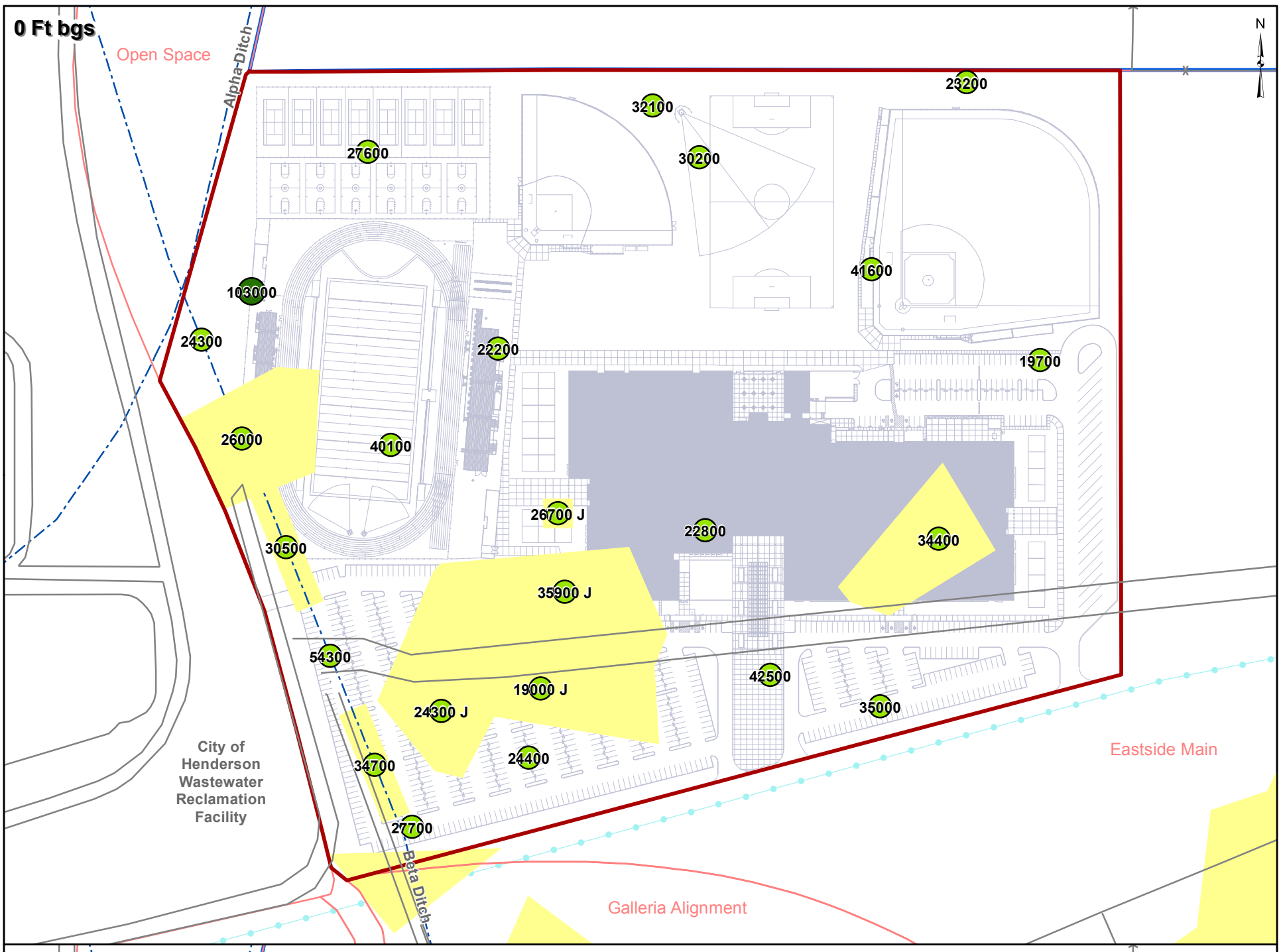
BMI Common Areas (Eastside)
Clark County, Nevada

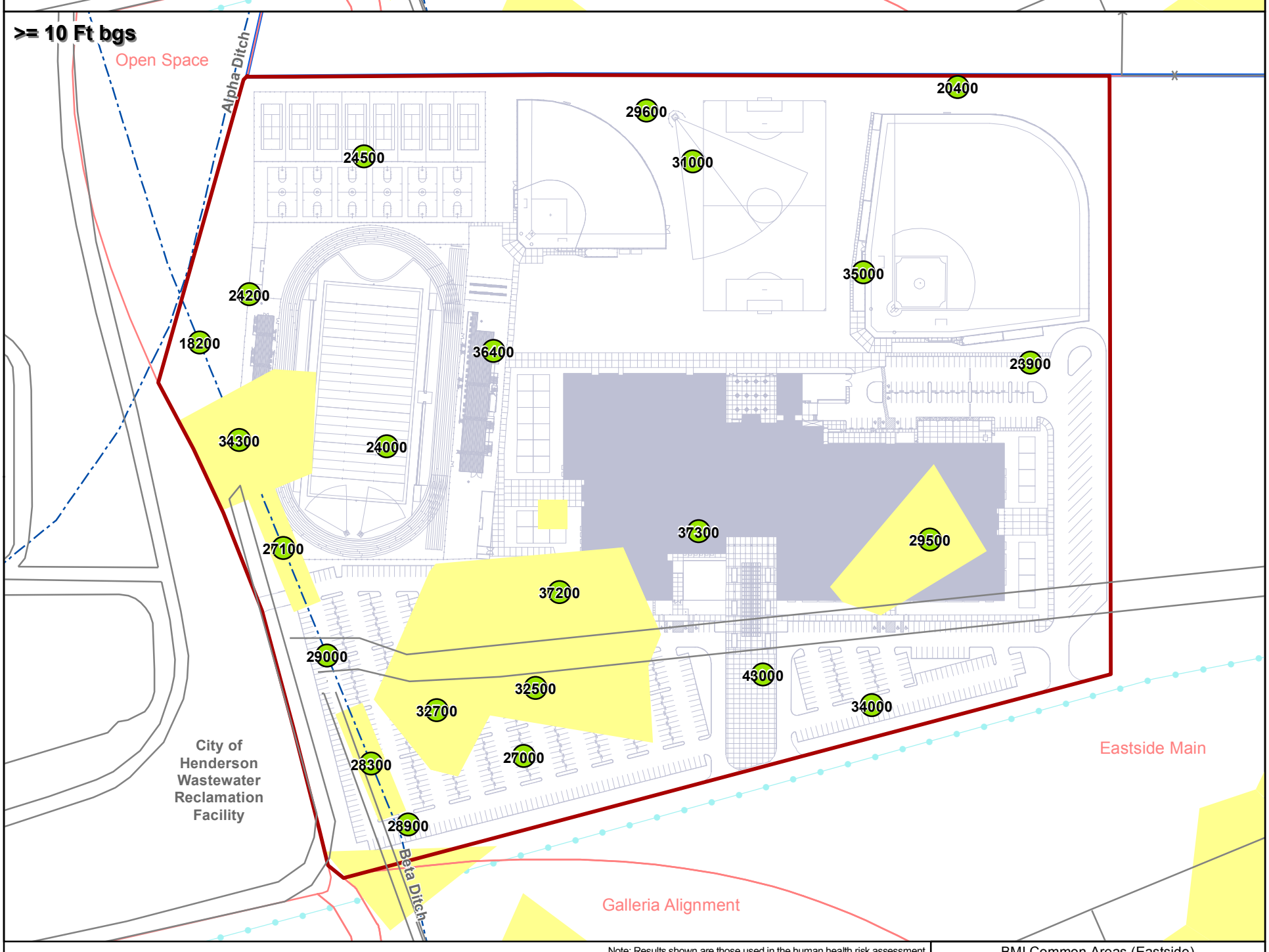
FIGURE J-7

CADMIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD




Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < Max. Shallow Background (82,800 mg/kg)
>= Max. Shallow Background

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-8

CALCIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (100,000 mg/kg)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-9

CHROMIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | ERM | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

**0 Ft bgs**

Open Space

Alpha Ditch

N

0.34 J

0.56

0.16 J

< 0.11 U

0.3 J

< 0.11 U

< 0.11 U

< 0.1 U

< 0.1 U

0.14 J

< 0.1 U

< 0.1 U

< 0.11 U

1.8

0.19 J

0.15 J

0.24 J

0.19 J

0.36 J

< 0.1 U

0.14 J

City of Henderson Wastewater Reclamation Facility

< 0.1 U

0.24 J

< 0.11 UJ

Beta Ditch

Eastside Main

Galleria Alignment

**>= 10 Ft bgs**

Open Space

Alpha-Ditch

0.34 J

< 0.1 U

0.16 J

0.11 J

0.11 J

0.3 J

< 0.11 U

0.16 J

0.19 J

< 0.11 U

< 0.11 U

0.2 J

0.16 J

< 0.11 U

0.3 J

0.24 J

0.19 J

0.19 J

< 0.11 U

0.19 J

City of Henderson Wastewater Reclamation Facility

0.19 J

0.14 J

Eastside Main

< 0.11 UJ

Beta Ditch

Galleria Alignment

Galleria North School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Recent Soil Removal Areas

Non-Detect

Detect < 1/10-Residential BCL

>= 1/10-Residential BCL and < Residential BCL (229 mg/kg)

>= Residential BCL and < 10x Residential BCL

>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-10

CHROMIUM (VI) SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | ERM | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

**0 Ft bgs**

Open Space

Alpha Ditch

N

9.6
11.5
10.1
9.3
10.4
5.2
10.4
9.9
8.8
10.8
8.9
11.2
9.2
12.8
10.9
10.6
8.1
8.8
10.9
11.3
8.8
8.7
9.9
8.1
Beta Ditch

City of Henderson Wastewater Reclamation Facility

Eastside Main

Galleria Alignment

**>= 10 Ft bgs**

Open Space

Alpha Ditch

10.5
8.3
11.6
10.5
8.3
12.4
12.2
9.3
7.5
10.4
10
10.9
9.3
9.6
8.5
9.8
8.5
7.9
8.9
9.3
8.7
9.7
7.7
Beta Ditch

City of Henderson Wastewater Reclamation Facility

Eastside Main

Galleria Alignment

Galleria North School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Recent Soil Removal Areas

Non-Detect

Detect < 1/10-Residential BCL

>= 1/10-Residential BCL and < Max. Shallow Background (16.3 mg/kg)

>= Max. Shallow Background and < Residential BCL (23.4 mg/kg)

>= Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-11

COBALT SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

**0 Ft bgs**

Open Space

Alpha-Ditch

N

27.1
22.2
25.4
20.1
24.7
13.3
21.6
18.2 J+
16.4 J+
22.3
18.3
20.4
18.1 J+
32.5
21.1
28.2 J
15.9
19.9 J+
20.3
22.6 J+
20.2
18.3
20.8
15.9

City of Henderson Wastewater Reclamation Facility

Eastside Main

Beta Ditch

Galleria Alignment

**>= 10 Ft bgs**

Open Space

Alpha-Ditch

22.8
18.5
22
20
15.7
23
19.9
18.5 J+
15.9 J+
20.3
18.5
18.3 J+
18
23
18.2 J+
19.6
19.1
18
21.7
17
16.4
20.7
13.5

City of Henderson Wastewater Reclamation Facility

Eastside Main

Beta Ditch

Galleria Alignment

Galleria North School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Recent Soil Removal Areas

Non-Detect

Detect < 1/10-Residential BCL

>= 1/10-Residential BCL and < Residential BCL (2,910 mg/kg)

>= Residential BCL and < 10x Residential BCL

>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-12

COPPER SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Max. Shallow Background (22,500 mg/kg)
>= Max. Shallow Background and < Residential BCL (54,800 mg/kg)
>= Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-13

IRON SOIL RESULTS
IN GALLERIA NORTH
SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (400 mg/kg)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-14

LEAD SOIL RESULTS
IN GALLERIA NORTH
SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Max. Shallow Background (26.5 mg/kg)
>= Max. Shallow Background and < Residential BCL (156 mg/kg)
>= Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

