BRC HUMAN HEALTH RISK ASSESSMENT REPORT

BORROW AREA
CLARK COUNTY, NEVADA

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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 were generated by a laboratory certified by the NDEP for each constituent and media presented herein.

March 26, 2007

Dr. Ranajit Sahu, C.E.M. (No. EM-1699, Exp. 10/07/2007) Date
BRC Project Manager

I hereby certify that I also reviewed the document for quality control purposes myself.

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Note: The December 2006 revision of this report was prepared and submitted by MWH. Subsequent to that submittal, the MWH staff who prepared this report joined Environmental Resources Management (ERM). The style and format of the original version of the report have been retained to promote consistency for reviewers.

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ACRONYMS AND ABBREVIATIONS

ADD	average daily dose
AF	absorption fraction
AT	averaging time
ATSDR	Agency for Toxic Substances and Disease Registry
BRC	Basic Remediation Company
bgs	below ground surface
BIO	oral bioavailability
BW	body weight
CAMU	Corrective Action Management Unit
CFR	Code of Federal Regulations
COPCs	chemicals of potential concern
CSF	cancer slope factor
CSM	conceptual site model
DBS&A	Daniel B. Stephens & Associates, Inc.
DOE	U.S. Department of Energy
DQIs	data quality indicators
DVSR	Data Validation Summary Report
ECAO	Environmental Criteria and Assessment Office
ED	exposure duration
EF	exposure frequency
FSSOP	Field Sampling and Standard Operating Procedures
ft/ft	foot per foot
GES	Geotechnical & Environmental Services, Inc.
GISdT	Guided Interactive Statistical Decision Tools
HI	hazard index
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HQ	hazard quotient
IEUBK	Integrated Exposure Uptake Biokinetic Model
ILCR	incremental lifetime cancer risk
IR	intake rate
IRIS	Integrated Risk Information System
LCS	laboratory control sample
LCS/LCSD	laboratory control sample/ laboratory control sample duplicate

ACRONYMS AND ABBREVIATIONS (Continued)

LADD	lifetime average daily dose
LMS	linearized multi-stage
LOAEL	lowest-observed-adverse-effect-level
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter
mph	miles per hour
MS	matrix spike
MSD	matrix spike duplicate
MLE	maximum likelihood estimate
msl	mean sea level
MWH	MWH Americas, Inc.
NCEA	National Center for Environmental Assessment
NDEP	Nevada Division of Environmental Protection
NOAEL	no-observable-adverse-effect-level
NRS	Nevada Revised Statutes
OEHHA	California Office of Environmental Health Hazards Assessment
PAHs	polycyclic aromatic hydrocarbons
PARCC	precision, accuracy, representativeness, comparability, and completeness
Parsons	Parsons Engineering Science, Inc.
PBT	persistent, bioaccumulative, and toxic
PCBs	polychlorinated biphenyls
PEF	Particulate Emission Factor
PPRTVs	Provisional Peer Reviewed Toxicity Values
ppt	parts per trillion
PR	percent recovery
PRGs	Preliminary Remediation Goals
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RAGS	Risk Assessment Guidance for Superfund
RBSL	risk based screening level
RfD	Reference dose
RPD	relative percent difference
SNWA	Southern Nevada Water Authority

ACRONYMS AND ABBREVIATIONS (Continued)

SOPs	Standard Operating Procedures
STL	Severn Trent Laboratories, Inc.
SVOCs	semi-volatile organic compounds
TCDD	tetrachlorodibenzo-*p*-dioxin
TEQ	toxic equivalency
TICs	tentatively identified compounds
TIMET	Titanium Metals Corporation
UCL	upper confidence limit
URF	Unit Risk Factor
USEPA	U.S. Environmental Protection Agency
VOCs	volatile organic compounds
WRF	wastewater reclamation facility

EXECUTIVE SUMMARY

On behalf of Basic Remediation Company (BRC), Environmental Resources Management (ERM) has prepared this Human Health Risk Assessment (HHRA) for the Borrow Area located within the area proposed for the BRC Corrective Action Management Unit (CAMU) (Site) in Clark County, Nevada. Findings of the HHRA are intended to support the use of excavated Borrow Area soils as off-site fill material. This risk assessment evaluates use scenarios that include placement of the excavated soils in non-residential areas subject to constraints as discussed in the *Human Health Risk Assessment Work Plan*. The risk assessment report was conducted using validated data collected during a number of investigations from 1999 to 2006.

This risk assessment conforms with Revision 3 of the *Human Health Risk Assessment Work Plan*, which incorporates Nevada Division of Environmental Protection (NDEP) comments dated May 19, 2006 on the April 2006 revision (Revision 0) of the Work Plan; NDEP comments dated July 10, 2006 on the June 2006 revision (Revision 1) of the Work Plan; NDEP comments dated August 25, 2006 on the June 2006 revision (Revision 2) of the Work Plan; and NDEP comments dated November 9, 2006 and November 16, 2006 on the October 2006 revision (Revision 3). Revision 3 of the Work Plan was accepted by the NDEP on November 17, 2006. In addition, this revision of the risk assessment (Revision 1) also incorporates NDEP comments on the December 2006 *Human Health Risk Assessment* dated March 4, 2007, as well as issues resolved with NDEP and their consultants concerning data usability, and incorporates NDEP supplemental comments concerning VLEACH modeling dated March 13, 2007, as well as comments on background comparison statistics and exposure point concentrations received via email on March 18, 2007. The basic procedures outlined by the U.S. Environmental Protection Agency (USEPA) were followed. Because the anticipated use of the fill material is for non-residential commercial purposes, the risk assessment did not evaluate a hypothetical future residential exposure scenario.

This report is composed of several chapters that include: a discussion of the history of the Site including site characterization findings (Chapter 2); an evaluation of the data to ensure data quality objectives were met for risk assessment and an overview of the data validation with respect to the data usability of the dataset (Chapter 3); a detailed conceptual site model (CSM) including fate and transport analyses of chemicals of potential concern (COPCs) (Chapter 4); the selection of COPCs (Chapter 5); the human health risk assessment (Chapter 6); the uncertainties associated with the risk estimates are discussed (Chapter 7), followed by a summary of results for the risk assessment (Chapter 8), and finally, the analysis of potential impacts to groundwater associated with the proposed fill placement scenarios is discussed (Chapter 9).

BACKGROUND

The Site is comprised of the north and south Borrow Areas, excluding the portion of the Western Ditch that separates these areas. The north Borrow Area is in the southwest portion of the CAMU, north of the Western Ditch, and encompasses an area of approximately 9.3 acres. The north Borrow Area is bordered on the west by the western CAMU boundary along Eastgate Road, on the north by the westernmost portion of the existing landfill (approximately 300 feet north of the Borrow Area), on the east by the southern lobe of the existing landfill, and to the south by the Western Ditch.

The south Borrow Area is in the southwest portion of the CAMU, south of the Western Ditch, and encompasses an area of approximately 8.5 acres. The south Borrow Area is bordered on the west by the western CAMU boundary along Eastgate Road, on the north by the Western Ditch, on the east by vacant land, and to the south by southern CAMU boundary.

Use of excavated Borrow Area soils is intended as off-site fill material. This risk assessment evaluates on-site scenarios that include current or future trespassers as well as the presence of future construction workers involved in the excavation of borrow material, and off-site scenarios that include planned non-residential development conditions at off-site locations as well as commercial/industrial use scenarios at off-site locations subject to the constraints discussed in the accepted Work Plan. Therefore, potentially exposed current and future receptors would include future on-site/off-site construction workers, current/future on-site trespassers, and future off-site maintenance workers.

SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The objective of the COPC selection process was to identify and focus on those substances that contribute the greatest to the incremental risk to human health. COPCs identified in soils at the Site included inorganic chemicals (for example, arsenic), volatile organic compounds (VOCs; for example, benzene), semi-volatile organic compounds (SVOCs; hexachlorobenzene), organo-chlorine pesticides (for example, 4,4'-DDT), dioxins/furans, asbestos, and radionuclides. The procedures used to eliminate detected chemicals as COPCs for evaluation in the risk assessment include:

- identification of chemicals with detected levels which are statistically comparable to background concentrations (where applicable), and

- identification of chemicals that are infrequently detected at the Site, with the exception of metals, known human carcinogens, and persistent, bioaccumulative, and toxic (PBT) chemicals. Prior to eliminating a COPC based on the frequency of detection criteria, (1) any elevated detection limits are addressed, and (2) data distributions within the Site are considered.

HUMAN HEALTH RISK ASSESSMENT

The human health risks associated with the Borrow Area soils for a given individual are dependent upon the degree to which that individual is likely to be exposed. Exposure is influenced by the types and duration of activities that will be conducted on the property. In the future the soils will be used in areas planned for non-residential development conditions as well as commercial/industrial use scenarios commercial development purposes. Therefore, future on-site and off-site construction workers, future off-site outdoor maintenance workers, and current/future on-site trespassers are the populations that might be potentially exposed to chemicals in Borrow Area soils.

In evaluating the exposure of chemicals to future on-site/off-site construction workers, future off-site maintenance workers, and current/future onsite trespassers, a series of assumptions were developed. Many of the exposure assumptions in this evaluation were developed by USEPA and reflect activities expected to result in a reasonable maximum exposure to chemicals. Default values are not defined by USEPA for the trespasser. The current/future on-site trespasser exposure parameters were developed taking into account site-specific conditions and professional judgment as discussed in the accepted Work Plan. The use of reasonable maximum exposure assumptions is conservative and the risk estimates calculated in this risk assessment are likely to overestimate risks for the potentially exposed populations.

RISK CHARACTERIZATION RESULTS

This section summarizes the major findings of the risk assessment. A summary of the results of this assessment are presented in Table ES-1. Consistent with USEPA guidance, non-cancer health effects and theoretical upper-bound incremental lifetime cancer risks (ILCRs)[1] were

[1] From USEPA (1989), "For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen (*i.e.*, incremental or excess individual lifetime cancer risk)." The term "incremental" here means site-related cancer risk in addition to/above and beyond the "normal" background probability of cancer expected as a result of other factors such as other exposures, diet and genetic predisposition.

evaluated separately. ILCRs are expressed as an estimate of the probability that a person could develop cancer from exposure to the carcinogenic chemical. A risk level of 1×10^{-6} represents an incremental probability of one in a 1,000,000 that an individual could develop cancer due to the carcinogen under the defined set of exposure conditions. A risk range of 10^{-4} to 10^{-6} (one in 10,000 to one in 1,000,000) is defined by USEPA as the acceptable risk range. According to USEPA, "…acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response." (*National Oil and Hazardous Substances Pollution Contingency Plan*; 40 Code of Federal Regulations [CFR] 300.430). NDEP considers a cumulative theoretical upper-bound incremental carcinogenic risk level of 1×10^{-6} as the regulatory point of departure. Non-cancer health effects are expressed as a hazard index (HI). Hazard indices less than one are not considered to be associated with adverse health effects.

EVALUATION OF UNCERTAINTIES

Each of the risk estimates calculated in this report is associated with some degree of uncertainty. Uncertainties arise at each of the steps of the risk assessment including the environmental sampling, selection of COPCs, exposure assessment, and toxicity assessment. Uncertainties associated with the environmental sampling and the selection of COPCs depend on the degree to which samples collected and analyzed in the risk assessment are representative of Site chemical and radiological conditions. In this assessment, the environmental sampling was conducted for a broad suite of analytes, and the COPCs were selected using conservative criteria. Therefore, it is unlikely that significant risks were missed or underestimated.

Uncertainties related to the receptor selected to represent the populations chosen for evaluation and their assumed extent of exposure are also found in a risk assessment. In this assessment, several different populations with different levels of exposure were considered, and for each population conservative assumptions (often the 95th percentile of exposure activity parameters) regarding the extent of exposure were made. Use of these reasonable maximum exposure assumptions will overestimate the risks for most exposure scenarios. For example, skin contact risks estimated with reasonable maximum exposure assumptions are two to three orders of magnitude higher than skin contact risks using average assumptions.

There are also uncertainties associated with the toxicity parameters used in the risk characterization. When data are lacking, the toxicity criteria incorporate conservative assumptions and are intended to overestimate risk. In some cases in this assessment, toxicity criteria were unavailable for some COPCs. Therefore, a quantitative estimation of risk was not

conducted for certain chemicals and the risks presented in this assessment could be underestimated as a result.

In general, because conservative assumptions were made at many different steps and are compounded in the risk estimate, the values calculated in this report are more likely to overestimate rather than underestimate the true risk associated with the Site.