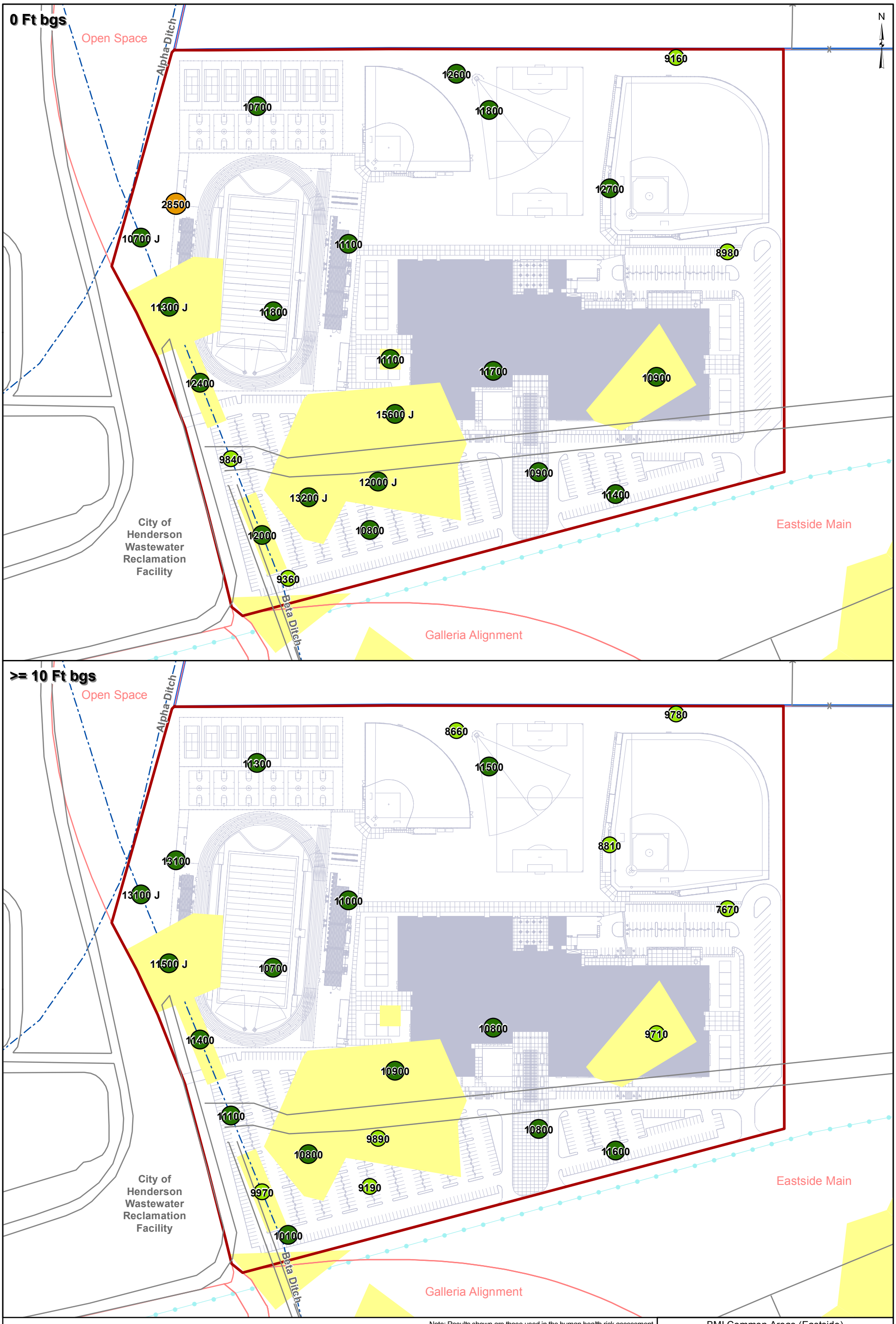
BMI Common Areas (Eastside)
Clark County, Nevada

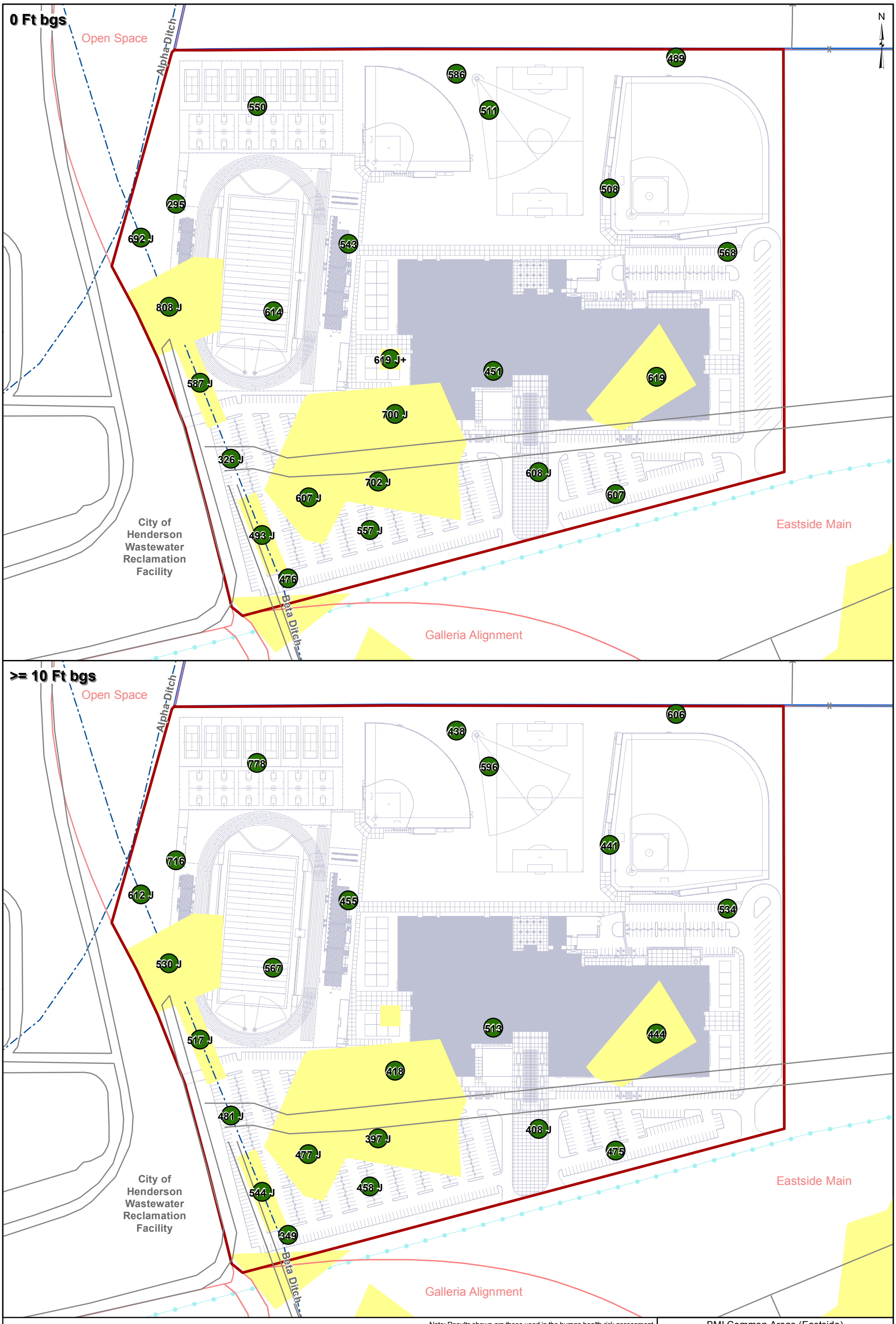
FIGURE J-15

LITHIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD


0 Ft bgs
Open Space
Alpha Ditch
9160
12600
10700
11800
12700
28500
10700 J
11100
8980
11300 J
11800
11100
11700
10900
12400
15600 J
9840
10900
12000 J
13200 J
11400
City of Henderson Wastewater Reclamation Facility
10800
12000
9360
Beta Ditch
Galleria Alignment
Eastside Main
>= 10 Ft bgs
Open Space
Alpha Ditch
9780
8660
11300
11500
8810
13100
13100 J
11000
7670
11500 J
10700
11400
10800
9710
10900
11100
9890
10800
11600
10800
9970
9190
10100
City of Henderson Wastewater Reclamation Facility
Beta Ditch
Galleria Alignment
Eastside Main
N
Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas
Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Max. Shallow Background (17,500 mg/kg)
>= Max. Shallow Background and < Residential BCL (100,000 mg/kg)
>= Residential BCL
Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.
BMI Common Areas (Eastside)
Clark County, Nevada
FIGURE J-16
MAGNESIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA
Basic Remediation Company
Prepared by MKJ (ERM)
ERM
Date 09/06/11
JOB No. 0064276
FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD


0 Ft bgs
Open Space
Alpha Ditch
N
489
586
550
511
508
295
692 J
543
568
808 J
614
619 J+
451
619
587 J
700 J
326 J
608 J
702 J
607 J
607
City of Henderson Wastewater Reclamation Facility
557 J
493 J
476
Beta Ditch
Eastside Main
Galleria Alignment
>= 10 Ft bgs
Open Space
Alpha Ditch
606
438
778
596
441
716
612 J
455
534
530 J
567
513
444
517 J
418
481 J
408 J
397 J
477 J
475
544 J
458 J
349
City of Henderson Wastewater Reclamation Facility
Beta Ditch
Eastside Main
Galleria Alignment
Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas
Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (1,820 mg/kg)
>= Residential BCL and < Max. Shallow Background (2,070 mg/kg)
>= Max. Shallow Background
Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.
BMI Common Areas (Eastside)
Clark County, Nevada
FIGURE J-17
MANGANESE SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA
Basic Remediation Company
Prepared by MKJ (ERM)
ERM
Date 09/06/11
JOB No. 0064276
FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

**0 Ft bgs**

Open Space

Alpha Ditch

N

< 0.005 U

0.0369

0.047

< 0.0345 U

< 0.0349 U

< 0.0351 U

< 0.0367 U

< 0.0348 UJ

< 0.0346 UJ

< 0.0356 U

0.0742

< 0.0061 U

0.0366 J-

0.082

0.0421 J+

0.122 J

< 0.005 U

0.0575 J+

0.0366

0.0479

0.0366

City of Henderson Wastewater Reclamation Facility

< 0.0353 UJ

0.0912 J+

Eastside Main

< 0.0367 U

Beta Ditch

Galleria Alignment

**>= 10 Ft bgs**

Open Space

Alpha Ditch

< 0.005 U

0.0565

< 0.0351 U

< 0.005 U

< 0.005 U

< 0.005 U

< 0.0373 U

< 0.005 UJ

< 0.005 UJ

< 0.0354 U

< 0.0354 U

< 0.0357 UJ

< 0.0351 U

< 0.0356 UJ

0.0587 J-

< 0.005 U

< 0.005 U

< 0.035 UJ

< 0.005 U

0.0484 J+

City of Henderson Wastewater Reclamation Facility

< 0.0354 UJ

< 0.035 UJ

Eastside Main

< 0.0355 U

Beta Ditch

Galleria Alignment

Galleria North School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Recent Soil Removal Areas

Non-Detect

Detect < 1/10-Residential BCL

>= 1/10-Residential BCL and < Residential BCL (23.5 mg/kg)

>= Residential BCL and < 10x Residential BCL

>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-18

MERCURY SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | ERM | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

## 0 Ft bgs

Open Space

Alpha Ditch

N

1 J
0.99 J
0.99 J
0.74 J
0.66 J
1.3 J
0.65 J
1.1 J
0.76 J
1.7 J
0.93 J
< 2.5 U
1.5 J
3.2
0.9 J
< 2.6 UJ
0.69 J
0.69 J
< 2.7 UJ
< 2.6 UJ
0.89 J
0.58 J
0.69 J
< 0.47 U

City of Henderson Wastewater Reclamation Facility

Eastside Main

Beta Ditch

Galleria Alignment

## >= 10 Ft bgs

Open Space

Alpha Ditch

0.76 J
0.67 J
1.1 J
0.99 J
1.4 J
1 J
1.1 J
1.4 J
0.77 J
1.3 J
1.2 J
1.1 J
0.61 J
1.3 J
1.1 J
0.89 J
1.1 J
0.76 J
0.93 J
1.1 J
0.64 J
1.7 J
0.62 J

City of Henderson Wastewater Reclamation Facility

Eastside Main

Beta Ditch

Galleria Alignment

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (391 mg/kg)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

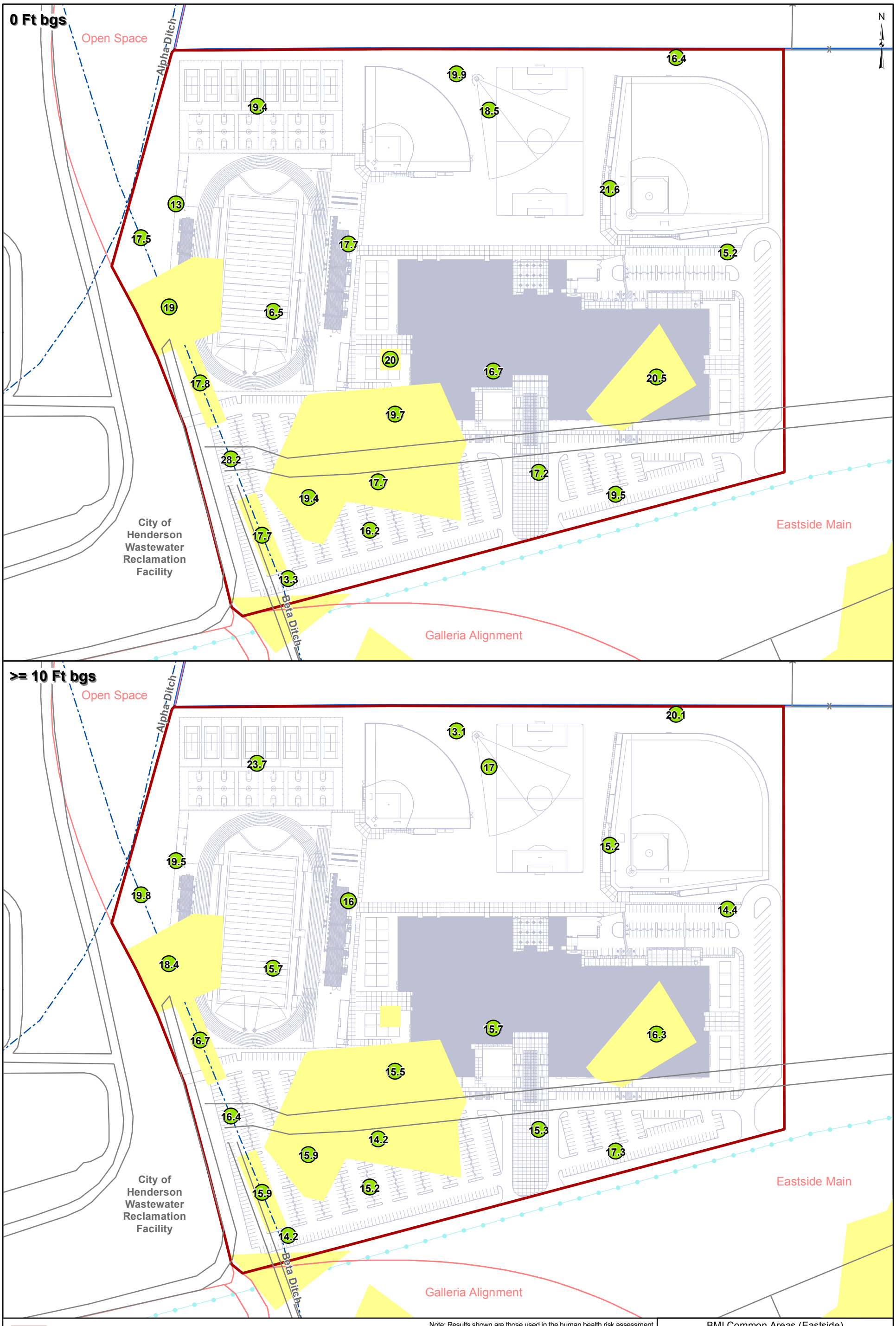
BMI Common Areas (Eastside)
Clark County, Nevada

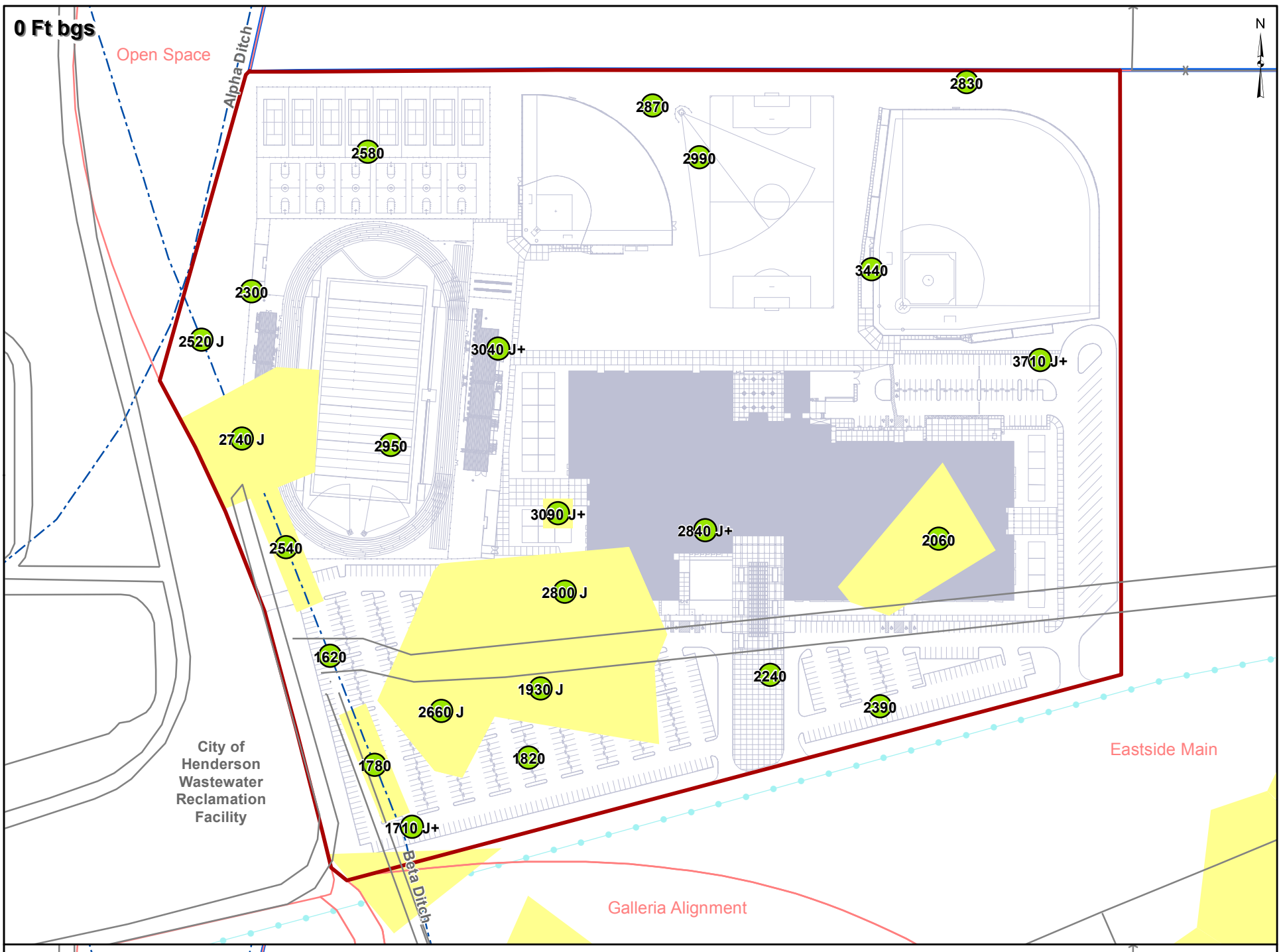
FIGURE J-19

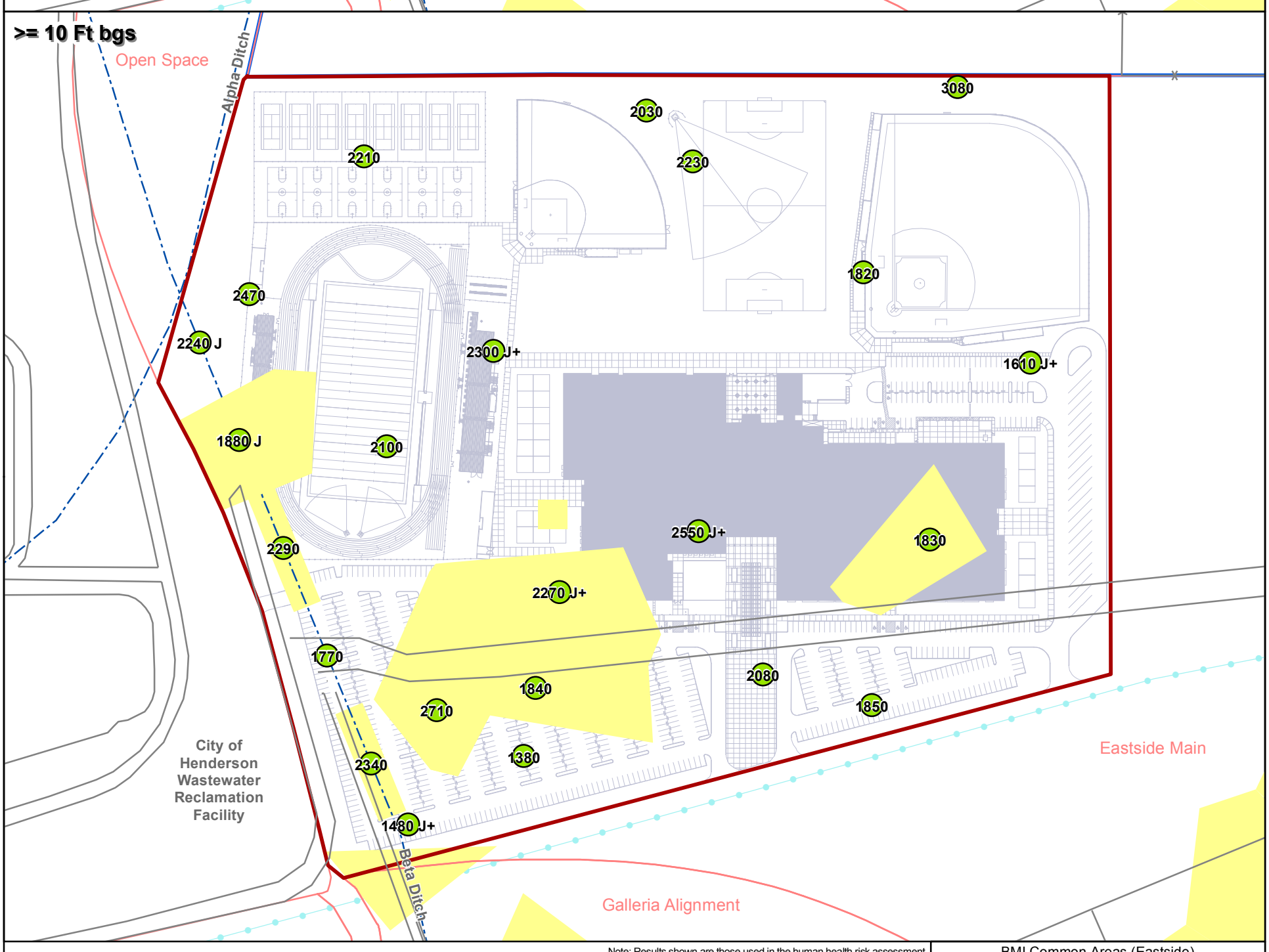
MOLYBDENUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD


0 Ft bgs
Open Space
Alpha-Ditch
16.4
19.9
19.4
18.5
21.6
13
17.5
17.7
15.2
19
16.5
20
16.7
20.5
17.8
19.7
28.2
17.7
17.2
19.4
19.5
16.2
17.7
13.3
Beta Ditch
City of Henderson Wastewater Reclamation Facility
Eastside Main
Galleria Alignment
N
>= 10 Ft bgs
Open Space
Alpha-Ditch
20.1
13.1
23.7
17
15.2
19.5
19.8
16
14.4
18.4
15.7
16.7
15.7
16.3
15.5
16.4
14.2
15.3
15.9
17.3
15.9
15.2
14.2
Beta Ditch
City of Henderson Wastewater Reclamation Facility
Eastside Main
Galleria Alignment
Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas
Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (1,540 mg/kg)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL
Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.
BMI Common Areas (Eastside)
Clark County, Nevada
FIGURE J-20
NICKEL SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA
Basic Remediation Company
Prepared by MKJ (ERM)
ERM
Date 09/06/11
JOB No. 0064276
FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD




Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < Max. Shallow Background (12,600 mg/kg)
>= Max. Shallow Background

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-21

POTASSIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | ERM | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

**0 Ft bgs**

Open Space

Alpha Ditch

< 0.4 U

< 2.5 U

< 2.6 UJ

< 2.7 UJ

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Galleria Alignment

Eastside Main

N

**>= 10 Ft bgs**

0.47 J

Galleria North School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Recent Soil Removal Areas

Non-Detect

Detect < 1/10-Residential BCL

>= 1/10-Residential BCL and < Residential BCL (391 mg/kg)

>= Residential BCL and < 10x Residential BCL

>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

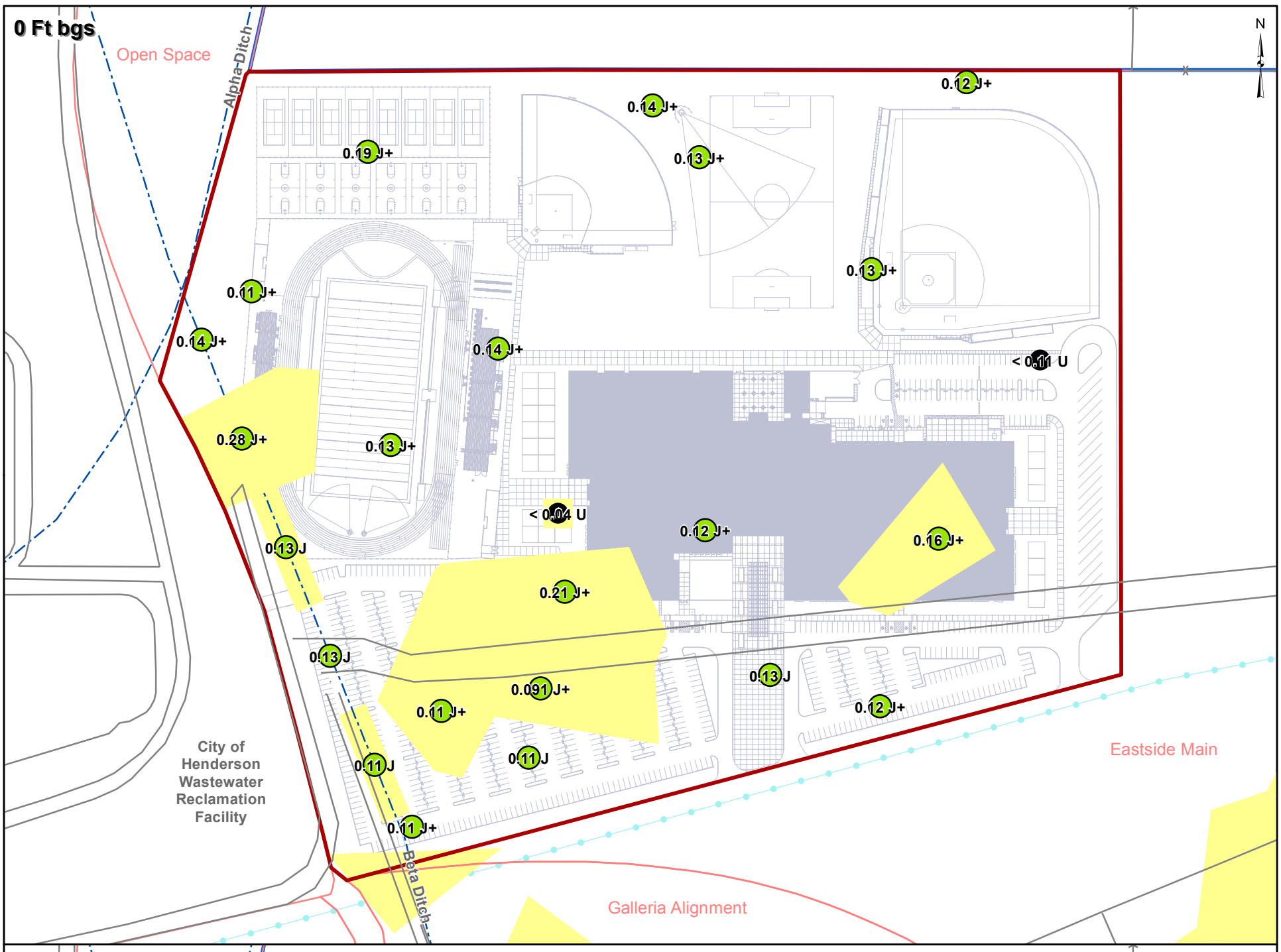
FIGURE J-22

SELENIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

## 0 Ft bgs




## >= 10 Ft bgs

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (391 mg/kg)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-23