SUMMARY OF RESULTS

Workers. Chemical risks to future on-site/off-site construction workers are below the USEPA acceptable cancer risk range (10^{-6} to 10^{-4}), and for future off-site maintenance workers are within the acceptable risk range, and for both receptors below the non-cancer target HI of 1.0. The asbestos risks to the future off-site maintenance worker are below the acceptable cancer risk range (10^{-6} to 10^{-4}), and the risks to the future on-site/off-site construction worker are within the acceptable risk range. However, this risk is for amphiboles which had no detections of long fibers. Risks to amphiboles were conservatively calculated as there was a detection of a single short fiber at the site. In addition, risks to workers for radionuclide exposures are generally consistent with the background soil cancer risk and within the USEPA acceptable cancer risk range (10^{-6} to 10^{-4}) for each receptor. These results indicate that exposures to COPCs in Borrow Area soil are not likely to result in adverse health effects to future workers.

Current/Future On-site Trespassers. Chemical risks to current/future on-site trespassers are below the USEPA acceptable cancer risk range (10^{-6} to 10^{-4}) and below the non-cancer target HI of 1.0. The asbestos risks to the current/future on-site trespasser are below the acceptable cancer risk range (10^{-6} to 10^{-4}). In addition, risks to current/future on-site trespassers for radionuclide exposures are consistent with the background soil cancer risk and within the USEPA acceptable cancer risk range (10^{-6} to 10^{-4}). These results indicate that exposures to COPCs in Borrow Area soil are not likely to result in adverse health effects to current/future on-site trespassers.

Table ES-1. Risk Summary

	Borrow Area			Background	
	Chemical		Radiation	Soil Chemical	Soil Radiation
Receptor	Total HI	Total ILCR	Cancer Risk	Cancer Risk	Cancer Risk
Future On-Site/Off-Site Construction Worker	0.3	7×10^{-7}	6×10^{-6}	3×10^{-7}	2×10^{-6}
Future Off-Site Maintenance Worker	0.08	3×10^{-6}	1×10^{-4}	1×10^{-6}	5×10^{-5}
Current/Future On-Site Trespasser	0.02	2×10^{-7}	3×10^{-6}	7×10^{-8}	1×10^{-6}

HI = hazard index
ILCR = incremental lifetime cancer risk

Table ES-1. Risk Summary

	Asbestos					
Methodology	**Estimated Chrysotile Mean Risks**			**Estimated Amphibole Mean Risks**		
2003 Methodology	Expected		Upper Bound	Expected		Upper Bound[b]
Future On-Site/Off-Site Construction Worker	5×10^{-8}	-	1×10^{-7}	0[a]	-	6×10^{-6}
Future Off-Site Maintenance Worker	8×10^{-10}	-	2×10^{-9}	0[a]	-	9×10^{-8}
Current/Future On-Site Trespasser	2×10^{-11}	-	6×10^{-11}	0[a]	-	2×10^{-9}

[a]Zero risks are associated with those scenarios that utilize measured long amphibole structure concentrations. Long amphibole have not been detected at the property, therefore, expected risks are zero.

[b]The high-end cancer risk estimate is based on a UCL of the Poisson distribution of three amphibole structures per cm^3; the 95 percent UCL of the Poisson is presented because although long structures have not been detected at the Site, a single short fiber was detected at the site

POTENTIAL IMPACT TO GROUNDWATER

An evaluation of the potential impacts to groundwater considering the use of Borrow Area soil as off-site fill material was conducted using the VLEACH vertical migration model and site-specific soil analytical results. The VLEACH modeling was conducted for all COPCs identified in the HHRA. The evaluation was conducted using the USEPA VLEACH model (Version 2.2a). VLEACH was run separately for each of the distinctly different soil layers (that is, Borrow Area fill material and underlying native soil). In order to evaluate heterogeneous soil layers using VLEACH, multiple iterations of VLEACH were performed, where the output of one run (Borrow Area fill material) was used as the input into another run (underlying native soil). VLEACH results are the maximum pore water concentrations in the vadose zone at the groundwater interface and do not take into account groundwater mixing. VLEACH model results indicate that none of the COPCs should adversely impact groundwater quality.

1.0 INTRODUCTION

On behalf of Basic Remediation Company (BRC), Environmental Resources Management (ERM) has prepared this Human Health Risk Assessment (HHRA) for the Borrow Area. The Borrow Area is within the area proposed for the BRC Corrective Action Management Unit (CAMU) in Clark County, Nevada. Figure 1 shows the location and configuration of the Borrow Area. One of the constraints on the future use of Borrow Area soil is that such soils cannot be placed in environmentally sensitive areas, nor be exposed to ambient conditions. This is to ensure the protection of the environmental following soil placement. Therefore, this risk assessment focuses on estimating the potential risks to human health. The constraints on the use of Borrow Area soil as fill material are discussed in Section 4.3.

1.1 PURPOSE OF THE RISK ASSESSMENT

The purpose of the risk assessment is to determine whether human health risks or a threat to groundwater are anticipated from use of the soils as fill material for various non-residential construction projects in non-environmentally sensitive areas. The objective is to obtain a determination from the Nevada Division of Environmental Protection (NDEP) that allows the use of excavated Borrow Area soils as off-site fill material. The results of the risk assessment will provide risk managers an understanding of the potential human health risks associated with background conditions and additional risks associated with constituents that may be present in Borrow Area soils. The overall goal is to identify if chemical concentrations in Borrow Area soils are: (1) either representative of background conditions; or (2) do not pose an unacceptable risk to human health and the environment under current and anticipated future use conditions.

Human health risks are represented by estimated theoretical upper-bound cancer risks and non-cancer hazards derived in accordance with standard U.S. Environmental Protection Agency (USEPA) methods. If the carcinogenic risks or non-cancer hazards exceed USEPA acceptable levels or NDEP risk goals, then alternatives to use of the Borrow Area soils as fill material must be considered. The acceptable risk levels defined by USEPA for the protection of human health, and following those discussed previously with NDEP, are:

1. For non-carcinogenic compounds, the acceptable criterion is a cumulative hazard index of one or less; and

2. For known or suspected carcinogens, the acceptable ceiling for a cumulative incremental lifetime cancer risk (ILCR) ranges from 10^{-6} to 10^{-4}. The risk goal established by the NDEP is 10^{-6}.

3. Radionuclides in Site soils are to have risks no greater than those associated with background conditions, or the NDEP's risk goal of 10^{-6}, whichever is greater.

4. For lead, the target goal is 400 milligrams per kilogram (mg/kg), which is a soil concentration identified by USEPA (based on the Integrated Exposure Uptake Biokinetic Model [IEUBK]) as protective of a residential scenario.

5. For asbestos, calculations are based upon cancer criterion and a risk goal of 10^{-6}.

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). Other guidance documents consulted for the risk assessment include:

- USEPA. 1992a. *Guidelines for Exposure Assessment.*
- USEPA. 1997a. *Exposure Factors Handbook.*
- USEPA. 2000. *Soil Screening Guidance for Radionuclides.*
- USEPA. 2002a. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.*
- USEPA. 2003a. *Technical Support Document for a Protocol to Assess Asbestos-Related Risk. Final Draft.*

This risk assessment conforms with Revision 3 of the *Human Health Risk Assessment Work Plan* (MWH 2006) which incorporates NDEP comments dated May 19, 2006 on the April 2006 revision (Revision 0) of the Work Plan; NDEP comments dated July 10, 2006 on the June 2006 revision (Revision 1) of the Work Plan; NDEP comments dated August 25, 2006 on the June 2006 revision (Revision 2) of the Work Plan; and NDEP comments dated November 9, 2006 and November 16, 2006 on the October 2006 revision (Revision 3). In addition, this revision of the risk assessment (Revision 1) also incorporates NDEP comments on the December 2006 *Human Health Risk Assessment* dated March 4, 2007, as well as issues resolved with NDEP and their

consultants concerning data usability, and incorporates NDEP supplemental comments concerning VLEACH modeling dated March 13, 2007, as well as comments on background comparison statistics and exposure point concentrations received via email on March 18, 2007. The Work Plan, including all NDEP comments and BRC response to comments and NDEP's acceptance of the Work Plan, and all NDEP comments and BRC response to comments on the December 2006 revision of the risk assessment are provided in Appendix A.

1.3 REPORT ORGANIZATION

The risk assessment is composed of several chapters that are outlined below. This chapter presents the purpose of the risk assessment, and the methods used in this assessment. Chapter 2 presents background on the Site, the environmental setting for the Site, and a summary of previous investigations.

Chapter 3 presents the data evaluation procedures used, including determination of background concentrations, and data usability and adequacy. Chapter 4 presents the conceptual site model (CSM) for the risk assessment including fate and transport analyses. This includes identification of potentially exposed populations, and the potential pathways of human exposure.

Chapter 5 presents the selection of chemicals of potential concern (COPCs) recommended for further assessment. Chapter 6 presents the human health risk assessment. This includes relevant statistical analyses, determination of representative exposure point concentrations, applicable fate and transport modeling, exposure assessment, toxicity assessment, and risk characterization.

In Chapter 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 Chapter 8. The results of the analysis of potential impacts to groundwater are presented in Chapter 9. A list of references is provided in Chapter 10, followed by tables, figures, and appendices. An electronic version of the entire risk assessment report, including all calculation spreadsheets, is provided in Appendix B.

2.0 SITE DESCRIPTION

Chapter 2 presents a description of the Site, including site background and history, the environmental setting, and a summary of previous investigations.

2.1 SITE DESCRIPTION

The following description of the Site was obtained from the *Revised Sampling and Analysis Plan to Conduct Soil Characterization of Borrow Areas* (Daniel B. Stephens & Associates, Inc. [DBS&A] 2006a) submitted to NDEP on February 13, 2006, and the draft CSM for the CAMU being prepared by DBS&A (2006b, in revision, per NDEP comments).

The proposed BRC CAMU is located within a 113-acre area northwest of the active plant area of the BMI Complex (Figure 1). Approximately 55 acres, the footprint of the BRC CAMU consists of two contiguous landfill areas, known as the North Mesa and South Mesa. The separate, distinct, and existing BMI Landfill occupies approximately 66 acres of this area and was initially used as effluent disposal ponds for the Basic Magnesium, Inc. magnesium refinery since its inception. Following shut-down of the refinery in November 1944, most of the two western-most ponds were converted to a solid waste disposal area which became known as the BMI Landfill. Plans have been developed to mine the Borrow Area for borrow materials and to create a portion of the space for the proposed CAMU.

The Site is comprised of the north and south Borrow Areas, excluding the portion of the Western Ditch that separates these areas. As currently envisioned, soils from the Borrow Area will be used as general backfill material for commercial projects in non-sensitive areas, subject to the constraints discussed in Section 4.3 below and Section 2.1.3 of the accepted Work Plan (see Appendix A).

The north Borrow Area is in the southwest portion of the CAMU, north of the Western Ditch, and encompasses an area of approximately 9.3 acres. The north Borrow Area is bordered on the west by the western CAMU boundary along Eastgate Road, on the north by the westernmost portion of the existing landfill (approximately 300 feet north of the Borrow Area), on the east by the southern lobe of the existing landfill, and to the south by the Western Ditch. The north Borrow Area is shown on Figure 2.

The south Borrow Area is in the southwest portion of the CAMU, south of the Western Ditch, and encompasses an area of approximately 8.5 acres. The south Borrow Area is bordered on the west by the western CAMU boundary along Eastgate Road, on the north by the Western Ditch,

on the east by vacant land, and to the south by southern CAMU boundary. The south Borrow Area is shown on Figure 2.

Groundwater underlying the Site is known to be contaminated. As discussed in Section 4.3 below, exposure pathways associated with groundwater were not evaluated in this HHRA. Excavations within the Borrow Area will stop prior to reaching groundwater. The objective of the various investigations and assessments within the Borrow Area were to demonstrate to NDEP that it is acceptable to use soil within this area as off-site fill material. Because locations for placement of Borrow Area soil as off-site fill material have not been determined for certain, groundwater quality at these locations is unknown. It is expected that most, if not all of the Borrow materials will be used in the BMI industrial complex, including for CAMU construction. Eight potential Borrow Area material use sites within the BMI industrial complex are shown on Figure 3.

2.2 EXCAVATION AND PROCESSING OF BORROW AREA MATERIAL

Excavation and processing of Borrow Area material will require activity both in the two portions (northern and southern) of the Borrow Area and in the loading yard adjacent to the Borrow Area.

In each of the two portions (northern and southern), material will be mass-graded and gathered using a bulldozer and belly scraper in tandem. The bulldozer will cut or rake the material, creating a soft bed of dirt that can be easily gathered by the belly scraper. Once the material is gathered by the scraper, it will be transported to a central location along the boundary between the Area and the loading center. There, the material will be dumped into trucks and transported.

Based on current disposal options, it is likely that all of the material will be disposed as “pit run” – thereby not requiring separation into two different grades of materials. However, even if the material were separated into two grades, it is BRC’s professional judgment that, given the other conservative assumptions being made in estimating potential risks, the potential risks estimated in this report will not underestimate any actual risk. Please note also with regards to differences in concentration between coarse and fine grained separated materials, it is BRC’s belief that the sample preparation step prior to analysis involves grinding the material – making this difference moot for the samples gathered and used in this risk assessment.

The following discussion is provided in the event that materials are segregated, for the sake of completeness.

If the pit-run material is processed it will be transported using a front loader onto a crusher conveyer belt and then onto a crusher, where it will be separated into two piles. The first pile will be Type II aggregate material. Type II aggregate is a granular, structure material used to construct building pads and roadway beds. This material is of high value and is structural in nature. The second pile will be reject sand. This is material that is too small to be included in the Type II material. This material has a smaller granular consistency and is typically used as bedding material for pipeline construction and in landscape applications. However, BRC will not use reject sand for landscape applications or for pipeline bedding. Any material used in the CAMU construction, will be used in the "ops" layer and not in the cover or in the leachate collection layer. Should rejected sand be needed for off-site uses, its use will be subject to the same constraints as Type II material.

The definition of Type II is as follows (Ref: Section 704.03.04, found at http://www.rtcsouthernnevada.com/streets/streets_specsindex.htm). Type II can consist of a distribution of sizes, within acceptable ranges as indicated below. For example, Type II materials can contain materials that pass sieve size No. 16 but only as long as such materials do not comprise less than 15 percent or more than 40 percent of the material.

Sieve Sizes	Nom. Sieve Opening (mm)	% of Dry Weight Passing Sieve
1"	25.4	100
¾"	6.35	90-100
No. 4	4.76	35-65
No. 16	1.19	15-40
No. 200	0.074 (74 microns)	2-10

2.3 ENVIRONMENTAL SETTING

The summary provided below is focused toward Site features that pertain to the risk assessment. Some of this summary was obtained from various sources including DBS&A's draft CSM for the CAMU (DBS&A 2006b, in preparation) and Tetra Tech's *Draft Final Sampling and Analysis Plan, Hydrogeologic Characterization, Titanium Metals Corporation Facility* (Tetra Tech 2005).

2.3.1 Climate

The Site is located in a natural desert area, where evaporation/evapotranspiration rates are very high, due to influence by high temperatures, high winds, and low humidity. Average monthly

temperatures fall within a range of 45.4 to 91.1 degrees Fahrenheit during 2001. Total 2001 precipitation measured at McCarran International Airport was 3.74 inches. Rainfall was highest in the winter months (January and February). However, the months with the highest evaporation coincide with those months with the highest intensity of rainfall.

Wind flow patterns were fairly consistent from one month to another, but vary slightly between measurement stations (McCarran International Airport and a station 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). The mean annual wind velocity is 9 miles per hour (mph), but velocities in excess of 50 mph are known to occur.

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-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 development (*i.e.*, vegetation destruction, pavement extent, and construction).

2.3.2 Surface Water

The Las Vegas Wash collects storm water, shallow groundwater, urban runoff, and treated 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 City of Henderson contributes a smaller amount (8.4 million gallons per day) (Las Vegas Wash Coordination Committee 2000). TIMET discharges permitted stormwater and once-through non-contact cooling water via the Pittman By-Pass (NDEP 2002). 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 create high run-

off conditions which coincide with the highest evaporation rate for the year. 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).

2.3.3 Physical Attributes

The Borrow Area is 17.8 acres, in a commercial/industrial area. The ground surface slopes gradually to the north-northeast toward the Las Vegas Wash at a gradient of approximately 0.02 foot per foot (ft/ft). Ground surface elevations across the Site range from approximately 1,775 feet above mean sea level (msl) on the southern boundary to approximately 1,750 feet msl at the northern boundary.

2.3.4 Geology

The general geologic model of the CAMU site consists of two geologic formations: Quaternary alluvium associated with alluvial fan deposits shed from McCullough Range Mountains, which unconformably overlies the Muddy Creek Formation.

The Site is located near the southeastern margin of Las Vegas Valley on Quaternary-age alluvial fan deposits deposited northeast of the McCullough Range. The Quaternary alluvium, which is the present-day land surface at most of the BMI Industrial Complex and throughout much of the Henderson area, slopes north toward the Las Vegas Wash. On the CAMU site, the slope gradient is 0.02 ft/ft. In wells and borings advanced at the CAMU site, the average thickness of the Quaternary alluvium is about 50 to 60 feet. Therefore, the Quaternary alluvium likely extends below the proposed limit of excavation. The Quaternary alluvium is predominantly sands and gravels that consist mainly of volcanic detritus (Carlsen *et al*. 1991). More than 500 borings and monitor wells have been drilled into the Quaternary alluvium at the BMI Industrial Complex and Common Areas, and lithologic descriptions show that the unit is typically logged as silty or sandy gravel, sand, or silty sand.

2.3.5 Groundwater

In the vicinity of the CAMU site, first groundwater is typically encountered in the Quaternary alluvium under unconfined conditions. Under current hydrologic conditions, the direction of the unconfined groundwater flow in the Quaternary alluvium is approximately parallel to the slope of the land surface. Shallow groundwater in the Quaternary alluvium at and near the CAMU site

flows generally to the north-northeast, toward Las Vegas Wash. The depth to groundwater in the vicinity of the CAMU as measured in BRC monitoring wells in 2005, ranged from 34 to 53 feet below ground surface (bgs). The shallowest depth to groundwater for the seven soil placement sites, as shown on Figure 3, is approximately 25 feet bgs as measured by Kerr-McGee in 2005 at monitoring well PC-40 in the north portion of the northernmost placement site (Kerr-McGee 2005).

2.4 SUMMARY OF PREVIOUS INVESTIGATIONS

From 1999 to 2006, BRC installed borings in the Borrow Area from which soil samples were collected and analyzed for a suite of analytes including metals, radionuclides, organochlorine and organophosphorus pesticides, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), dioxins/furans, perchlorate and asbestos. The results of these sampling and analysis events were presented in the following reports:

- 2000 Environmental Assessment by Parsons Engineering Science, Inc. (Parsons) (Dataset 10);
- 2000 Implementation of Sampling Plan for the Proposed Gravel Pit Site, Henderson, Nevada. by Geotechnical & Environmental Services, Inc. (GES) (Dataset 13a)
- 2003a Implementation of Sampling Plan (GES) (Dataset 26a);
- 2003b Limited Environmental Phase II Investigation (GES) (Dataset 26b);
- 2003 Asbestos Evaluation by MWH Americas, Inc. (MWH) and Aeolus, Inc.; and
- 2006 Soil Investigation by BRC and MWH (Dataset 36).

Sample locations from each of these investigations are shown on Figure 2. A summary of each of the investigations and assessments listed above are provided in the following sections.

2.4.1 2000 Environmental Assessment by Parsons (Dataset 10)

In 1999, as reported in Parsons (2000), a limited environmental investigation was performed to assess conditions at the Borrow Area. The purpose of the environmental sampling was to provide a preliminary indication regarding the presence of contamination on the Site.

Soil and groundwater sampling activities were conducted in September 1999. Soil samples were collected at various depths from six boreholes (B-1, B-4, B-5, B-8, B-10, and B-12; see Figure 2) advanced using hollow-stem auger drilling. Samples were analyzed for VOCs, SVOCs,

organochlorine pesticides, perchlorate, gross alpha, nonvolatile beta, and metals. Groundwater samples were collected from two of the borings and analyzed for the same constituents.

Near-surface and subsurface soils observed during this investigation consisted primarily of alluvial granular soils overlying fine-grained soils, the top of which generally coincides with the groundwater table. Groundwater at the time of this investigation (1999) was encountered at depths ranging from approximately 38 to 58 feet bgs. No VOCs or SVOCs were detected in the soil samples, although low levels of pesticides and perchlorate were detected in several of the samples. No VOCs or SVOCs were detected in the two groundwater samples collected beneath the Site, although pesticides and perchlorate were detected in one of the samples.

2.4.2 2000 Implementation of Sampling Plan by GES (Dataset 13a)

In 2000 GES (2000) collected soil samples from four locations within the Borrow Area (B-13, B-14, B-15, and B-16; see Figure 2). Samples were collected at 0, 5, 10, 20, and 30 feet bgs. Samples were analyzed for VOCs, SVOCs, organochlorine pesticides, perchlorate, asbestos (surface only) and metals. Results indicated the presence of various VOCs, SVOCs, organochlorine pesticides, perchlorate, and metals. Asbestos was not detected in any samples.

2.4.3 2003 Limited Environmental Phase II Investigation by GES (Datasets 26a and 26b)

In 2003 GES conducted a limited Environmental Phase II investigation at the Borrow Area (GES 2003a). The objective of this investigation was to verify the northern and eastern boundaries of the Borrow Area with the collection of samples from eight locations (EB-1 through EB-8). The investigation was also performed to determine a volume estimate of 'useable' material within the Borrow Area. GES performed a supplemental investigation in June 2003 (GES 2003b). Samples were collected from ten borings (PEB-9 through PEB-18) at new locations, and six borings (EB-3, EB-6, EB-7, EB-8, B-5 and B-10) from previous locations. The supplemental investigation was performed to augment the previous investigations in order to completely evaluate the boundary of the Borrow Area.

The borehole locations from both investigations are presented on Figure 2. No groundwater was encountered during these investigations. Each boring was terminated at a depth of approximately 35-feet bgs. All soil samples analyzed for one or more of the following analyses: VOCs, SVOCs, organochlorine pesticides, organophosphorous pesticides (broad suite), metals, perchlorate, and radionuclides.

2.4.4 2003 Asbestos Evaluation by MWH and Aeolus

In October 2003, MWH conducted asbestos sampling from within the Borrow Area. The sampling consisted of the collection of surface and shallow sub-surface soil samples from 50 locations (Figure 2), combined into ten soil composites (five from each of two depths). Each composite sample was prepared in the field by weighing, sieving, homogenizing, and combining ten designated, component samples. Sampling recommendations were developed by Aeolus (2003a). Once in the laboratory, samples were prepared and analyzed per the Modified Elutriator Method (Berman and Kolk 2000).

2.4.5 2006 Soil Investigation by BRC (Dataset 36)

At the request of BRC, MWH and GES implemented the *Revised Sampling and Analysis Plan to Conduct Soil Characterization of Borrow Areas*, dated February 13, 2006, prepared by DBS&A. All field work was completed between February 22 and February 28, 2006.

During the soil characterization sampling, 10 soil borings (BP-01 through BP-10) were advanced at locations using a truck-mounted hollow stem auger drill rig operated by Eagle Drilling Company of Las Vegas, Nevada. A total of 49 primary soil samples were collected from depths of 0 to 1 foot below ground surface, 10 to 11.5 feet bgs, 20 to 21.5 bgs, 30 to 31.5 feet bgs, 40 to 41.5 feet bgs, and 50 to 51.5 feet bgs. The maximum total depth of samples collected at each boring varied at each boring location based on the depth of encountered saturated soil.

Select soil samples were collected during the investigation and were submitted to Severn Trent Laboratories, Inc. (STL) in St. Louis, Missouri. STL St. Louis was unable to perform all of the analyses. STL St. Louis performed the analyses of general chemistry parameters, moisture determination, metals, hexavalent chromium, perchlorate, VOCs, SVOCs, glycols/alcohols, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), organochlorine pesticides, chlorinated herbicides. STL West Sacramento performed the dioxin/furan analyses. STL Richland performed the radionuclide analyses. STL Denver performed the organophosphorus analyses. Asbestos soil samples were submitted to EMS Laboratories in Pasadena, California, and prepared and analyzed per the Modified Elutriator Method (Berman and Kolk 2000).

2.4.6 Soil Background Investigation (Datasets 24 and 34)

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 historic site operations or regional anthropogenic conditions. Therefore, it is necessary to establish site-specific background conditions to support the risk assessment.

The soils background dataset presented in the *Background Shallow Soil Summary Report, BMI Complex and Common Area Vicinity* (BRC/TIMET 2007, currently in review by the NDEP) was utilized. This soils background dataset includes both the Environ (2003) dataset and the BRC/TIMET dataset collected in 2005. This combined background dataset is still draft and has not yet been approved by NDEP. It is BRC's expectation that the final background dataset will not deviate in any material manner from the dataset used in this risk assessment.