SILVER SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

| Prepared by | | Date | JOB No. 0064276 |
|---|---|---|---|
| MKJ (ERM) | ERM | 09/06/11 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD |

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < Max. Shallow Background (4,210 mg/kg)
>= Max. Shallow Background

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-24

SODIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

0 Ft bgs

Open Space

Alpha Ditch

306 J
296 J
401 J
308 J
226 J
457 J
290 J
289 J
189 J
347 J
599 J
285
319 J
247 J
277
330 J
193
317
216 J
249
281 J
City of Henderson Wastewater Reclamation Facility
303
202
262
Beta Ditch
Eastside Main
Galleria Alignment

N

>= 10 Ft bgs

Open Space

Alpha Ditch

226 J
443 J
305 J
293 J
288 J
516 J
324 J
538 J
257 J
411 J
407 J
444 J
397 J
399
623 J
309
401
358
385
345
280
308
342
City of Henderson Wastewater Reclamation Facility
Beta Ditch
Eastside Main
Galleria Alignment

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (46,900 mg/kg)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-25

STRONTIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | ERM | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

0 Ft bgs

Open Space

Alpha Ditch

< 0.75 U

< 0.29 U

< 0.105 U

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Eastside Main

Galleria Alignment

N

>= 10 Ft bgs

Open Space

Alpha-Ditch

< 0.75 U

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Eastside Main

Galleria Alignment

Galleria North School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Recent Soil Removal Areas

Non-Detect

Detect < 1/10-Residential BCL

>= 1/10-Residential BCL and < Max. Shallow Background (2.0 mg/kg)

>= Max. Shallow Background and < Residential BCL (5.48 mg/kg)

>= Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-26

THALLIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM)

ERM

Date 09/06/11

JOB No. 0064276

FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

0 Ft bgs

Open Space

Alpha-Ditch

N

< 0.75 U

1

< 1.1 U

< 1 U

< 1.1 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 1.1 U

< 1 U

< 1 U

< 0.75 U

10.4

< 0.75 U

1.7 J+

< 0.75 U

1 J

< 0.75 U

4.2 J

< 0.75 U

1.2

< 0.75 U

City of Henderson Wastewater Reclamation Facility

Eastside Main

Beta Ditch

Galleria Alignment

>= 10 Ft bgs

Open Space

Alpha-Ditch

1.2

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

< 0.75 U

City of Henderson Wastewater Reclamation Facility

Eastside Main

Beta Ditch

Galleria Alignment

Galleria North School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Recent Soil Removal Areas

Non-Detect

Detect < 1/10-Residential BCL

>= 1/10-Residential BCL and < Residential BCL (46,900 mg/kg)

>= Residential BCL and < 10x Residential BCL

>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-27

TIN SOIL RESULTS
IN GALLERIA NORTH
SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | ERM | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (100,000 mg/kg)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-28

TITANIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

**0 Ft bgs**

Open Space

Alpha Ditch

< 1.25 U
< 1.25 U
< 1.25 U
< 1.25 U
< 1.25 U
< 1.25 U UJ
< 1.25 UJ
< 1.25 UJ
3.2 J-
< 1.25 U
< 0.41 UJ
< 1.25 UJ
< 1.25 U
< 1.25 UJ
< 0.185 U
< 1.25 UJ
< 2.6 U
< 1.25 UJ
< 2.6 U
< 1.25 UJ
< 1.25 UJ
< 1.25 UJ
< 1.25 UJ

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Galleria Alignment

Eastside Main

N

**>= 10 Ft bgs**

Open Space

Alpha Ditch

< 1.25 U
< 1.25 U
< 1.25 U
< 1.25 U
< 1.25 U
< 1.25 UJ
< 1.25 UJ
< 1.25 UJ
< 1.25 UJ
< 1.25 U
< 1.25 UJ
< 1.25 UJ
< 1.25 UJ
< 1.25 UJ
< 1.25 UJ
< 1.25 UJ
< 1.25 UJ
< 1.25 UJ
2.9
1.4 J-

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Galleria Alignment

Eastside Main

- Galleria North School Site Sub-Area
- Site AOC3 Boundary
- Eastside Soil Sub-Areas
- Recent Soil Removal Areas

- Non-Detect
- Detect < 1/10-Residential BCL
- >= 1/10-Residential BCL and < Residential BCL (587 mg/kg)
- >= Residential BCL and < 10x Residential BCL
- >= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

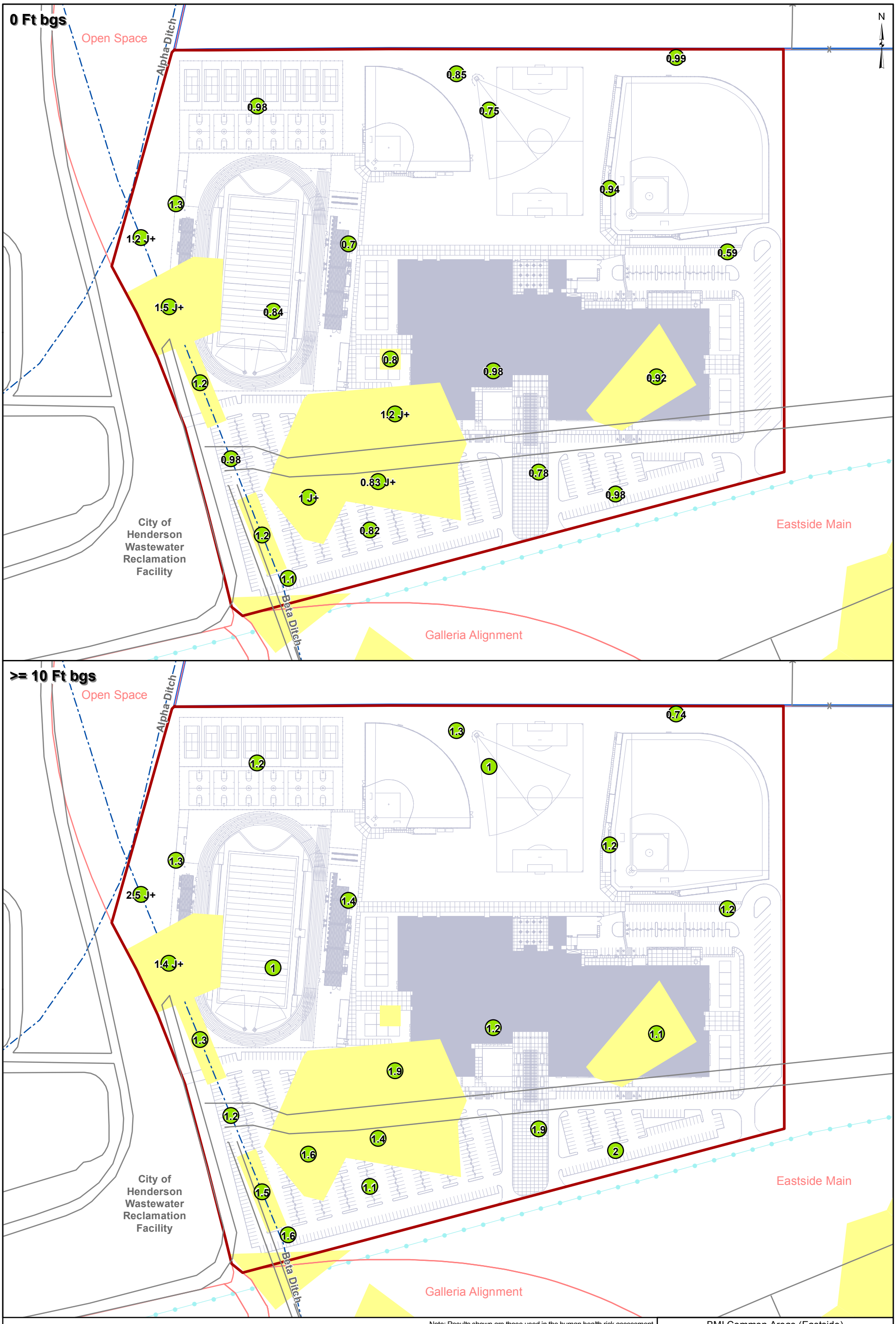
BMI Common Areas (Eastside)
Clark County, Nevada

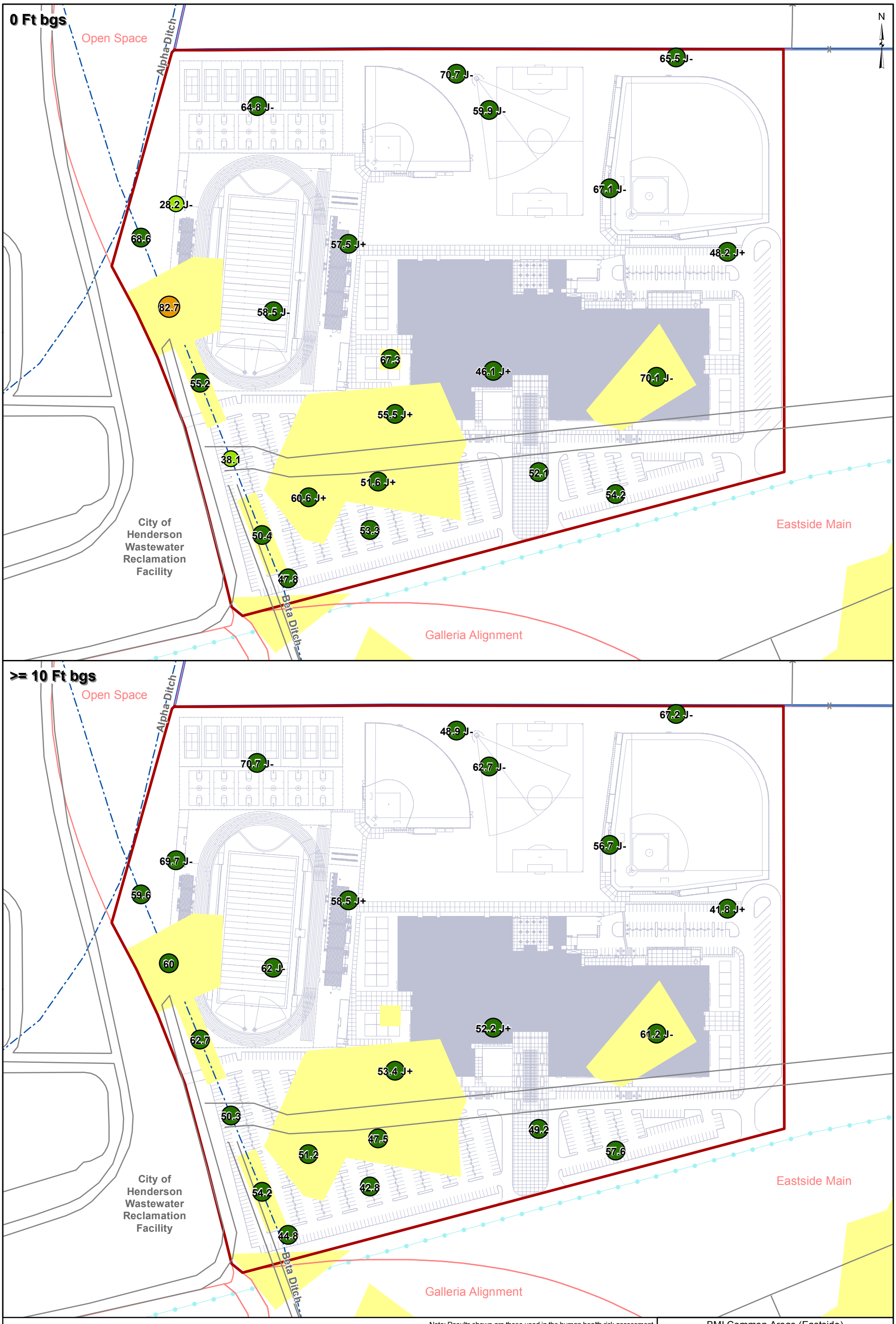
FIGURE J-29

TUNGSTEN SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD


0 Ft bgs
Open Space
Alpha-Ditch
0.99
0.85
0.98
0.75
0.94
1.3
1.2 J+
0.7
0.59
1.5 J+
0.84
0.8
0.98
0.92
1.2
1.2 J+
0.98
0.78
0.83 J+
1 J+
0.98
1.2
0.82
1.1
Beta Ditch
City of Henderson Wastewater Reclamation Facility
Eastside Main
Galleria Alignment
>= 10 Ft bgs
Open Space
Alpha-Ditch
0.74
1.3
1.2
1
1.2
1.3
2.5 J+
1.4
1.2
1.4 J+
1
1.2
1.1
1.3
1.9
1.2
1.9
1.4
1.6
2
1.1
1.5
1.6
Beta Ditch
City of Henderson Wastewater Reclamation Facility
Eastside Main
Galleria Alignment
N
Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas
Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (235 mg/kg)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL
Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.
BMI Common Areas (Eastside)
Clark County, Nevada
FIGURE J-30
URANIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA
Basic Remediation Company
Prepared by MKJ (ERM)
ERM
Date 09/06/11
JOB No. 0064276
FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD


0 Ft bgs
Open Space
Alpha Ditch
N
65.5 J-
70.7 J-
64.8 J-
59.9 J-
67.1 J-
28.2 J-
68.6
57.5 J+
48.2 J+
82.7
58.5 J-
67.3
46.1 J+
70.1 J-
55.2
55.5 J+
38.1
52.1
51.6 J+
60.6 J+
54.2
50.4
53.3
47.8
City of Henderson Wastewater Reclamation Facility
Beta Ditch
Eastside Main
Galleria Alignment
>= 10 Ft bgs
Open Space
Alpha Ditch
67.2 J-
48.9 J-
70.7 J-
62.7 J-
69.7 J-
56.7 J-
59.6
58.5 J+
41.8 J+
60
62 J-
62.7
52.2 J+
61.2 J-
53.4 J+
50.3
49.2
47.5
57.6
51.2
54.2
42.8
44.8
City of Henderson Wastewater Reclamation Facility
Beta Ditch
Eastside Main
Galleria Alignment
Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas
Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Max. Shallow Background (73.3 mg/kg)
>= Max. Shallow Background and < Residential BCL (391 mg/kg)
>= Residential BCL
Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.
BMI Common Areas (Eastside)
Clark County, Nevada
FIGURE J-31
VANADIUM SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA
Basic Remediation Company
Prepared by MKJ (ERM)
ERM
Date 09/06/11
JOB No. 0064276
FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

0 Ft bgs

Open Space

Alpha Ditch

N

47.7
62.5
55.8
81
65.3
52.6
58.5 J
51.8 J
41.4 J
82.2 J
52.8
52.9
47.7 J
150
52.2
84.5 J+
48
67.2
55.2 J+
59.3 J+
59.2 J-
48
155
48

City of Henderson Wastewater Reclamation Facility

Eastside Main

Beta Ditch

Galleria Alignment

>= 10 Ft bgs

Open Space

Alpha-Ditch

52.6
39.6
53.4
52.8
43.8
56.4
67.9 J
43.8 J
37.2 J
63.5 J
53.1
46.3 J
49
47
45 J
44.3
41.5
36.9
38.6
44 J-
40.6
47.5
33.6

City of Henderson Wastewater Reclamation Facility

Eastside Main

Beta Ditch

Galleria Alignment

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (23,500 mg/kg)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

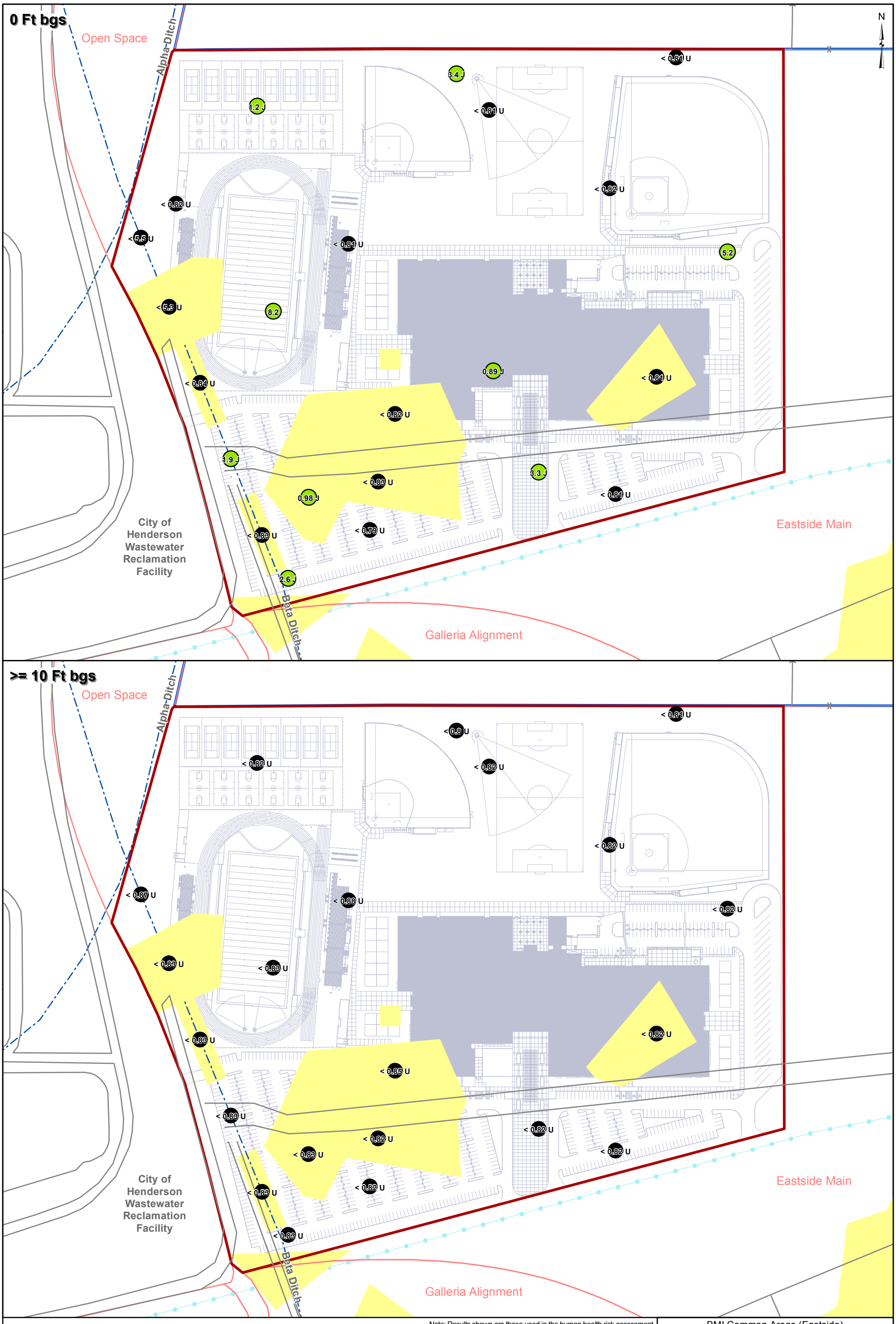
BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-32

ZINC SOIL RESULTS
IN GALLERIA NORTH
SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | ERM | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD


0 Ft bgs
Open Space
Alpha Ditch
N
< 0.81 U
3.4 J
1.2 J
< 0.81 U
< 0.82 U
< 0.82 U
< 5.5 U
< 0.81 U
5.2
< 5.3 U
8.2
0.89 J
< 0.81 U
< 0.84 U
< 0.82 U
1.9 J
3.3 J
< 0.83 U
0.98 J
< 0.81 U
< 0.83 U
< 0.79 U
2.6 J
City of Henderson Wastewater Reclamation Facility
Beta Ditch
Eastside Main
Galleria Alignment
>= 10 Ft bgs
Open Space
Alpha Ditch
< 0.81 U
< 0.8 U
< 0.82 U
< 0.82 U
< 0.82 U
< 0.87 U
< 0.88 U
< 0.82 U
< 0.83 U
< 0.83 U
< 0.82 U
< 0.83 U
< 0.85 U
< 0.83 U
< 0.82 U
< 0.82 U
< 0.83 U
< 0.82 U
< 0.83 U
< 0.83 U
City of Henderson Wastewater Reclamation Facility
Beta Ditch
Eastside Main
Galleria Alignment
Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas
Non-Detect
Detect (No BCL for Ammonia)
Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.
BMI Common Areas (Eastside)
Clark County, Nevada
FIGURE J-33
AMMONIA (as N) SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA
Basic Remediation Company
Prepared by MKJ (ERM)
ERM
Date 09/06/11
JOB No. 0064276
FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

## 0 Ft bgs

Open Space

Alpha Ditch

N

< 0.00174 U

0.00412 J

0.00431 J

0.0026 J

0.00285 J

0.00282 J

0.0101

< 0.00172 U

< 0.00173 U

0.00199 J

0.00185 J

0.00911

< 0.00175 U

0.0585

0.00573 J

0.0294 J

< 0.00169 U

< 0.0017 U

< 0.00172 U

< 0.00174 U

0.00194 J

City of Henderson Wastewater Reclamation Facility

0.00443 J

< 0.00172 U

Eastside Main

< 0.00178 U

Beta Ditch

Galleria Alignment

## >= 10 Ft bgs

Open Space

Alpha-Ditch

< 0.00175 U

< 0.00176 U

< 0.00178 U

< 0.00176 U

< 0.00176 U

< 0.00177 U

< 0.00178 U

< 0.00176 U

< 0.00175 U

< 0.00177 U

< 0.00177 U

< 0.00178 U

< 0.00175 U

0.00763

< 0.00176 U

< 0.00178 U

< 0.00176 U

< 0.00174 U

< 0.00182 U

City of Henderson Wastewater Reclamation Facility

< 0.00179 U

< 0.00179 U

Eastside Main

< 0.00182 U

Beta Ditch

Galleria Alignment

Galleria North School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Recent Soil Removal Areas

Non-Detect

Detect < 1/10-Residential BCL

>= 1/10-Residential BCL and < Residential BCL (0.0622 mg/kg)

>= Residential BCL and < 10x Residential BCL

>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

Benzo(a)pyrene is shown as representative of the PAH COPCs.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-34

BENZO(a)PYRENE SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM)

ERM

Date 09/06/11

JOB No. 0064276

FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

## 0 Ft bgs

Open Space

Alpha Ditch

< 0.0695 U
< 0.0695 U
< 0.0705 U
< 0.0698 U
< 0.0691 U
< 0.0695 U
< 0.0702 U
< 0.0687 U
< 0.0693 U
< 0.0714 U
< 0.0733 U
< 0.07 U
< 0.0697 U
< 0.0701 U
126 J
< 0.0677 U
< 0.068 U
< 0.0688 U
< 0.0696 U
< 0.0696 U
< 0.0695 U
< 0.0688 U
< 0.0713 U

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Eastside Main

Galleria Alignment

## >= 10 Ft bgs

Open Space

Alpha-Ditch

< 0.0698 U
< 0.0704 U
< 0.0714 U
< 0.0704 U
< 0.0703 U
< 0.0708 U
< 0.0711 U
< 0.0704 U
< 0.07 U
< 0.0708 U
< 0.0708 U
< 0.0699 U
< 0.0713 U
< 0.0718 UJ
< 0.0706 U
< 0.071 U
< 0.0705 U
< 0.0696 U
< 0.073 U
< 0.0715 U
< 0.0716 U
< 0.0726 U

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Eastside Main

Galleria Alignment

Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (240 mg/kg)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-35

BUTYL BENZYL PHTHALATE SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

**0 Ft bgs**

Open Space

Alpha Ditch

N

0.326

28.6 J

1.96

0.165

1.6

1.27

7.48

0.0555

0.375

20.1

23.2

21.1

0.0172 J

0.116 J

0.382

3.76

5.99

0.637

0.0553

3.36

0.161

0.0337 J

0.0841

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Eastside Main

Galleria Alignment

**>= 10 Ft bgs**

Open Space

Alpha-Ditch

0.278

0.805

0.419

0.81

1.22

1.83

0.462

4.55

0.955

0.176

3.83

0.737

3.31

1.5

0.311

0.318

0.602

0.653

1.65

10.1

0.657

0.449

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Eastside Main

Galleria Alignment

Galleria North School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Recent Soil Removal Areas

Non-Detect

Detect < 1/10-Residential BCL

>= 1/10-Residential BCL and < Residential BCL (54.8 mg/kg)

>= Residential BCL and < 10x Residential BCL

>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-36

PERCHLORATE SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

Prepared by MKJ (ERM) | Date 09/06/11 | JOB No. 0064276 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

0 Ft bgs

Open Space

Alpha-Ditch

N

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Galleria Alignment

Eastside Main

>= 10 Ft bgs

Open Space

Alpha-Ditch

City of Henderson Wastewater Reclamation Facility

Beta Ditch

Galleria Alignment

Eastside Main

Galleria North School Site Sub-Area

Site AOC3 Boundary

Eastside Soil Sub-Areas

Recent Soil Removal Areas

None Detected

1 Long Chrysotile Fiber

2-3 Long Chrysotile Fibers

4-7 Long Chrysotile Fibers

>7 Long Chrysotile Fibers

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

Results shown are for long fibers. No long amphibole fibers were detected in the human health risk assessment dataset.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-37