3.0 DATA EVALUATION

This Chapter 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 analysis process. Although all samples used in this risk assessment were collected prior to the preparation of the approved Field Sampling and Standard Operating Procedures (FSSOP) manual for the project (BRC and MWH 2006a), established industry standards for sample collection 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.

3.1 DATA USABILITY EVALUATION

The primary objective of the data review and usability evaluation was to identify appropriate data for use in risk assessment. The analytical data were reviewed for applicability and usability following procedures in the *Guidance for Data Usability in Risk Assessment (Parts A and B;* USEPA 1992b,c) and USEPA (1989). 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:

- availability of information associated with site data;
- documentation;
- data sources;
- analytical methods and detection limits;
- data review; and
- data quality indicators, including precision, accuracy, representativeness, comparability, and completeness.

A summary of these six criteria for determining data usability in the present risk assessment is provided below. In addition, a Data Usability Worksheet from the *Risk Assessment Guidance for Superfund Part D* (USEPA 2001a), which summarizes the criteria used to identify data usability, is presented in Table 1.

3.1.1 Borrow Area HHRA Datasets

A number of investigations have been performed within the Borrow Area since 2000. These include:

- 2000 Environmental Assessment by Parsons Engineering Science, Inc. (Parsons 2000) (Dataset 10)[2];
- 2000 Implementation of Sampling Plan for the Proposed Gravel Pit Site by GES (2000) (Dataset 13a)
- 2003 Limited Environmental Phase II Investigation by GES (2003a,b) (Datasets 26a and 26b);
- 2003 Asbestos Investigation by MWH and Aeolus Inc. (Aeolus 2003b); and
- 2006 Soil Investigation by BRC (Dataset 36).

Since the Work Plan was written and approved, the boundary definition of the area considered for use as Borrow Area soils has changed. The most recent boundary definition is presented in the CSM (shown in Figure 2) for the proposed CAMU prepared by DBS&A (2006b, in preparation). Data within the Borrow Area from the investigations above in the project database and included in this assessment are:

- Borings B-15, and B-16 from the 2000 GES investigation
- Borings PEB-9, PEB-11, PEB-13, PEB-17, and PEB-18 from the 2003 GES investigation;
- Borings EB-1, EB-2, EB-3, EB-7 and EB-8 from the 2003 GES investigations;
- Asbestos samples BEC-1Sb, BEC1Sa through BEC5Sa, and BEC1Da though BEC5Da from the 2003 MWH and Aeolus investigation; and
- Borings BP-01 through BP-10 from the 2006 BRC investigation.

These locations are presented on Figure 2. All valid data from these investigation locations to a depth of 40 feet (the maximum proposed depth of Borrow Area soil excavation) were included in the HHRA. Remaining locations from the Borrow Area investigations excluded from the list above are in areas that are not proposed for use as off-site fill material. These datasets do not

[2] Although two sample locations (B-8 and B-12; see Figure 2) from this investigation fall within the Borrow Area boundary, the data from these locations have not been validated; only validated data is included in the risk assessment. The omission of these two locations from the risk assessment are discussed in further detail in the Uncertainty Analysis (Chapter 7).

include several chemicals that are on the project site-related chemicals list. Discussions of those chemicals that are on the site-related chemicals list but that were not analyzed for are discussed in the Uncertainty Analysis (Chapter 7). Data Validation Summary Reports (DVSRs) for all of the datasets that were used in the risk assessment have been submitted to and approved by NDEP. DVSRs, including laboratory reports, are provided in Appendix C.

3.1.2 Criterion I – 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. The following lists the information sources and the availability of such information for the data usability process associated with this risk assessment:

- A site description provided in Chapter 2 of this report identifies the location and features of the Site, the characteristics of the site vicinity, and contaminant transport mechanisms.
- A site map with sample locations is provided in Figure 2 of this report.
- Sampling design, protocols and results are discussed briefly in Section 2.4 and details are provided in the reports for each of these efforts.
- Analytical methods and detection limits are provided in Table 2 of this report and as part of Appendix B, as well as Appendix D, Attachment D-1.
- A complete dataset is provided in Appendix B of this report.
- 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 each of the DVSRs.
- QC results are provided by the laboratory, including blanks, replicates, and spikes. The laboratory QC results are included as part of each of the DVSRs.
- Data flags used by the laboratory were defined adequately.
- Electronic files containing the raw data made available by the laboratory are provided in Appendices B and C.

3.1.3 Criterion II – Documentation Review

The objective of the documentation review is to confirm that the analytical results provided are associated with a specific 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. Based on the documentation review, all samples analyzed by the laboratory were included on the chain-of-custody forms and were correlated to the correct geographic location at the Site. Field procedures included documentation of sample times, dates and locations, other sample specific information such as depth bgs were 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 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 detection limits, and provides the results of appropriate quality control samples such as laboratory control spike samples, sample surrogates and internal standards (organic analyses only), and matrix spike samples. All laboratory reports, except for asbestos, provided the documentation required by USEPA's Contract Laboratory Program (USEPA 2003b, 2004a,b) 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. Reported sample analysis results were imported into the project database.

The recommended method for providing asbestos data which are useful for risk assessment purposes was performed by EMS Laboratory in Pasadena, California. This laboratory is not currently certified in the State of Nevada, but has California and national accreditation for asbestos analysis.

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 2003a). 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).

The Modified Elutriator Method incorporates collection of samples that are re-suspended and then forced through an airway and filter. Asbestos structures are isolated and concentrated of 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. These are precisely the dimensions required to combine such measurements with published dust emission and dispersion models to convert them to asbestos emission and dispersion estimates. Thus, because published dust emission and dispersion models can be used to address many of the exposure pathways of interest in this study, these can be combined with measurements from the Modified Elutriator Method to predict airborne exposures and assess the attendant risks.

3.1.4 Criterion III –Data Sources

The review of data sources is performed to determine whether the analytical techniques used in the site characterization process are appropriate to identify the COPCs in the risk assessment. The site data collection activities (Section 2.4) were developed to characterize a broad spectrum of chemicals potentially present on the Site, including VOCs, SVOCs, metals and other inorganics, radionuclides, dioxins/furans, asbestos, PCBs, PAHs, and pesticides. Site data collection activities have included analyses for soil and appropriately reflect anticipated exposures.

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 the risk assessment.

3.1.5 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 whether the analytical methods used appropriately identify COPCs and 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. Table 2 identifies the USEPA and DOE methods that were used in conducting the laboratory analysis of soil samples from the 2006 BRC investigation. Methods

used in the other investigations are included in Appendix B, and each of the DVSRs (Appendix C). Each of the identified USEPA methods are considered the most appropriate method for the respective constituent class, and each was submitted as part of the DVSRs approved by NDEP.

For the analytical data, the most recent associated reference method utilized in Borrow Area investigations is provided in the following guidelines:

- *Contract Laboratory Program Statement of Work for Chlorinated Dibenzo-p-Dioxin and Chlorinated Dibenzofuran: Multi-media, Multi-concentration* (USEPA 2005a);
- *Contract Laboratory Program Statement of Work for Organic Analysis* (USEPA 2003b);
- *Contract Laboratory Program Statement of Work for Organic Analysis* (USEPA 2004a);
- *Contract Laboratory Program Statement of Work for Inorganic Analysis* (USEPA 2004b);
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), Third Edition* (USEPA 2005b);
- *Procedures Manual of the Environmental Measurements Laboratory, HASL-300* (DOE 1997); and
- *Modified Elutriator Method for the Determination of Asbestos in Soils and Bulk Material* (Berman and Kolk 2000).

Laboratory reporting limits were based on those outlined in the reference method and the sampling and analysis plan. In accordance with respective laboratory standard operating procedures (SOPs), the analytical processes included performing instrument calibration, laboratory method blanks, and other verification standards used to ensure quality control during the analyses of collected samples. Laboratory reporting limits were used in the risk assessment unless detection limits were modified due to blank contamination.

The range of detection limits achieved in field samples was compared to USEPA Region 9 industrial Preliminary Remediation Goals (PRGs) (USEPA 2004c). A number of chemicals had non-detectable results with detection limits above industrial PRGs: 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), benzo(a)pyrene, dibenzo(a,h)anthracene, cobalt-60, lead-210, uranium-235, 3,3'-dichlorobenzidine, bis(2-chloroethyl) ether, hexachlorobenzene, N-nitrosodimethylamine, N-nitrosodi-n-propylamine, 1,2,3-trichloropropane, 1,2-dibromoethane, and trichloroethylene.

The detection limits exceeded PRGs by a factor(s) of 3.8 for 2,3,7,8-TCDD, 1.6 to 2.4 for benzo(a)pyrene, 1.6 to 2.4 for dibenzo(a,h)anthracene, 1.1 to 2.2 for cobalt-60, 1.1 to 32.7 for lead-210, 1.4 for uranium-235, 1.01 to 1.4 for 3,3'-dichlorobenzidine, 1.04 to 1.9 for bis(2-chloroethyl) ether, 1.02 for hexachlorobenzene, 9.8 to 14.8 for N-nitrosodimethylamine, 1.3 to 4.5 for N-nitrosodi-n-propylamine, 1.6 for 1,2,3-trichloropropane, 1.6 for 1,2-dibromoethane, and 1.1 for trichloroethylene. A single dioxin sample contained elevated reporting limits for 2,3,7,8-TCDD. As discussed below, dioxins/furans were retained as COPCs due to this detection limit issue. For lead-210, the frequency and range of detected concentrations are very similar between the site and background. For N-nitrosodimethylamine and N-nitrosodi-n-propylamine, all of the detection limits are above the PRG value. This may lead to the potential for concentrations to be present at levels that exceed *de minimus* risk metrics. However, the detection limits for all other nitroso-amine type compounds are sufficiently low to detect concentrations of interest should nitroso-amine compounds have been present at the site, none have been detected, and there is no site history to suggest the compounds may have been utilized at the property. The available lines of evidence suggest that although the detection limits for N-nitrosodimethylamine and N-nitrosodi-n-propylamine are elevated, this should have minimal impact on the outcome of the risk assessment. Therefore, the detection limits are considered adequate for risk assessment purposes.

For asbestos, there is no regulatory limit to compare the detection limits of chrysotile and amphibole fibers for this method. For asbestos, the appropriate measure of adequate characterization is not a detection limit, but the analytical sensitivity. There was a single detection of short amphibole fibers. The short amphibole fibers are not used to calculate risks. However, based on the presence of amphibole at the site, risks due to amphibole fibers were calculated using the analytical sensitivity for the appropriate receptors. The analytical sensitivity is perhaps not low enough in regards to the amphibole fibers. No long fibers were detected; however, upper bound risks were greater than 10^{-6}.

3.1.6 Criterion V – Data Review

The data review portion of the data usability process focuses primarily of the quality of the analytical data received from the laboratory. All Site data that are used in the risk assessment must be evaluated on the basis of completeness, precision (based on duplicates), and accuracy (based on laboratory spikes). In addition, the laboratory results data are reviewed for blank contamination. DVSRs were prepared for each data collection effort. The results of ERM's data review for these issues are presented below.

3.1.6.1 Laboratory QA/QC – Precision, Accuracy and Method Performance

Although certain laboratory limits, such as percent recovery (PR) and relative percent difference (RPD) between sample and duplicate, were exceeded for certain compounds or analyses, as identified by the laboratory (and confirmed during ERM's review of the data), there does not appear to be a wide-spread effect on the quality of the analytical results. Additional discussion of specific exceedances, with respect to precision and accuracy, is summarized below under Criterion VI (sections 3.1.7.1 and 3.1.7.2) with more detail provided in tabular form in Appendix D, Attachment D-2).

3.1.6.2 Field Duplicates

Seven field duplicate samples were collected and analyzed for perchlorate, organochlorine pesticides, VOCs, metals, and SVOCs at locations EB-3 (at 15 feet bgs), EB-8 (at 25 feet bgs), PEB-13 (at 0.5 feet bgs), and PEB-17 (at 25 feet bgs) and for perchlorate, radionuclides, dioxin/furans, PAHs, pH, herbicides, organophosphorus and organochlorine pesticides, PCBs, VOCs, metals, and SVOCs at BP-03 (at 0 feet bgs), BP-06 (at 0 feet bgs), and BP-09 (at 0 feet bgs). In addition, a field duplicate was collected at BEC-01 for asbestos. Also for asbestos, there are two samples (BP-08-0A and BP-02-0A) which were run twice due to difficulty in identifying fibers. These samples are not field duplicates but are presented for informational purposes. One sample identified a short amphibole fiber which provides a reason for calculating risks due to potential amphibole exposure even though no long fibers were detected. The field duplicates were reviewed to provide an indication of the precision of the field sampling procedures. It is expected that the concentration of a given chemical in a field duplicate and the original sample should be similar given that the samples are collected in the same location, in the same manner, and at the same time. Nonetheless, some variation is expected, and the relative difference (measured as the RPD) between the samples is likely to be greater than for laboratory duplicates. ERM reviewed the analytical data for the chemicals detected in the field duplicate pairs. The RPD between the sample concentrations was calculated for those chemicals that were detected in both samples. All RPD's were below 50 percent except for the following: delta-BHC at location EB-8 with an RPD of 144%; barium at location EB-3 with an RPD of 57.1%; lead at location PEB-13 with an RPD of 71.5%; chromium at location PEB-17 with an RPD of 57%; 2,3,7,8-tetrachlorodibenzofuran and sodium at location BP-06 with RPDs of 138% and 84%, respectively; and phosphorus (as P) and ronnel at location BP-09 with RPD's of 55% and 93%, respectively. These results were qualified as estimated. For asbestos, the primary sample BEC-01

was qualified due to blank contamination. The duplicate sample was used in the risk assessment. Data which resulted in qualification are provided in detail in Appendix D, Attachment D-2.

3.1.6.3 Data Validation

Soil sample data were subject to data validation. DVSRs for each of the investigations used in this risk assessment have been submitted and approved (Appendix C). The analytical data were validated according to the internal procedures using the principles of USEPA National Functional Guidelines (USEPA 1999, 2001b, 2002b, 2004d) and were designed to ensure completeness and adequacy of the dataset. Any analytical errors and/or limitations in the data have been addressed and an explanation for data qualification provided in the respective data tables.

For some analytical results, 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 USEPA guidelines (USEPA 1999, 2001b, 2002b, 2004d). Data validation flags indicate when results were considered non-detect (U), estimated (J), or rejected (R). Sample results were rejected based on findings of serious deficiencies in the ability to properly collect or analyze the sample and meet QC criteria. Only rejected data were considered unusable for decision-making purposes and rejected analytical results were not used in the risk assessment. Sample results qualified as estimated were affected by special circumstances and are likely to be quantitatively biased to some degree; estimated analytical results were used in the risk assessment. Data qualified as non-detect represents an analyte or compound that was not detected above the sample quantitative limit and such data were used in the risk assessment. These data usability decisions follow the guidelines provided in the *Guidance for Data Usability in Risk Assessment (Parts A and B;* USEPA 1992b,c). The details of the data evaluation for the background dataset are provided by Environ (2003) and BRC/TIMET (2007, currently in review by the NDEP).

3.1.7 Criterion VI – Data Quality Indicators

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 the risk assessment. The DQIs include precision, accuracy, representativeness, comparability, and completeness (PARCC). The project Quality Assurance

Project Plan (QAPP; BRC and MWH 2006b) 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, Organics and Inorganics and Dioxin/Furans* (USEPA 1999, 2001b, 2002b, 2004d).

3.1.7.1 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 laboratory limits for precision, as measured by the RPD between laboratory control sample (LCS) analyses, are the laboratory control limits based on historical data calculated as specified in the analytical methods. If these limits are not met, the laboratory will follow the actions specified in the analytical method and the laboratory's SOPs.

Precision of a set of analyses is evaluated by determining the RPDs for matrix spike and matrix spike duplicate (MS/MSD) samples for organics and duplicate samples for inorganics. Precision is calculated using the following equation, where Xl and X2 are duplicate measurements:

$$RPD(\%) = \left[\frac{X_1 - X_2}{\left(\frac{X_1 + X_2}{2} \right)} \right] \times 100$$

As discussed above, the precision of the data was evaluated using several laboratory QA/QC procedures. Based on ERM's review of the results of these procedures, there do not appear to be any wide-spread data usability issues associated with precision. In several instances, however, the calculated RPDs were outside the laboratory QC limits for individual chemicals as discussed below.

Matrix spike/matrix spike duplicates - Except as noted below, laboratory MS/MSD analyses were performed and RPDs were calculated for all analyses. MS/MSD results were not provided for the eight samples associated with the 2000 Borrow Area investigation (GES 2000). The

metals results were rejected from the 2000 Borrow Area investigation, since no QC data were available. The organic data were deemed usable based on the availability of surrogate data.

RPD exceedances occurred in at least one preparation batch for the following analytes: 2,4,5-T, 2,4,5-TP, 2,4-D, dicamba, dichlorodifluoromethane, dichlorprop, dinitrobutyl phenol, phosphorus (as P), 2,4-dinitrophenol, endosulfan II, endosulfan sulfate, methoxychlor, ethanol, 1,2,3,4,7,8,9-heptachlorodibenzofuran, 4,4'-DDE, endrin aldehyde, and titanium. Sample specific results are presented in tabular form in Appendix D, Attachment D-2. Based on both the laboratory and ERM review there does not appear to be any significant data usability issues resulting from the MS/MSD results.

Laboratory control samples (LCS) - Laboratory LCS/LCSD analyses were performed and RPDs were calculated by the laboratory in all sample lots except as noted below. LCS results were not provided with the 2000 Borrow Area investigation (GES 2000). The metals results were rejected from the 2000 Borrow Area investigation, since no QC data were available. The organic data were deemed usable based on the availability of surrogate data.

RPD exceedances occurred in at least one preparation batch for the following analytes: 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-dibromo-3-chloropropane, 1,2-dichloroethane, 1,3-dichloropropane, 1,4-dichlorobenzene, 2,2-dichloropropane, 2-nitropropane, acetone, benzoic acid, bromomethane, CFC-11, CFC-12, freon-113, chloroethane, chloromethane, cis-1,3-dichloropropylene, ethylbenzene, methyl ethyl ketone, methyl isobutyl ketone, methyl-n-butyl ketone, MTBE, naphthalene, trans-1,3-dichloropropylene, tribromomethane, vinyl acetate, and vinyl chloride. Results for benzoic acid in the nine associated samples were rejected due to low recoveries of the spike compound and not due to the RPD issue. Sample specific results are presented in tabular form in Appendix D, Attachment D-2. Based on both the laboratory and ERM review there does not appear to be any significant data usability issues resulting from the LCS/LCSD results.

3.1.7.2 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:

- Holding times and sample temperatures;

- LCS percent recovery;
- MS/MSD percent recovery (organics);
- Spike sample recovery (inorganics)
- Surrogate spike recovery; and
- Blank sample results

The results of ERM's analysis of accuracy are presented below:

Holding times and sample temperature - 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. The following samples had qualified results for a number of VOCs: EB-1-20-20.5, EB-1-35-35.5, EB-2-30-30.5, EB-2-35-35.5, EB-3-5-5.5, EB-3-10-10.5, EB-3-20-20.5, EB-3-30-30.5, EB-3-35-35.5, EB-7-5-5.5, EB-7-20-20.5, EB-7-30-30.5, and EB-7-35-35.5. A number of samples were also qualified for organophosphorus pesticides: EB-8-25, EB-8-26, EB-8-35, EB-7-25, EB-7-35, PEB-11-25, PEB-11-35, EB-3-25, EB-3-35, PEB-13-25, PEB-13-35, PEB-17-25, PEB-17-26, PEB-17-35, PEB-18-25, PEB-18-35, PEB-9-25, and PEB-9-35. One sample (BP-01-02-22-06) was qualified SVOCs, and three samples (BP-02-02-23-06, BP-03-02-27-06, and BP-07-40-41.5-A) had removed data for organochlorine pesticides and SVOCs, and was rejected for hexavalent chromium results due to not meeting recommended holding times. The VOCs and organophosphorus pesticides were qualified as estimated and associated risk estimates may be biased low. However, there are many other samples for both analyses that were not compromised by missed holding times.

Twenty-eight sample IDs also received VOC, SVOC, PCB, and pesticide data qualifiers due to sample temperature.

Laboratory control samples - LCS evaluation reports were included with all analyses of metals, dioxin/furans, VOCs, SVOCs, PCBs, PAHs, and organochlorine pesticides except for eight samples analyzed for VOCs, SVOCs and metals associated with the GES 2000 Borrow Area investigation. Percent recoveries were reported outside the laboratory recovery limits for 1,1-dichloropropene, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-butanone, 2-chloroethyl vinyl ether,

2-chlorotoluene, 2-hexanone, 4-chlorotoluene, 4-methyl-2-pentanone, acetone, benzene, benzoic acid, bromobenzene, bromomethane, carbon disulfide, CFC-12, chlorobenzene, cymene, dibutyl phthalate, dichlorofluoromethane, endrin aldehyde, iodomethane, isopropyl benzene, m,p-xylene, methoxychlor, methylene chloride, naphthalene, n-propylbenzene, o-xylene, radium-226, tert-butylbenzene, toluene, trichloroethene, trichlorofluoromethane, tungsten, vinyl acetate, and vinyl chloride. Associated results were qualified. Twenty-five results for 2-butanone, 18 for 2-chloroethylvinyl ether, 19 for 2-hexanone, 13 for 4-methyl-2-pentanone, 35 for benzoic acid, and six results for vinyl acetate were rejected for use due to low or 0 percent recovery. All other results were qualified as estimated and are acceptable for use. Most results were biased low; however, some detections for 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 2-chloroethyl vinyl ether, 2-hexanone, acetone, methylene chloride, naphthalene, and radium-226 were biased high and may represent a high bias to the risk estimates. Except as noted, no LCS evaluations were flagged by the laboratory due to percent recovery outside of the laboratory's acceptance criteria. ERM, therefore, believes that LCS evaluations meet the requirement of accuracy.

Matrix spike recovery - Matrix spike evaluation reports were included in all sample lots for analyses of metals, radionuclide, dioxin/furans, VOCs, SVOCs, PCBs, PAHs, and organochlorine pesticides except for eight samples analyzed for VOCs, SVOCs and metals associated with the 2000 GES Borrow Area investigation. Matrix spike percent recovery was outside of the laboratory's recovery limits for the following SDGs:

F6B240341 (metals, cyanide, dioxins and PAHs),

F6B240362 (metals, cyanide and perchlorate)

F6B240403 (metals, perchlorate)

F6B280340(metals, perchlorate, organochlorine pesticides)

L0306194 (metals, organochlorine pesticides, VOCs, SVOCs)

L0306231 (metals, organochlorine pesticides, VOCs, SVOCs)

L0306232 (metals)

L0306230 (metals, SVOCs)

L0306252 (metals, organochlorine pesticides, VOCs, SVOCs)

L0306289 (metals, VOCs, SVOCs)

L0306250 (metals)

L0306300 (metals, organochlorine pesticides, VOCs)

L0306291 (metals, organochlorine pesticides)

L0304003 (SVOCs)

L0304004 (organochlorine pesticides, SVOCs)

L0304005 (SVOCs)

The following list contains the analytes impacted (qualified) by the variances in the matrix spike recoveries:

1,2,4-trichlorobenzene, 2-hexanone, 2,3,7,8-tetrachlorodibenzofuran, 4,4'-DDE, acenaphthylene, aluminum, antimony, barium, calcium, chromium (total), copper, cyanide (total), dichlorodifluoromethane, dieldrin, endosulfan I, endrin aldehyde, heptachlor, iron, magnesium, nickel, niobium, octachlorodibenzodioxin, perchlorate, phosphorus (as P), silicon, strontium, thallium, titanium, tungsten, vanadium, vinyl acetate, zinc, and zirconium.

Most of the spike recoveries that were outside control limits are slightly outside the control limits and only represent a minor potential to underestimate risks. As such these results were considered for use in the risk assessment. Only the matrix spike results for total cyanide, 4,4'-DDE, endosulfan I, endrin aldehyde, heptachlor, and tungsten show the potential for a significant underestimation of a soil concentration at locations BP-01 (cyanide), BP-02 (cyanide), BP-03 (cyanide), BP-04 (cyanide), PEB-11-0.5 (tungsten), PEB-11-35 (tungsten), EB-3-0.5 (tungsten), EB-3-15 (tungsten), EB-3-25 (tungsten) and BP-09-0-1A (4,4'-DDT, endosulfan I, endrin, and heptachlor). However, the inability to recover measurable levels of these constituents is likely due to matrix interferences and correcting for initial soil concentrations of the samples. The associated results were rejected and not used in the risk assessment. The remainder of the data were qualified as estimated and the majority of the qualified data are for metals. They are mostly biased low due to low recoveries and may represent an underestimation of risks. However, since the qualified data do not represent all of the data for a single analyte, they are not expected to have a large impact on risk estimates. With the exception of those analyses noted, no MS/MSD evaluations were flagged by the laboratory due to percent recovery outside of the laboratory's acceptance criteria. ERM, therefore, believes that MS/MSD evaluations meet the requirements of the accuracy parameter.