ASBESTOS SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation COMPANY

Prepared by MKJ (ERM)

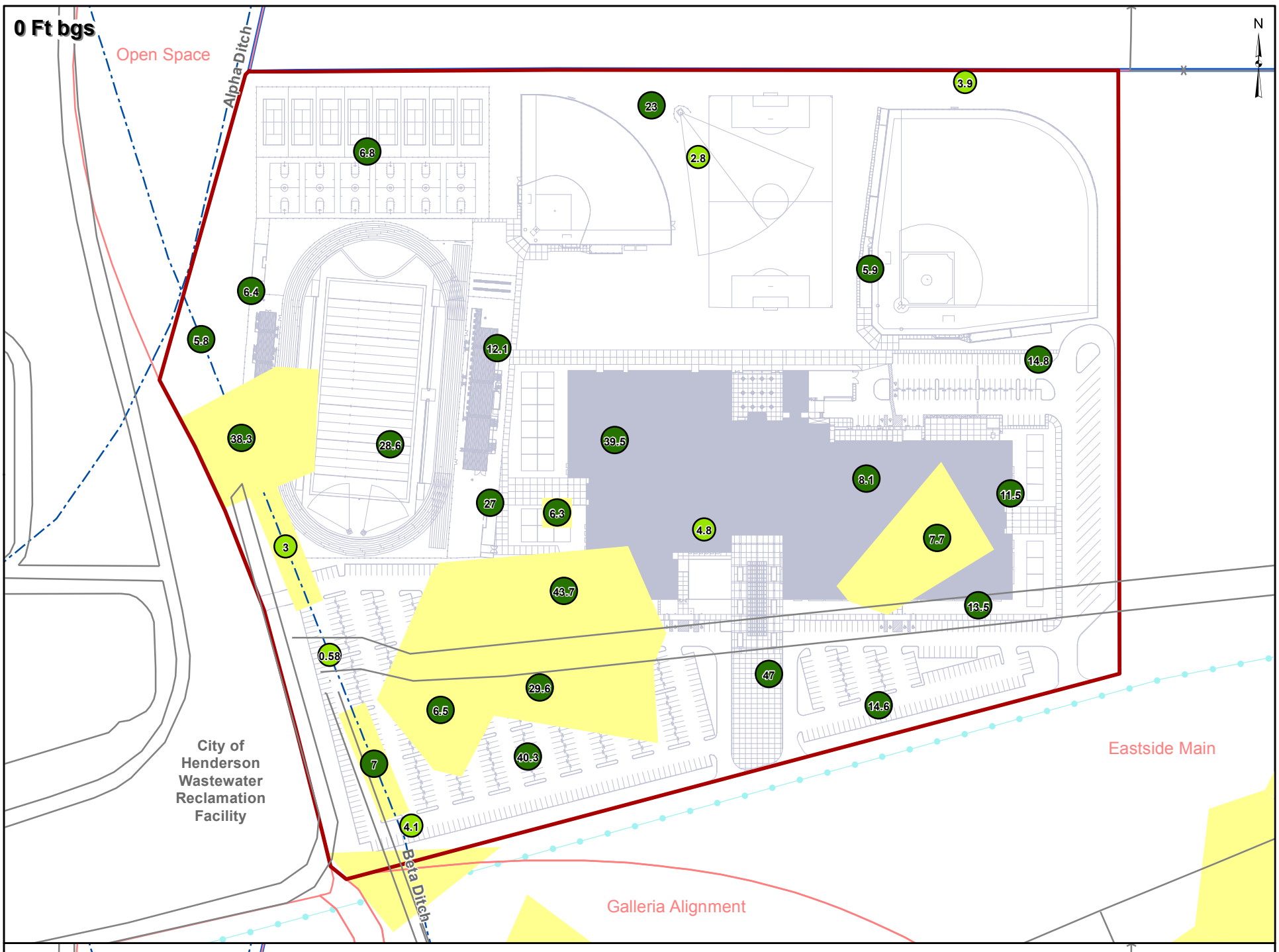
ERM

Date 09/06/11

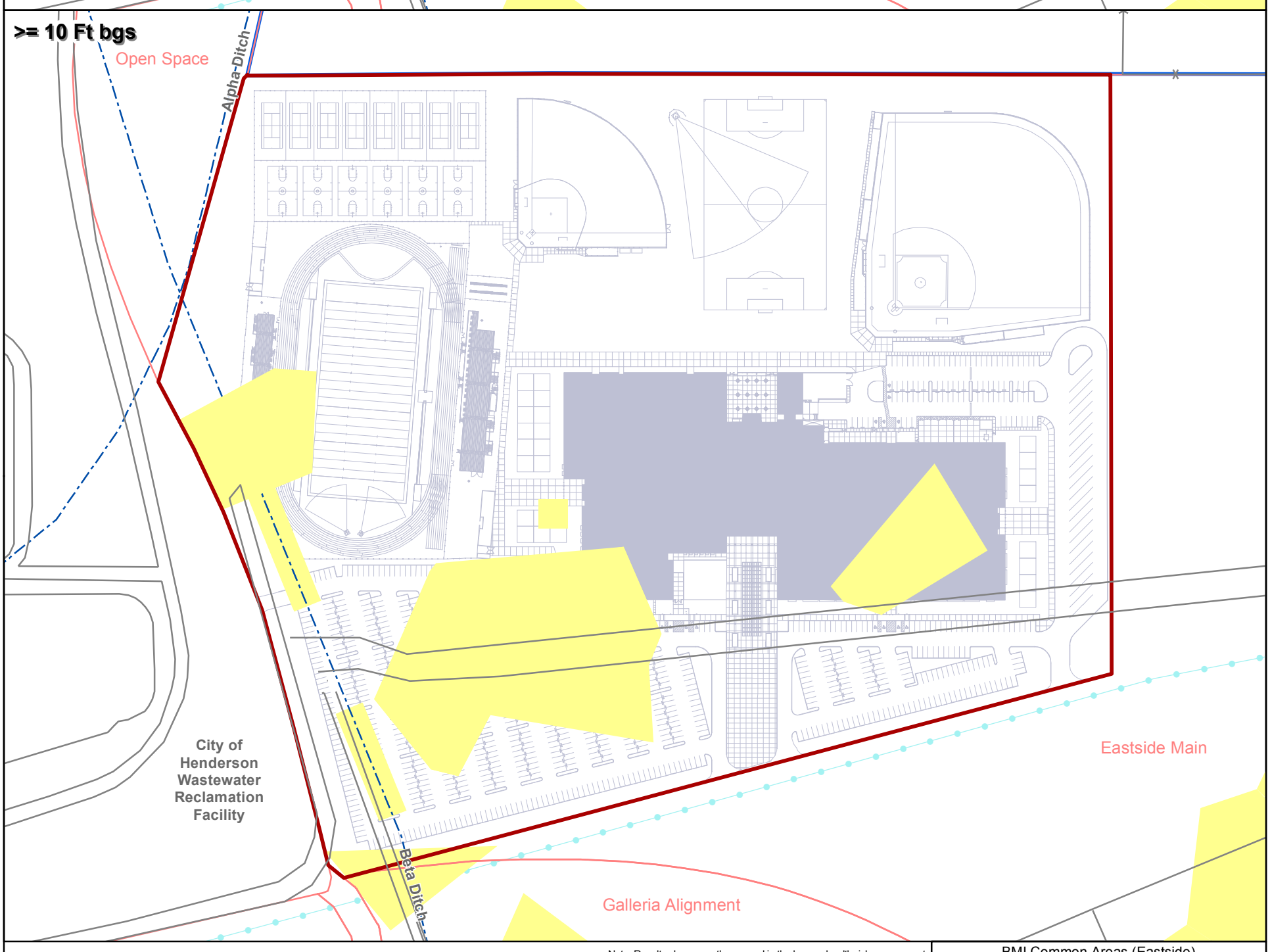
JOB No. 0064276

FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD

**0 Ft bgs**




**>= 10 Ft bgs**




Galleria North School Site Sub-Area
Site AOC3 Boundary
Eastside Soil Sub-Areas
Recent Soil Removal Areas

Non-Detect
Detect < 1/10-Residential BCL
>= 1/10-Residential BCL and < Residential BCL (50 ppt)
>= Residential BCL and < 10x Residential BCL
>= 10x Residential BCL

Note: Results shown are those used in the human health risk assessment. Comparison values (BCLs, max. background) are presented in Table 3-4.

Although not a COPC in the human health risk assessment, TCDD TEQ is presented here because it is a primary chemical of interest for the project.

BMI Common Areas (Eastside)
Clark County, Nevada

FIGURE J-38

TCDD TEQ SOIL RESULTS IN GALLERIA NORTH SCHOOL SITE SUB-AREA

Basic Remediation Company

| Prepared by | | Date | JOB No. 0064276 |
|---|---|---|---|
| MKJ (ERM) | ERM | 09/06/11 | FILE: GIS/BRC/GALLERIA-NORTH/APPENDIX_J.MXD |

# APPENDIX K

# IMPACTS TO GROUNDWATER MODELING

## LIST OF TABLES (APPENDIX K)


Table K-1 Rationale for COPCs Included in Impacts to Groundwater Modeling

Table K-2 Climate Parameters Used in the Impacts to Groundwater Modeling

Table K-3 Soil Physical Parameters Used in the SESOIL Modeling

Table K-4 Chemical Properties for COPCs in Vadose Zone

Table K-5 Chemical Application Data for SESOIL Modeling

Table K-6 Initial Chemical Concentrations at Time Zero for SESOIL Modeling

Table K-7 Impacts to Groundwater Modeling Results – Baseline Rainfall Recharge Conditions

Table K-8 Impacts to Groundwater Modeling Results – Normal Post-Development Recharge Conditions

Table K-9 Impacts to Groundwater Modeling Results – Enhanced Recharge Conditions

**TABLE K-1**
**RATIONALE FOR COPCS INCLUDED IN IMPACTS TO GROUNDWATER MODELING**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter of Interest | COPC | Units | Total Count | Detect Freq. | Censored (Non-Detect) Data | | | Detected Data | | | | | Residential Soil BCL | LBCL (DAF 1) | Count of Detects > DAF 1 | COPC? | Detects > DAF 1 | Max/ BCL Ratio | Model? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Count | Min | Max | Count | Min | Median | Mean | Max | | | | | | | | |
| **General Ions** | Ammonia (as N) | mg/kg | 49 | 20.4% | 39 | 0.79 | 5.5 | 10 | 0.89 | 2.3 | 2.9 | 8.2 | -- | -- | -- | Yes | No LBCL | No LBCL | Yes | (1) |
| | Perchlorate | mg/kg | 50 | 100% | 0 | -- | -- | 50 | 0.0172 | 0.7 | 3.3 | 28.6 | 54.8 | -- | -- | Yes | No LBCL | No LBCL | Yes | (2) |
| **Polynuclear Aromatic Hydrocarbons** | Benzo(a)anthracene | mg/kg | 50 | 16.0% | 42 | 0.00169 | 0.00183 | 8 | 0.00225 | 0.0042 | 0.012 | 0.0576 | 0.622 | 0.08 | 0 | Yes | No | NA | No | (3) |
| | Benzo(a)pyrene | mg/kg | 50 | 34.0% | 33 | 0.00169 | 0.00182 | 17 | 0.00185 | 0.0043 | 0.0098 | 0.0585 | 0.0622 | 0.4 | 0 | Yes | No | NA | No | (3) |
| | Benzo(b)fluoranthene | mg/kg | 50 | 38.0% | 31 | 0.0017 | 0.00183 | 19 | 0.0022 | 0.008 | 0.019 | 0.129 | 0.622 | 0.2 | 0 | Yes | No | NA | No | (3) |
| | Benzo(k)fluoranthene | mg/kg | 50 | 12.0% | 44 | 0.00169 | 0.00182 | 6 | 0.00229 | 0.0033 | 0.0038 | 0.00658 | 6.21 | 2 | 0 | Yes | No | NA | No | (3) |
| | Chrysene | mg/kg | 50 | 34.0% | 33 | 0.00169 | 0.00182 | 17 | 0.00231 | 0.0061 | 0.016 | 0.0904 | 62.1 | 8 | 0 | Yes | No | NA | No | (3) |
| | Dibenzo(a,h)anthracene | mg/kg | 50 | 8.0% | 46 | 0.00169 | 0.00182 | 4 | 0.00208 | 0.0082 | 0.019 | 0.0587 | 0.0622 | 0.08 | 0 | Yes | No | NA | No | (3) |
| | Indeno(1,2,3-cd)pyrene | mg/kg | 50 | 10.0% | 45 | 0.00169 | 0.00183 | 5 | 0.00195 | 0.0042 | 0.0092 | 0.0311 | 0.622 | 0.7 | 0 | Yes | No | NA | No | (3) |
| **SVOCs** | Butylbenzyl phthalate | mg/kg | 49 | 2.0% | 48 | 0.0677 | 0.0733 | 1 | 126 | 126 | 126 | 126 | 240 | 810 | 0 | Yes | No | NA | No | (3) |

**Notes:**

This table includes only data included in the risk assessment. Because of this, the total number of analyses does not always coincide with the total number of analyses reported in the tables in Appendix B, which include all data, regardless of status.