Surrogate recovery - Surrogate spike recovery is used to evaluate the accuracy of reported measurements. A surrogate standard is a distinct chemical that behaves similarly to the target

chemical and is purposely added to the sample prior to cleanup and extraction. The surrogate spike recovery is used to assess recovery of the target chemical from the sample matrix. A known amount of a surrogate standard is added to the sample prior to cleanup. The amount of the surrogate detected in the analysis is compared to the amount added and the percent recovery's determined. Accuracy is calculated as follows:

$$\%R = \left[\frac{X - T}{K} \right] \times 100$$

where:

R = recovery
X = analytical result of spike sample
T = analytical result of the un-spiked aliquot
K = known addition of the spiked compound

Surrogate spike recoveries were listed for all organochlorine and organophosphorus pesticides, PCBs, PAHs, SVOCs, and VOCs. Surrogate recoveries fell below the laboratory's acceptance criteria for the following samples and parameters: BP-01-0-1-A (organophosphorus pesticides), BP-02-30-31.5-A (VOCs), BP-07-10-11.5A (organophosphorus pesticides), EB-8-5.0-5.5 (organochlorine pesticides), EB-2-20-20.5 (VOCs), and EB-3-30-30.5 (organochlorine pesticides). Surrogate recoveries exceeded the laboratory's acceptance criteria for the following samples and parameters: BP-01-30-31.5-A (VOCs), BP-02-40-41.5-A (VOCs), BP-03-20-21.5-A (VOCs), BP-03-30-31.5-A (VOCs), BP-04-30-31.5-A (VOCs), BP-05-40-41.5-A (VOCs), BP-06-40-41.5-A (VOCs), BP-07-40-41.5-A (VOCs), BP-08-20-21.5-A (VOCs), BP-08-30-31.5-A (VOCs), BP-08-40-41.5-A (VOCs), BP-09-0-1-A (organochlorine pesticides), BP-09-10-11.5-A (organochlorine and organophosphorus pesticides), BP-09-20-21.5-A (organochlorine pesticides and VOCs), BP-09-30-31.5-A (organochlorine and organophosphorus pesticides and VOCs), BP-09-40-41.5-A (VOCs), BP-10-30-31.5-A (VOCs), BP-10-40-41.5-A (VOCs), and PEB-11-35 (organochlorine pesticides). No data were rejected due to low surrogate recoveries. The majority of the data were biased high due to high recoveries and may represent an overestimation of risks. Sample specific results are discussed in tabular form in Appendix D, Attachment D-2. With the exception of those analyses noted, no surrogate/spike recoveries were flagged by the laboratory due to recoveries outside of the laboratory's acceptance criteria.

Blanks - Accuracy is also evaluated by comparing results for the analysis of blank samples to results for investigative samples. 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. Contaminant concentrations in blanks should be less than detection or reporting limits. The following are analytes that were detected in blanks that were within five times detections in field samples, which resulted in field sample results being considered non-detects or estimated detections with a high bias.

2003 BRC Analytes		
Vinyl acetate	Chromium	Dibutyl phthalate
Asbestos		
2006 BRC Analytes		
Arsenic	Boron	Dichloromethane
Mercury	Molybdenum	Niobium
Phosphorus	Radium 226	Radium 228
Silicon	Thallium	Tungsten
Vanadium	Zinc	

3.1.7.3 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 2002b). 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 were selected randomly in order to adequately assess the exposure areas. The various site characterization efforts discussed in Section 2.4 (Parsons 2000, GES 2000, GES 2003a,b, Aeolus 2003b, 2006 soil investigation by BRC) were developed to allow collection of samples that are representative of the media to which the receptors may be exposed. The samples were analyzed for a broad spectrum of analyses across the site. Samples were delivered to the laboratory in coolers with ice to minimize the loss of analytes. At times the samples were received outside the recommended temperature range or were analyzed beyond the holding time. Sample specific results are discussed in tabular form in Appendix D, Attachment D-2.

3.1.7.4 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 Borrow Area is 99 percent. Blank contamination resulted in the qualification of a few of the data, based on application of the protocol described in RAGS (USEPA 1989) which led to treatment of some of the measurements as non-detects. Not all of the analytical data collected were used in the risk assessment. Besides the rejected data, some samples were reanalyzed and the best or least qualified result was selected.

3.1.7.5 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 listed in Table 2; 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. Only when precision and accuracy are known can datasets be compared with confidence.

Comparability is a concern within the context of this risk assessment because the data used were collected during several site characterization programs over several years. The only results included in the risk assessment that may be from different methods is for metals. The analyses USEPA 6010B and 6020 were used. The main difference between the analyses is that the USEPA 6020 method uses a mass spectrometer to identify the metals which allows it to achieve lower detection limits for some metals, but both methods use inductively coupled plasma. There is no anticipated problem in combining these results. All of the other analyses for each analyte and medium were conducted by the same laboratory and method. There are a few compounds (*e.g.*, naphthalene) which are included in multiple analyses with different reporting limits. Naphthalene is included in the VOC (SW8260B) analysis which has relatively low reporting limits, but it is also included in the SVOC (SW8270C) analysis which has much higher reporting limits. In this case, the VOC result was selected unless the VOC result was rejected. For radium-226, the analysis was performed by two methods. Many results were qualified due to blank contamination in one method; consequently, the result from the other method was used in the risk assessment. Otherwise, detection limits were comparable between different site characterization programs as well as between the background dataset and the site dataset.

3.1.8 Data Adequacy

The concept of data adequacy incorporates: (1) an analytical program that seeks to quantify all relevant Site chemicals that have the potential to affect risk calculations, and (2) a spatial density of sampling points that provides confidence that the Site has been sufficiently characterized. The risk assessment analytical program for the Site represents a broad suite of analyses that cover all chemicals that might be conceivably expected to be present at elevated levels at the Site as a result of historical operations on the Site or adjacent to the Site. An evaluation of the adequacy of the sampling for use in risk assessment is presented in Appendix D, Attachment D-3. The evaluation includes results from two unrelated analyses. The first qualitatively evaluates whether the sample collection appears to be adequately representative in relation to the CSM. The second addresses data quality using traditional classical statistics-based process. The focus of the evaluation was on four chemicals that are likely to be important in the risk assessment; arsenic, radium-226, beta-BHC, and dioxins/furans.

3.1.8.1 Conceptual Site Model

Statistical analysis is only one aspect to evaluating sample size adequacy. It is also important to make sure that the data are fully representative of the fate and transport, exposure pathways, and receptor scenarios being evaluated for decision making. At the Borrow Area the investigations have focused on possible contamination in surface and subsurface soils. The samples were analyzed for chemicals that are likely to be important in the risk assessment. The sample locations are reasonably spread out throughout the Site and include surface and multiple subsurface depths at most of the locations.

Background comparisons have also been performed. Although it is concluded that radium-226 site concentrations are statistically greater than background, the differences do not visually appear large. Under these circumstances, the sampling scheme seems appropriate. In general as the data do not show indications of outliers, the sampling scheme seems appropriate.

3.1.8.2 Traditional Data Quality Assessment Approach

The sample size calculations presented in Appendix D, Attachment D-3 use a formula that accommodates data that are not normally distributed. This test is based on comparing an average concentration to a threshold (*i.e.*, risk-based screening level [RBSL]) that is analyte specific. The target RBSLs were calculated using the risk assessment inputs in this risk assessment for construction workers, maintenance workers, and trespassers. These RBSLs are presented in the

project QAPP (BRC and MWH 2006b). The RBSLs were based on a target hazard index (HI) of 1.0 or a target cancer risk level of 10^{-6}. The minimum RBSL for worker receptors was selected for the evaluation, which was the maintenance worker due to greater exposure time. For some radionuclides the site mean concentration exceeded an RBSL based on the target cancer risk level of 10^{-6}. For these chemicals an RBSL was calculated using a 10^{-5} or 10^{-4} target cancer risk level.

The methodology evaluates the number of samples needed to determine with sufficient statistical power the attainment of site concentrations relative to a target soil concentrations given a desired level of confidence, target soil concentrations, specified tolerable difference from the target soil concentrations, and site data standard deviations. Site standard deviations are calculated using site data in Appendix D, Attachment D-3. A matrix table was created with estimated sample size needs for a range of confidence levels. The level of confidence range included 0.15, 0.20 and 0.25 false negative error (β) and 0.05, 0.10, and 0.15 false positive error (α). The tolerable difference from the RBSL ranged from 10 percent to 30 percent. A drawback of this analysis is that the acceptable alpha and beta error as well the desired tolerable difference from the RBSL have not been previously established nor selected. Results could change based on selection of different acceptable error rates and tolerable differences.

For arsenic, beta-BHC, and dioxins/furans sample sizes were adequate for a wide range of threshold concentrations. For radium-226, sample size was adequate for the RBSL at the 10^{-4} target risk level. It should be noted that sample size adequacy could change if alternate tolerable differences were used. However, since the existing site means are much higher than the maximum current tolerable difference of 30 percent, much higher tolerable differences would likely have to be selected as alternate criteria to result in a different outcome from the current tests. For example, at the lowest RBSL where sample adequacy was observed the site means for arsenic, beta-BHC, dioxins/furans, and radium-226 were 85%, 99%, 90%, and 30% lower than the RBSL, respectively.

Overall, the results of the evaluation indicates that there are an adequate number samples collected for each chemical for use in this risk assessment.

4.0 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 data quality objectives and developing exposure scenarios.

The risk assessment evaluates current and potential future land-use conditions. Currently, the Site is undeveloped. Current receptors that may use the property include on-site construction workers involved in the excavation of borrow area material, and current/future on-site trespassers. The CSM also considers other future land-uses. For example, the CSM includes the planned use of borrow area material. All potential transfer pathways were included in the CSM. The human health CSM is presented in Figure 4.

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
- Fugitive dust generation and transport
- Vapor emission and transport

The following release mechanisms were not evaluated in this evaluation:

- Storm/surface water runoff into surface water and sediments
- Vapor emission and transport into indoor air
- Uptake by plants

Although these release mechanisms are identified here, no quantitative modeling is presented in this Chapter. Instead, those primary release mechanisms identified for particular receptors are presented in this Chapter, and are quantitatively evaluated in Chapter 6. The potential for downward vertical migration in the vadose zone is evaluated in Chapter 9.

4.1 IMPACTED ENVIRONMENTAL MEDIA

Environmental media at the Site consist of three categories: soil, groundwater and ambient outdoor air. Generally, impacted soil is the source of chemical exposures for other media at the Site.

As shown in Figure 2, the two areas are bisected by the known contaminated area of the previous Western Ditch, which will not be used as the source of any of the borrow materials. Even though there is no evidence of disposal of any waste materials in the proposed Borrow Area, because the area, in general, lies in the midst of other waste disposal areas, it is possible that some surface contamination due to water run-off and airborne deposition may have occurred. Historically, there have been drainage channels in the Borrow Area created by storm water runoff from adjoining CAMU and plant areas. It is possible that the soil in the Borrow Area has been impacted by runoff from neighboring sites.

4.2 MIGRATION PATHWAYS

Exposure to Borrow Area soils chemicals may be direct, or indirect following migration pathways. These pathways can be primary or secondary and impacted soil is the initial source. For example, upward migration of chemicals entrained on dust particles from impacted soil into ambient air thereby reaching a point of human inhalation represents a primary transfer.

These migration pathways represent the potential that one or more chemicals may be transported to an area away from the Borrow Area soil where a human receptor could be exposed. Discussions of each of the identified potential migration pathways are presented below. Figure 4 presents a conceptualized diagram of the migration pathways and fate and transport modeling for the Borrow Area soil.

Four initial migration 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 outdoor air. The second primary migration pathway is via fugitive dust emissions into ambient air. The third primary migration pathway is downward migration of chemicals from soil to groundwater. This pathway is evaluated in Chapter 9. Finally, chemicals in soil can migrate to plants grown in Borrow Area soil via uptake through the roots. The plant uptake pathway is typically evaluated for residential receptors; however, as discussed in Section 4.3 below, because the Borrow Area soil will not be used as fill material for residential development, this pathway was not evaluated in the HHRA.

While the constraints for borrow soil placement excludes the use as fill for residential development, the soil could be used for commercial development where the volatiles could potentially migrate from soil into indoor air of commercial buildings. These exposures are expected to be negligible compared to the risks associated with the pathways considered in this risk assessment as discussed in the Uncertainty Analysis (Chapter 7).

4.3 POTENTIAL HUMAN EXPOSURE SCENARIOS

The following section summarizes Borrow Area soil exposures and the potential human exposure scenarios. 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, soil);
- A point of potential human contact with the medium; and
- A route of exposure (*e.g.*, inhalation, ingestion, dermal contact).

The Borrow Area soil is proposed for use as fill material for various construction projects. Any such project will involve limited or no post-construction exposures to the Borrow Area soil. The constraints placed on the use of Borrow Area soil as fill material are: (1) the materials will be used in non-residential areas; (2) the placement of soils will be such that there are limited exposure pathways for receptors; (3) a minimum soil column height will be maintained between where these soils are placed and the local groundwater such that impacts to groundwater demonstrated via the leaching evaluation are negligible; (4) to the extent possible, these materials will be placed in significant quantities (approximately 50,000 yards) at each location (DBS&A 2006a). An additional constraint on the use of Borrow Area soil as fill material is that it will not be placed in environmentally sensitive areas.[3] Therefore, the following presents the primary exposure pathways for each of the potential receptors to Borrow Area soil. These populations

[3] These areas may include wetlands, National and State parks, critical habitats for endangered or threatened species, wilderness and natural resource areas, marine sanctuaries and estuarine reserves, conservation areas, preserves, wildlife areas, wildlife refuges, wild and scenic rivers, recreational areas, national forests, Federal and State lands that are research national areas, heritage program areas, land trust areas, and historical and archaeological sites and parks. These areas may also include unique habitats such as aquaculture sites and agricultural surface water intakes, bird nesting areas, critical biological resource areas, designated migratory routes, designated seasonal habitats, State designated Natural Areas, State designated areas for protection or maintenance of aquatic life, and particular areas, relatively small in size, important to maintenance of unique biotic communities.

and complete/potentially complete exposure pathways for each of the receptors were evaluated in the HHRA.

4.3.1 Identification of Exposure Pathways and Receptors

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 one hour a day are less than those associated with exposure to the same chemicals at the same concentrations for two hours a day. An exposure pathway is a description of the ways in which a person could be exposed to chemicals. Potential health impacts from chemicals in a medium can occur via one or more exposure pathways. Exposure pathways for each of the receptors evaluated in this risk assessment are presented in Figure 4, and summarized below.

- Future Construction Workers (on-site soil/off-site fill material)
  - incidental soil ingestion*
  - external exposure from soil†
  - dermal contact with soil
  - outdoor inhalation of dust*‡
  - outdoor inhalation of VOCs from soil

- Current/Future Trespassers (on-site soil)
  - incidental soil ingestion*
  - external exposure from soil†
  - dermal contact with soil
  - outdoor inhalation of dust*‡
  - outdoor inhalation of VOCs from soil

- Future Outdoor Maintenance Workers (off-site fill material)
  - incidental soil ingestion*
  - external exposure from soil†
  - dermal contact with soil
  - outdoor inhalation of dust*‡
  - outdoor inhalation of VOCs from soil

*Includes radionuclide exposures.
†Only radionuclide exposures.
‡Includes asbestos exposures; evaluated separately.

As indicated above and in Figure 4, future outdoor off-site maintenance workers, future on-site/off-site construction workers, and current/future on-site trespassers could be exposed to chemicals in soil through skin contact, inhalation of VOCs in outdoor air, inhalation of chemicals adsorbed to fugitive dust, or incidental ingestion of soil when soiled hands or objects are placed in or near the mouth. For radionuclides, external radiation is also a potential soil-related exposure pathway for all receptors. For asbestos, inhalation of fugitive dust is considered the only potential soil-related exposure pathway for all receptors. Risks to potential nearby, off-site receptors that may be impacted during excavation and placement activities are addressed qualitatively in the Uncertainty Analysis (Chapter 7) based on the risk characterization for the on-site receptors.

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, in order to ensure that a risk assessment focuses on those substances that contribute the greatest to the overall risk (USEPA 1989); two procedures were used to eliminate the COPCs for quantitative evaluation in the risk assessment:

- identification of chemicals with detected levels which are at or less than background concentrations (where applicable), and
- identification of chemicals that are infrequently detected at the Site.

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 Chapter indicate that such elimination is possible. The procedure for evaluating COPCs relative to background conditions is presented below.

5.1 EVALUATION OF DETECTIONS RELATIVE TO BACKGROUND CONDITIONS

USEPA (1989, 2002c,d) guidance allows for the elimination of chemicals from further quantitative evaluation if detected levels are not elevated above naturally occurring levels. Typically for purposes of selecting COPCs for the risk assessment, COPCs are chemicals that are elevated above naturally occurring levels based on statistical comparison. For the purpose of selecting COPCs for the risk assessment, appropriate statistical methods were applied for the background comparison. When the results of the statistical analyses indicate that a particular chemical is within background levels, then the chemical was not quantitatively evaluated in the risk assessment. That is, a chemical was selected as a COPC based on background conditions if it was determined to be above background levels in any individual background comparison test. With the application of this conservative approach, a chemical was excluded as a COPC only if it was determined to be at or below background levels in all statistical comparison tests. Chemicals that would have been eliminated as COPCs utilizing a weight of evidence approach (rather than exceedance of a single test metric) are identified in the Uncertainty Analysis (Chapter 7). Additionally, chemicals eliminated as COPCs are addressed qualitatively in the Uncertainty Analysis (USEPA 2002c).

Background concentrations of metals and radionuclides considered representative of the Site soils were evaluated. A comparison of site-related soil concentrations to background levels was conducted using the existing, provisional soils background dataset presented in the *Background Shallow Soil Summary Report, BMI Complex and Common Area Vicinity* (BRC/TIMET 2007, currently in review by the NDEP), which includes both the Environ (2003) dataset and the BRC/TIMET dataset collected in 2005. A single site-related dataset was used for the background comparisons containing all depths; no stratification of data was performed. These comparisons were performed using the Quantile test, Slippage test, *t*-Test and the Wilcoxon rank sum test with Gehan modification. The Quantile test, Slippage test, and Wilcoxon Rank Sum test are non-parametric. That is, the tests are distribution free, thus an assumption of whether the data are normally or lognormally distributed is not necessary. The computer statistical software program Guided Interactive Statistical Decision Tools (GISdT®; Neptune and Company 2007), was used to perform all statistical comparisons, with a decision error of alpha = 0.025.

The Wilcoxon Rank Sum test performs a test for a difference between two population measures of center. This is a non-parametric method that relies on the relative rankings of data values and the measure of center is quantified by the sum of the ranks in both Site and background data. Knowledge of the precise form of the population distributions is not necessary. The Wilcoxon Rank Sum test has less power than the two-sample t-test when the data are in fact normally distributed; however the assumptions are not as restrictive. The GISdT® version of the Wilcoxon Rank Sum test uses the Mantel approach which is equivalent to using the Gehan ranking system.

The Quantile test addresses tail effects which are not addressed in the Wilcoxon rank-sum test. The Quantile test looks for differences in the right tails (upper-end of the dataset) rather than central tendency like the Wilcoxon rank-sum test. The Quantile test was performed using a defined quantile = 0.80.

The Slippage test evaluates whether there are an unreasonable number of site data points that exceed the maximum background value.

Typically an alpha = 0.05 is used to evaluate a statistically significant result. Since several correlated tests were conducted, a lower alpha was selected. As more tests are performed, it becomes more likely that a statistically significant result will be obtained purely by chance. Given the use of the multiple statistical tests, an alpha = 0.025 was selected as a reasonable significance level for the COPC selection. Additionally, these tests are set up with one-sided hypotheses.

Consequently, not only are differences between the two samples able to be detected, a directional determination can be made as well (*i.e.*, Site is greater than background). Normal QQ plots and side-by-side box-and-whisker plots were also prepared to evaluate whether the Site data and background data are representative of a single population. These plots were qualitatively used in the selection of COPCs. These plots give a visual indication of the similarities between the Site and background datasets. Table 3 presents the background comparison results for the Site. The comparison statistics, summary statistics, and box-and-whisker and normal QQ plots are included in Appendix E.

5.2 FURTHER SELECTION OF COPCS

From the list of COPCs identified in Section 5.1, further selection of COPCs was performed by:

- Including chemicals positively identified in at least one sample, including: (1) chemicals with no qualifiers attached (excluding non-detect results with unusually high detection limits, if warranted), and (2) chemicals with qualifiers attached that indicate known identities but estimated concentrations (*e.g.*, J-qualified data); and

- Including chemicals detected at levels significantly elevated above levels of the same chemicals detected in associated blank samples (this protocol includes an analyte if it is known to be Site-related and its concentration is greater than five times the maximum amount detected in any blank; if the chemical is a common laboratory contaminant [as defined by USEPA 1989], it is included only if its concentration is greater than 10 times the maximum amount detected in any blank).

In further deriving the list of COPCs, the following criteria established by USEPA (1989) were also considered:

Concentration and Toxicity – Aspects of concentration and toxicity must be considered prior to eliminating a chemical as a COPC. For example, weight-of-evidence for human toxicity is considered in conjunction with site exposure concentrations. Thus, Class A carcinogens (*e.g.*, benzene) were retained as COPCs.

Furthermore, consistent with Agency for Toxic Substances and Disease Registry (ATSDR) guidance (De Rosa *et al*. 1997), if the maximum dioxins/furans toxic equivalency (TEQ) concentration does not exceed the ATSDR screening value of 50 parts per trillion (ppt), dioxins/furans will generally not be retained as COPCs. This screening value is consistent with a recent review of the scientific evidence for the risks posed by dioxins (Paustenbach *et al*. 2006).

The maximum TCDD TEQs for all samples with detections were less than the screening level of 50 ppt. However, the reporting limit for 2,3,7,8-TCDD in sample BP-09 was 61 pg/g (ppt). Due to this elevated reporting limit, a TCDD TEQ concentration of 31.8 pg/g was calculated. This means that the TCDD TEQ for this sample lies somewhere between 0.35 pg/g (based on detected congeners only) and approximately 63 pg/g (based on full reporting limits for the non-detected congeners), a value which exceeds the ATSDR screening target level of 50 pg/g. Therefore, dioxins/furans (as TCDD TEQ) are retained as COPCs.

Availability of Toxicity Criteria – Some chemicals have not been assigned toxicity criteria by USEPA. Although included as COPCs, these chemicals were not quantitatively evaluated in the risk assessment. These chemicals include organic tentatively identified compounds (TICs) (cyclic octaatomic sulfur, o,o'-diethyl s-methyl thiophos, diethyl phosphorodithioic acid, phosphorothioic acid s-[2-[(1, S-methyl methanethiosulphonate), and several organic compounds (O,O,O-triethyl phosphorothioate, p-chlorothiophenol), and metals (calcium, magnesium, niobium, potassium, sodium, tungsten, zirconium). Because of the inconclusive nature of TICs as potentially 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. The exclusion of these COPCs from quantitative analysis is addressed qualitatively in the Uncertainty Analysis (Chapter 7).

Frequency of Detection – Another criterion that may warrant COPC reduction is the frequency of detection. In general, chemicals exhibiting a low frequency of detection will 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 (USEPA 2007a), may be considered for elimination. PBT chemicals are toxic, persist in the environment and bioaccumulate in food chains and, thus, pose risks to human health and ecosystems. Prior to eliminating a COPC based on the frequency of detection criteria, (1) any elevated detection limits are addressed, and (2) data distributions within the Site are considered. Results of the selection of COPCs, including the rationale for excluding chemicals as COPCs are presented in Table 4.

6.0 HUMAN HEALTH RISK ASSESSMENT

This Chapter presents the human health risk assessment of all COPCs identified in Chapter 5 for all receptors of concern via all complete pathways. The methods used in the risk assessment follow standard USEPA guidance. 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:

- USEPA. 1992a. *Guidelines for Exposure Assessment.*
- USEPA. 1991a. *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual. Supplemental Guidance.*
- USEPA. 1996. *Soil Screening Guidance*.
- USEPA. 1997a. *Exposure Factors Handbook.*
- USEPA. 2000. *Soil Screening Guidance for Radionuclides.*
- USEPA. 2002a. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.*
- USEPA. 2003a. *Technical Support Document for a Protocol to Assess Asbestos-Related Risk. Final Draft.*

The risk assessment is a deterministic risk assessment; meaning that, single values based on generally 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 each area.

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 media of concern. The second step is fate and transport modeling to predict concentrations that may be present when direct measurements are not available. The third 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 hazard indices are calculated.