LBCL = Leaching-based BCLs from NDEP 2011a.

Max = Maximum

Min = Minimum

-- = Not applicable or no value has been established.

(1) Chemical has no $LBCL_{DAF1}$, has physical properties indicating relatively high mobility.

(2) High detection frequency, physical chemical parameters indicating mobility, no $LBCL_{DAF1}$, project chemical of interest.

(3) Maximum detect does not exceed $LBCL_{DAF1}$.

**TABLE K-2**
**CLIMATE PARAMETERS USED IN THE IMPACTS TO GROUNDWATER MODELING**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Month | Monthly Mean Air Temperature (ºC) | Monthly Mean Cloud Cover (fraction) | Monthly Mean Rel. Humidity (fraction) | Albedo (fraction) | Monthly Mean Evapo-transpiration (cm/day) | Total Precipitation per Month (cm/mo) | Mean Duration of Individual Storm Events (days) | Mean Number of Storm Events (per month) | Length of Rainy Season Each Month (days) | Normal[b] Recharge Scenario Total Precipitation per Month (cm/mo) | Enhanced Recharge Scenario Total Precipitation per Month (cm/mo) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct | 19.8 | 0.4 | 0.76 | 0.2 | 0[a] | 0.64 | 0.5 | 4 | 30.4 | 1.522 | 5.42 |
| Nov | 12.0 | 0.4 | 0.76 | 0.2 | 0[a] | 1.09 | 0.5 | 4.5 | 30.4 | 1.522 | 5.42 |
| Dec | 7.4 | 0.4 | 0.76 | 0.3 | 0[a] | 0.81 | 0.6 | 5 | 30.4 | 1.522 | 5.42 |
| Jan | 7.0 | 0.4 | 0.76 | 0.3 | 0[a] | 1.27 | 0.6 | 5 | 30.4 | 1.522 | 5.42 |
| Feb | 10.1 | 0.4 | 0.76 | 0.3 | 0[a] | 1.17 | 0.55 | 6 | 30.4 | 1.522 | 5.42 |
| Mar | 12.9 | 0.4 | 0.76 | 0.3 | 0[a] | 1.04 | 0.5 | 6 | 30.4 | 1.522 | 5.42 |
| Apr | 17.5 | 0.4 | 0.68 | 0.2 | 0[a] | 0.56 | 0.5 | 6 | 30.4 | 1.522 | 5.42 |
| May | 22.9 | 0.4 | 0.68 | 0.2 | 0[a] | 0.51 | 0.45 | 5.5 | 30.4 | 1.522 | 5.42 |
| Jun | 28.7 | 0.4 | 0.68 | 0.2 | 0[a] | 0.23 | 0.4 | 5 | 30.4 | 1.522 | 5.42 |
| Jul | 32.4 | 0.4 | 0.72 | 0.2 | 0[a] | 1.14 | 0.35 | 5 | 30.4 | 1.522 | 5.42 |
| Aug | 31.1 | 0.4 | 0.72 | 0.2 | 0[a] | 1.37 | 0.3 | 4.5 | 30.4 | 1.522 | 5.42 |
| Sept | 26.7 | 0.4 | 0.72 | 0.2 | 0[a] | 0.81 | 0.35 | 4.5 | 30.4 | 1.522 | 5.42 |

Notes: Climate data is SESOIL default data for Las Vegas, Nevada.

[a]If zero is input, SESOIL calculates evapotranspiration.

[b]Normal post development (housing) recharge.

**TABLE K-3**
**SOIL PHYSICAL PARAMETERS USED IN THE SESOIL MODELING**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Soil Physical Parameters | Units | Values | Source |
|---|---|---|---|
| Soil Density | $g/cm^3$ | 1.64 | Site Specific Average |
| Intrinsic Permeability | $cm^2$ | 1.16E-08 | Site Specific Average |
| Disconnectedness Index | unitless | 4.53 | Model Default |
| Porosity | percent | 40.15 | Site Specific Average |
| Organic Carbon Content | percent | 0.47% | Site Specific Average |
| Cation Exchange Capacity | milli. eq./100 g dry soil | 0 | Model Default |
| Freundlich Exponent | unitless | 1 | Model Default |

**TABLE K-4**
**CHEMICAL PROPERTIES FOR COPCs IN VADOSE ZONE**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Chemical-Specific Parameters | Units | Ammonia | Perchlorate |
|---|---|---|---|
| Source | -- | a | -- |
| Solubility | ug/ml | 4.82E+05 | 2.00E+03 |
| Diffusion Coefficient in air | $cm^2$/sec | 2.00E-01 | 1.00E-03 |
| Henry's Law Constant | $m^3$-atm/mole | 1.60E-05 | -- |
| Henry's Law Constant | -- | 6.58E-04 | -- |
| Adsorption Coefficient on Organic Carbon (Koc) | ml/g | 3.09E+00 | -- |
| Adsorption Coefficient on Soil[c] | ml/g | -- | -- |
| Molecular Weight | g/mole | 17.03 | 117.49 |
| Valence | +/- | 0 | 0 |
| Neutral Hydrolysis Constant | /day | 0 | 0 |
| Base Hydrolysis Constant | l/mole-day | 0 | 0 |
| Acid Hydrolysis Constant | l/mole-day | 0 | 0 |
| Half Life ($t_{1/2}$ ) | years | 0 | 0 |
| Degradation Rate in Moisture | 1/day | 0 | 0 |
| Degradation Rate on Soil | 1/day | 0 | 0 |
| Ligand-Pollutant Stability Constant | unitless | 0 | 0 |
| No. Moles Ligand/Mole Pollutant | unitless | 0 | 0 |

Notes:
a - ORNL. 2011.

**TABLE K-5**
**CHEMICAL APPLICATION DATA FOR SESOIL MODELING**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Parameter | Units | Application Zone | Source |
|---|---|---|---|
| Soil Cover Efficiency | unitless | 0 | Site Specific |
| Number of Soil Infiltration Layers | unitless | 4 | Site Specific |
| Simulation run time | years | 100 | Site Specific |
| Area | acres | 44 | Site Specific |
| Application Area Latitude | degrees | 35 | Site Specific |
| Infiltration Layer 1 Thickness | cm (feet) | 305 (10) | Site Specific |
| Infiltration Layer 2 Thickness | cm (feet) | 152.4 (5) | Site Specific |
| Infiltration Layer 3 Thickness | cm (feet) | 152.4 (5) | Site Specific |
| Infiltration Layer 4 Thickness | cm (feet) | 152.4 (5) | Site Specific |
| Depth to Groundwater | cm (feet) | 762 (25) | Site Specific |
| Infiltration Layer Where Chemical is Applied | | 1 | Site Specific |
| pH of soil | unitless | 8.0 | Site Specific |
| Liquid Phase Biodegradation Ratio | unitless | 1 | Default |
| Soil Phase Biodegradation Ratio | unitless | 1 | Default |
| Organic Carbon Content Ratio | unitless | 1 | Default |
| Cation Exchange Capacity Ratio | unitless | 1 | Default |
| Frenudlich Exponent Ratio | unitless | 1 | Default |
| Adsorption Coefficient Ratio | unitless | 1 | Default |

**TABLE K-6**
**INITIAL CHEMICAL CONCENTRATIONS AT TIME ZERO FOR SESOIL MODELING**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Application Area | Depth (feet bgs) | Units | Source | Ammonia | Perchlorate |
|---|---|---|---|---|---|
| **Layer One** | | | | | |
| Infiltration Sub-Layer One | 0-1 | mg/kg | Site Specific | 8.2 | 28.6 |
| Infiltration Sub-Layer Two | 1-2 | mg/kg | Site Specific | 8.2 | 28.6 |
| Infiltration Sub-Layer Three | 2-3 | mg/kg | Site Specific | 8.2 | 28.6 |
| Infiltration Sub-Layer Four | 3-4 | mg/kg | Site Specific | 8.2 | 28.6 |
| Infiltration Sub-Layer Five | 4-5 | mg/kg | Site Specific | 8.2 | 28.6 |
| Infiltration Sub-Layer Six | 5-6 | mg/kg | Site Specific | 8.2 | 28.6 |
| Infiltration Sub-Layer Seven | 6-7 | mg/kg | Site Specific | 8.2 | 28.6 |
| Infiltration Sub-Layer Eight | 7-8 | mg/kg | Site Specific | 8.2 | 28.6 |
| Infiltration Sub-Layer Nine | 8-9 | mg/kg | Site Specific | 8.2 | 28.6 |
| Infiltration Sub-Layer Ten | 9-10 | mg/kg | Site Specific | 8.2 | 28.6 |
| **Layer Two** | | | | | |
| Infiltration Sub-Layer One | 10-11 | mg/kg | Site Specific | 0 | 10.1 |
| Infiltration Sub-Layer Two | 11-12 | mg/kg | Site Specific | 0 | 1.83 |
| Infiltration Sub-Layer Three | 12-13 | mg/kg | Site Specific | 0 | 0 |
| Infiltration Sub-Layer Four | 13-14 | mg/kg | Site Specific | 0 | 0 |
| Infiltration Sub-Layer Five | 14-15 | mg/kg | Site Specific | 0 | 0 |
| **Layer Three** | | | | | |
| Infiltration Sub-Layer One | 15-16 | mg/kg | Site Specific | 0 | 0 |
| Infiltration Sub-Layer Two | 16-17 | mg/kg | Site Specific | 0 | 0 |
| Infiltration Sub-Layer Three | 17-18 | mg/kg | Site Specific | 0 | 0 |
| Infiltration Sub-Layer Four | 18-19 | mg/kg | Site Specific | 0 | 0 |
| Infiltration Sub-Layer Five | 19-20 | mg/kg | Site Specific | 0 | 0 |
| **Layer Four** (sub layers one to five) | 20-25 | mg/kg | Site Specific | -- | -- |

**TABLE K-6**
**INITIAL CHEMICAL CONCENTRATIONS AT TIME ZERO FOR SESOIL MODELING**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| Application Area | Depth (feet bgs) | Units | Source | Ammonia | Perchlorate |
|---|---|---|---|---|---|
| **Layer One** | | | | | |
| Infiltration Sub-Layer One | 0-1 | ug/ml | Site Specific | 13.448 | 46.904 |
| Infiltration Sub-Layer Two | 1-2 | ug/ml | Site Specific | 13.448 | 46.904 |
| Infiltration Sub-Layer Three | 2-3 | ug/ml | Site Specific | 13.448 | 46.904 |
| Infiltration Sub-Layer Four | 3-4 | ug/ml | Site Specific | 13.448 | 46.904 |
| Infiltration Sub-Layer Five | 4-5 | ug/ml | Site Specific | 13.448 | 46.904 |
| Infiltration Sub-Layer Six | 5-6 | ug/ml | Site Specific | 13.448 | 46.904 |
| Infiltration Sub-Layer Seven | 6-7 | ug/ml | Site Specific | 13.448 | 46.904 |
| Infiltration Sub-Layer Eight | 7-8 | ug/ml | Site Specific | 13.448 | 46.904 |
| Infiltration Sub-Layer Nine | 8-9 | ug/ml | Site Specific | 13.448 | 46.904 |
| Infiltration Sub-Layer Ten | 9-10 | ug/ml | Site Specific | 13.448 | 46.904 |
| **Layer Two** | | | | | |
| Infiltration Sub-Layer One | 10-11 | ug/ml | Site Specific | 0.000 | 16.564 |
| Infiltration Sub-Layer Two | 11-12 | ug/ml | Site Specific | 0.000 | 3.001 |
| Infiltration Sub-Layer Three | 12-13 | ug/ml | Site Specific | 0.000 | 0.000 |
| Infiltration Sub-Layer Four | 13-14 | ug/ml | Site Specific | 0.000 | 0.000 |
| Infiltration Sub-Layer Five | 14-15 | ug/ml | Site Specific | 0.000 | 0.000 |
| **Layer Three** | | | | | |
| Infiltration Sub-Layer One | 15-16 | ug/ml | Site Specific | 0.000 | 0.000 |
| Infiltration Sub-Layer Two | 16-17 | ug/ml | Site Specific | 0.000 | 0.000 |
| Infiltration Sub-Layer Three | 17-18 | ug/ml | Site Specific | 0.000 | 0.000 |
| Infiltration Sub-Layer Four | 18-19 | ug/ml | Site Specific | 0.000 | 0.000 |
| Infiltration Sub-Layer Five | 19-20 | ug/ml | Site Specific | 0.000 | 0.000 |
| **Layer Four** (sub layers one to five) | 20-25 | ug/ml | Site Specific | -- | -- |

NOTE: Concentrations in units mg/kg are dry weight based and are converted to units of ug/ml based on site-specific measurements of soil bulk density (Table J-3).

$Conc.(ug/ml)=Conc.(mg/kg)\times 1000ug/mg\times 0.001kg/g\times 1.6131g/cm^3\times 1cm^3/ml$

**TABLE K-7**
**IMPACTS TO GROUNDWATER MODELING RESULTS - BASELINE RAINFALL RECHARGE CONDITIONS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| COPC | Time to Reach Groundwater (years) | Maximum Migration Depth (ft bgs) | Depth to Groundwater (ft bgs) | Maximum Soil Moisture Conc. at Groundwater Interface (µg/L) | Maximum Measured Groundwater Concentration[a] (µg/L) | Residential Water BCL (µg/L) |
|---|---|---|---|---|---|---|
| Ammonia | 17 | GW | 25 | 1108000 | 13.5 | 730 |
| Perchlorate | 9 | GW | 25 | 2000000 | 7600 | 18 |

[a]From Sixth Round Groundwater Monitoring Report (Aug - Sept 2009) for the BMI Common Areas (Eastside).

**TABLE K-8**
**IMPACTS TO GROUNDWATER MODELING RESULTS - NORMAL POST-DEVELOPMENT RECHARGE CONDITIONS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| COPC | Time to Reach Groundwater (years) | Maximum Migration Depth (ft bgs) | Depth to Groundwater (ft bgs) | Maximum Soil Moisture Conc. at Groundwater Interface (µg/L) | Maximum Measured Groundwater Concentration[a] (µg/L) | Residential Water BCL (µg/L) |
|---|---|---|---|---|---|---|
| Ammonia | 8 | GW | 25 | 638000 | 13.5 | 730 |
| Perchlorate | 5 | GW | 25 | 2000000 | 7600 | 18 |

[a]From Sixth Round Groundwater Monitoring Report (Aug - Sept 2009) for the BMI Common Areas (Eastside).

**TABLE K-9**
**IMPACTS TO GROUNDWATER MODELING RESULTS - ENHANCED RECHARGE CONDITIONS**
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH SCHOOL SITE SUB-AREA**
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**


| COPC | Time to Reach Groundwater (years) | Maximum Migration Depth (ft bgs) | Depth to Groundwater (ft bgs) | Maximum Soil Moisture Conc. at Groundwater Interface (µg/L) | Maximum Measured Groundwater Concentration[a] (µg/L) | Residential Water BCL (µg/L) |
|---|---|---|---|---|---|---|
| Ammonia | 2 | GW | 25 | 166800 | 13.5 | 730 |
| Perchlorate | 2 | GW | 25 | 588000 | 7600 | 18 |

[a]From Sixth Round Groundwater Monitoring Report (Aug - Sept 2009) for the BMI Common Areas (Eastside).

# APPENDIX L

# LEGAL DESCRIPTION OF THE GALLERIA NORTH SCHOOL SITE SUB-AREA

ATKINS

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# LEGAL DESCRIPTION
# NFA – GALLERIA SCHOOL SITE

A PORTION OF SECTION 31, TOWNSHIP 21 SOUTH, RANGE 63 EAST, M.D.M., CITY OF HENDERSON, CLARK COUNTY, NEVADA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHWEST CORNER OF THE SOUTH HALF (S 1/2) OF SAID SECTION 31; THENCE SOUTH 89°50'56" EAST, ALONG THE NORTH LINE OF SAID SOUTH HALF (S 1/2), 2662.71 FEET; THENCE SOUTH 00°59'58" EAST, DEPARTING SAID NORTH LINE, 814.04 FEET TO **THE POINT OF BEGINNING**; THENCE SOUTH 00°59'58" EAST, 1058.03 FEET TO THE BEGINNING OF A NON-TANGENT CURVE CONCAVE SOUTHEASTERLY HAVING A RADIUS OF 14039.00 FEET, A RADIAL LINE TO SAID BEGINNING BEARS NORTH 14°05'47" WEST; THENCE ALONG SAID CURVE TO THE LEFT THROUGH A CENTRAL ANGLE OF 2°12'57", AN ARC LENGTH OF 542.96 FEET TO THE BEGINNING OF A REVERSE CURVE CONCAVE NORTHWESTERLY HAVING A RADIUS OF 15930.00 FEET, A RADIAL LINE TO SAID BEGINNING BEARS SOUTH 16°18'44" EAST; THENCE ALONG SAID CURVE TO THE RIGHT THROUGH A CENTRAL ANGLE OF 2°10'25", AN ARC LENGTH OF 604.33 FEET TO THE BEGINNING OF A COMPOUND CURVE CONCAVE NORTHEASTERLY HAVING A RADIUS OF 20.00 FEET, A RADIAL LINE TO SAID BEGINNING BEARS SOUTH 14°08'19" EAST; THENCE ALONG SAID CURVE TO THE RIGHT THROUGH A CENTRAL ANGEL OF 89°48'56", AN ARC LENGTH OF 31.35 FEET; THENCE NORTH 14°19'23" WEST, 347.45 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE SOUTHWESTERLY HAVING A RADIUS OF 2030.00 FEET; THENCE ALONG SAID CURVE TO THE LEFT THROUGH A CENTRAL ANGLE OF 13°51'53", AN ARC LENGTH OF 491.23 FEET TO THE BEGINNING OF A REVERSE CURVE CONCAVE NORTHEASTERLY HAVING A RADIUS OF 1970.00 FEET, A RADIAL LINE TO SAID BEGINNING BEARS SOUTH 61°48'44" WEST; THENCE ALONG SAID CURVE TO THE RIGHT THROUGH A CENTRAL ANGLE OF 1°04'35", AN ARC LENGTH OF 37.01 FEET TO THE BEGINNING OF A NON-TANGENT CURVE CONCAVE NORTHWESTERLY HAVING A RADIUS OF 1232.59 FEET, A RADIAL LINE TO SAID BEGINNING BEARS SOUTH 64°48'41" EAST; THENCE ALONG SAID CURVE TO THE LEFT THROUGH A CENTRAL ANGLE OF 13°15'17", AN ARC LENGTH OF 285.14 FEET; THENCE NORTH 11°56'02" EAST, 250.10 FEET; THENCE NORTH 89°49'05" EAST, 1251.33 FEET TO THE **POINT OF BEGINNING**.

CONTAINING 1,559,621 SQUARE FEET (35.8 ACRES), MORE OR LESS, AS DETERMINED BY COMPUTER METHODS.

**BASIS OF BEARINGS**

THE BASIS OF BEARINGS FOR THIS LEGAL DESCRIPTION IS GRID NORTH AS DEFINED BY THE NEVADA COORDINATE SYSTEM OF 1983(NC83) EAST ZONE (2701).

---

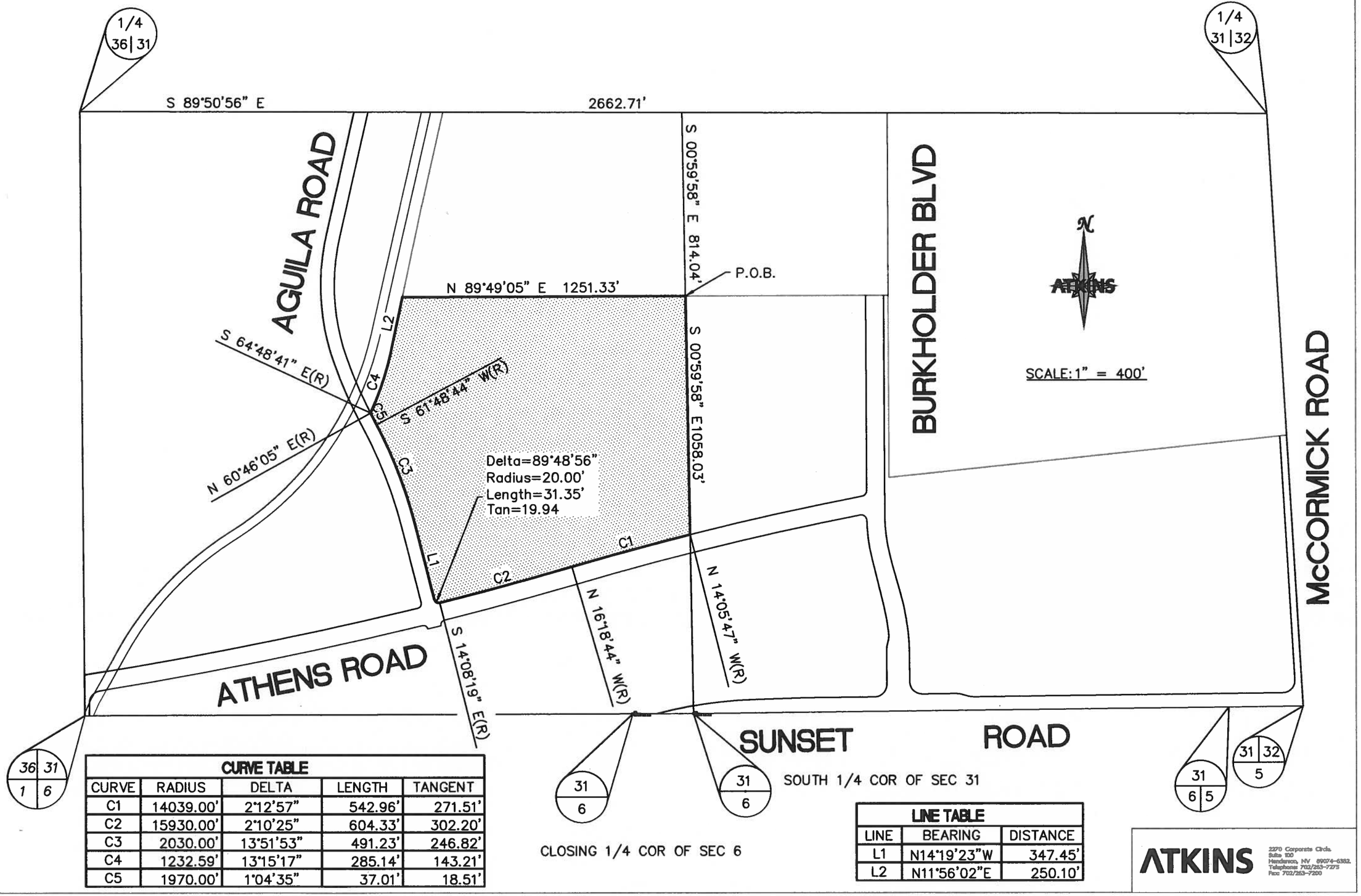
Parcel name: NFA-SCHOOLSITE

```
   North: 27312.8693          East : 19537.3807
Line  Course: S 00-59-58 E  Length: 1058.03
        North: 26254.9968           East : 19555.8339
Curve  Length: 542.96              Radius: 14039.00
        Delta: -2-12-57           Tangent: 271.51
        Chord: 542.93              Course: S 74-47-45 W
    Course In: S 14-05-47 E     Course Out: N 16-18-44 W
    RP  North: 12638.7428           East : 22975.0658
    End North: 26112.6082           East : 19031.9107
Curve  Length: 604.33              Radius: 15930.00
        Delta: 2-10-25            Tangent: 302.20
        Chord: 604.30              Course: S 74-46-28 W
    Course In: N 16-18-44 W     Course Out: S 14-08-19 E
    RP  North: 41401.3521           East : 14557.6276
    End North: 25953.9095           East : 18448.8250
Curve  Length: 31.35               Radius: 20.00
        Delta: 89-48-56           Tangent: 19.94
        Chord: 28.24               Course: N 59-13-51 W
    Course In: N 14-08-19 W     Course Out: S 75-40-37 W
    RP  North: 25973.3037           East : 18443.9397
    End North: 25968.3559           East : 18424.5613
Line  Course: N 14-19-23 W  Length: 347.45
        North: 26305.0091           East : 18338.6055
Curve  Length: 491.23              Radius: 2030.00
        Delta: -13-51-53          Tangent: 246.82
        Chord: 490.03              Course: N 21-15-19 W
    Course In: S 75-40-37 W     Course Out: N 61-48-44 E
    RP  North: 25802.8113           East : 16371.7051
    End North: 26761.7061           East : 18160.9565
Curve  Length: 37.01               Radius: 1970.00
        Delta: 1-04-35            Tangent: 18.51
        Chord: 37.01               Course: N 27-38-58 W
    Course In: N 61-48-44 E     Course Out: S 62-53-20 W
    RP  North: 27692.2593           East : 19897.3237
    End North: 26794.4918           East : 18143.7805
Curve  Length: 285.14              Radius: 1232.59
        Delta: -13-15-17          Tangent: 143.21
        Chord: 284.51              Course: N 18-33-41 E
    Course In: N 64-48-41 W     Course Out: S 78-03-58 E
    RP  North: 27319.0810           East : 17028.3952
    End North: 27064.2014           East : 18234.3449
Line  Course: N 11-56-02 E  Length: 250.10
        North: 27308.8952           East : 18286.0613
Line  Course: N 89-49-05 E  Length: 1251.33
        North: 27312.8693           East : 19537.3807

   Perimeter: 4898.94   Area: 1,559,621 sq. ft. 35.80 acres
```

# NFA GALLERIA NORTH SCHOOL SITE EXHIBIT

A PORTION OF THE SOUTH HALF (S 1/2) OF SECTION 31, TOWNSHIP 21 SOUTH, RANGE 63 EAST, M.D.M., CITY OF HENDERSON, CLARK COUNTY, NEVADA,,




**CURVE TABLE**

| CURVE | RADIUS | DELTA | LENGTH | TANGENT |
|---|---|---|---|---|
| C1 | 14039.00' | 2°12'57" | 542.96' | 271.51' |
| C2 | 15930.00' | 2°10'25" | 604.33' | 302.20' |
| C3 | 2030.00' | 13°51'53" | 491.23' | 246.82' |
| C4 | 1232.59' | 13°15'17" | 285.14' | 143.21' |
| C5 | 1970.00' | 1°04'35" | 37.01' | 18.51' |

**LINE TABLE**

| LINE | BEARING | DISTANCE |
|---|---|---|
| L1 | N14°19'23"W | 347.45' |
| L2 | N11°56'02"E | 250.10' |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