6.1 DETERMINATION OF EXPOSURE POINT CONCENTRATIONS

A representative exposure concentration is a COPC-specific and media-specific concentration value. In the 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.

6.1.1 Soil Exposure Point Concentrations

The HHRA incorporates representative exposure concentration estimates (*e.g.*, 95 percent upper confidence limit [UCL] on the arithmetic mean [USEPA 1992c, 2002e]) that specifically relate to potential site-specific human exposure conditions. For the 95 percent UCL concentration approach, the 95 percent UCL was computed in order to represent the area-wide exposure point concentrations. The UCL incorporates the uncertainty of the estimate of the mean and is the value that, with repeated sets of samples, will be greater than the true mean 95 percent of the time. Based on USEPA (1989) guidance and NDEP requests, 95 percent UCL were calculated using three options for non-detects; (1) use of the detection limit directly, (2) use of one-half the detection limit, and (3) a random number between zero and the detection limit for each non-detect. For radionuclide uncensored data, the actual reported value was used. For samples with field duplicates, the primary sample was used, unless rejected, in which case the duplicate sample was used if not rejected. Data identified in the data usability evaluation as unusable due to elevated reporting limits were not used in the calculation of representative exposure concentrations. The formulas for calculating the 95 percent UCL COPC concentration (as the representative exposure concentration) are presented in USEPA (1992c, 2002e).

The 95 percent UCL statistical calculations were performed using the computer statistical software program GISdT® (Neptune and Company 2007). Because 95 percent UCLs were calculated using three options for non-detects, three different sets of 95 percent UCL statistical calculations were performed for each COPC resulting in three estimates of a normal 95 percent UCL for normally distributed data and nine estimates of a bootstrap 95 percent UCL for non-normally distributed data. For normally distributed data the maximum of the three normal 95 percent UCLs was selected. For non-normal data the maximum of the nine bootstrap 95 percent UCLs was selected. If the selected 95 percent UCL did not exceed the maximum value (including detects and detection limits) it was selected as the exposure point concentration, otherwise the maximum value was used as the exposure point concentration.

The 95 percent UCL of the arithmetic mean concentration is used as the average concentration, because it is not possible to know the true mean. The 95 percent UCL, therefore, accounts for uncertainties due to limited sampling data. An estimate of average concentration is used because: carcinogenic and chronic non-carcinogenic toxicity criteria are based on lifetime average exposures; and, average concentration is most representative of the concentration that would be contacted at a site, over time (USEPA 1992c).

Representative exposure concentrations for soil are typically based on the potential exposure depth for each of the receptors. However, given that the HHRA purpose was to assess exposures to soil following excavation and use as off-site fill material, the 95 percent UCL was generated for all data collected within the excavation extent and depth. This 95 percent UCL is used for all potentially exposed receptors. The 95 percent UCL for each COPC is presented in Table 5. For indirect exposures, this concentration was used in fate and transport modeling. See Section 6.3.4 for a discussion on exposure point concentrations for asbestos. An analysis of the representativeness of the 95 percent UCL is provided below.

6.1.1.1 Representativeness of the 95 Percent UCL

For the purposes of this risk assessment, the 95 percent UCL on the arithmetic mean were calculated for each COPC for both site and background data using the computer statistical software program GISdT® (Neptune and Company 2007) and were used to estimate risks to human health if they did not exceed the maximum value. The 95 percent UCL on the mean is intended to estimate the average exposure across a defined area. Maximum values are sometimes used when 95 percent UCLs of the mean) are difficult to estimate, and when the UCLs are greater than the maximum value. They are also sometimes used to provide a greater degree of protection for human health, however, this does not follow guidance (*e.g.*, RAGS), and can result in action being taken at a site when such action is unnecessary.

In order to demonstrate that the 95 percent UCLs used in the risk assessment are representative and realistic, six chemicals were reviewed. The primary risk drivers arsenic, lead-210, and radium-226 as well as three chemicals with relatively high contributions to the total risk, hexachlorobenzene, alpha-BHC and beta-BHC were selected. The table below shows the summary statistics for the six chemicals. Risks for all six chemicals were calculated using the 95 percent UCL. The 95 percent UCL for all compounds is greater than the mean as expected. The 95 percent UCLs and the means are greater than the maximum detection for lead-210 and hexachlorobenzene. Hexachlorobenzene was only detected in one sample and was selected as a COPC because it is a PBT compound.

Based on the results in the table below, it is demonstrated that the exposure point concentrations used in the risk assessment are representative of the dataset because the 95 percent UCLs are greater than the mean; however, they are relatively close to the mean. Because there are large sample sizes it is expected that the 95 percent UCL and the means should be close. For the analytes presented below, no 95 percent UCLs are more than two times the mean concentration.

Analyte	Sample Size	Max Detect	Mean	Std. Dev.	95% UCL	EPC Basis	EPC
Arsenic	80	25	7.0	5.3	8.2	Bootstrap using DL	95% UCL
Lead-210	49	2.3	8.0	10	11	Bootstrap using DL	95% UCL
Radium-226	49	4.5	2.0	0.7	2.2	Bootstrap using DL	95% UCL
Hexachlorobenzene	81	0.072	0.43	0.17	0.46	Bootstrap using DL	95% UCL
alpha-BHC	102	0.073	0.0073	0.011	0.0097	Bootstrap using DL	95% UCL
beta-BHC	102	0.46	0.02	0.058	0.036	Random DL	95% UCL

DL = detection limit
UCL = upper confidence
EPC = exposure point concentration.

6.1.2 Air Exposure Point Concentrations

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 typically a time-dependent reduction of chemical concentrations in water, soil, and air.

The fate and transport modeling conducted for the Site took into account chemical-specific physical parameters and migration pathways discussed in Section 4.2. All modeling input parameters, calculations and results are presented in Appendix F.

6.1.2.1 Outdoor Air

Exposure to COPCs bound to dust particles was evaluated using the USEPA's Particulate Emission Factor (PEF) approach (2002a). The USEPA guidance for dust generated by construction activities (USEPA 2002a) was used for assessing construction worker exposures. For exposures to VOCs in outdoor air, the USEPA volatilization factor approach was used (USEPA 2002a). Input soil concentrations for these models were the exposure point concentrations identified above.

6.1.2.2 Outdoor Air Modeling for Volatiles

Ambient air concentrations due to subsurface volatilization were estimated using the USEPA volatilization factor approach (USEPA 2002a). This model combines information about the behavior of a chemical in the environment with site and atmospheric parameters to determine a volatilization factor of a chemical at the soil surface following upward migration from soil. The resultant volatilization factor was multiplied by the dispersion factor for volatiles (Q/C_{vol} for Las Vegas; from USEPA 2002a; see Table 1) for use in the outdoor air exposure pathway. Exposure point concentrations for outdoor air are presented in Table 6.

6.1.2.3 Fugitive Dust Generation, Dispersion, and Deposition

COPCs adsorbed to soil particles can potentially become airborne, resulting in possible exposure of receptors and/or migration and off-site deposition and accumulation in soil. Long-term exposure to COPCs bound to dust particles were evaluated using the USEPA's PEF approach (USEPA 2002a). 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 2002a]) values in this equation were for Las Vegas, Nevada (Appendix D of USEPA 2002a; see Table 1). The USEPA guidance for dust generated by construction activities (USEPA 2002a) was used for short-term construction worker exposures. The construction worker modeling uses default model assumptions, except for soil moisture and silt content, for which site-specific data are available.

6.1.3 Asbestos Exposure Point Concentrations

The exposure point concentrations for asbestos were based on the pooled analytical sensitivity of the dataset. The pooled analytical sensitivity was 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 2003a). 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 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 where the mean equals the number of structures detected. In EXCEL, the following equation may be employed to calculate this value:

$$\text{95\% UCL of Poisson Distribution } (10^6 \text{ s/gPM10}) = \text{CHIINV}(1 - \alpha, 2 \times (\text{Long fiber count} + 1)/2)$$

This value is then multiplied by the pooled analytical sensitivity to estimate the upper bound concentration. The intent of the risk assessment methodology was to predict the risk associated with airborne asbestos.

In order to quantify the airborne asbestos concentration, the estimated dust levels or PEFs used in other areas of the risk assessment were used:

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

6.2 EXPOSURE ASSESSMENT

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 and the chemical concentrations identified in Section 6.1.

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 7 through 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 were default factors developed by USEPA's Superfund program. Default values were modified to reflect site-specific conditions, where possible. The site-specific factors were derived to reflect average or reasonable maximum exposure conditions, based on Site data. This is the case for current/future on-site trespasser exposure frequency and time. In these instances, professional judgment was used to select appropriate exposure factors. For the current/future on-site trespasser exposure frequency and time, it is assumed that a current/future on-site trespasser could access the Site for 50 days per year (or one day per week) and spend four hours on the Site per visit. The exposure parameters used in the risk assessment were those defined in the Work Plan (MWH 2006).

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 average daily dose (ADD) of COPCs that may be taken in by the exposed individuals. Later, in the risk characterization step of the assessment, the ADDs 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 ADD of the COPCs via each of the complete exposure pathways is based on USEPA (1989, 1992a) 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:

$$ADD \ or \ LADD \ (mg/kg - day) = \frac{C \times IR \times EF \times ED \times (BIOorAF)}{AT \times BW}$$

where:

C = COPC concentration (*e.g.*, mg/kg, milligrams per cubic meter [mg/m^3])

IR	=	intake rate; the amount of the transport medium contacted per unit time (*e.g.*, mg/day, m^3/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
AF/BIO	=	absorption fraction (percent) / relative bioavailability (unitless)
AT	=	averaging time; the time over which the exposure is averaged (days)
BW	=	body weight (kilograms)

With the exception of arsenic, the relative oral bioavailability (BIO) of all COPCs was assumed to be 100 percent. For arsenic, based on scientific literature recommendations on arsenic bioavailability (Roberts *et al*. 2001; Ruby *et al*. 1999; USEPA 2001c), an arsenic oral bioavailability of 30 percent was used. The actual oral bioavailability of arsenic (as well as other metals at the Site) is likely to be lower than this value. Chemical-specific dermal absorption values from USEPA guidance were used in the risk assessment.

6.2.3 Radionuclides

Risks associated with radionuclides were evaluated separately from chemicals. Recently available USEPA risk assessment methodologies for radionuclides were used (USEPA 2000). There are several important differences between evaluating risks pertinent to radionuclides and those pertinent to chemicals. These differences include:

- Results are presented as activities (*e.g.*, pCi/g) instead of units of mass (*e.g.*, mg) in soil;
- Only the carcinogenic effects of radionuclides due to ionizing radiation are considered. A radionuclide may also have a chemical toxicity (*e.g.*, uranium or lead). These risks are addressed separately by using the concentration of mass of chemical in soil, rather than activity; and
- CSFs are based on the total theoretical age-averaged ILCR per intake of the radionuclide, or per unit external radiation exposure to gamma-emitting radionuclides. An adult only soil ingestion CSF is available and was used for all receptors. Except for external CSFs, which are presented as risk/year per pCi/g soil, CSFs for radionuclides are not expressed as a function of body weight or time as are CSFs for chemicals.

Exposure equations and parameter values used were the standard deterministic risk assessment exposure parameters based on typical USEPA (2000, 2007b) default values. The exposure equations were modified to include radionuclide decay as used in USEPA's radionuclide PRG

equations (USEPA 2007b). Default parameter values are presented in Tables 7 through 9. These factors were also used in the calculation of a site-specific background radionuclide risk level.

6.2.4 Asbestos

Although final guidance is unavailable at this time, USEPA recommends that site-specific risk assessments be performed for asbestos. Risks associated with asbestos in soil were evaluated using the most recent draft methodology proposed by USEPA (2003a). 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). Exposure pathways, equations, and parameters used are those presented in USEPA (2003a). Adjustments for exposure duration and exposure intensity, consistent with the methodology, were made for each of the receptor populations, based on the respective exposure parameters presented in Tables 7 through 9. The calculation of risks to asbestos are presented in Appendix G.

For assessing asbestos risks, Table 8-2 (Based on Optimum Risk Coefficients) of USEPA (2003a) was used. Table 8-2 presents best estimate risks estimates based upon 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 were selected for use 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 (2003a), because the asbestos risks to male and female smokers/non-smokers are different, population averaged risks were evaluated based on Equation 8-1. This equation (presented in Section 6.3.5 below) considers male smokers, male non-smokers, female smokers, and female non-smokers, and is based upon the assumption that 21.4% of the general population smokes (USEPA 2003a). The population averaged risks accounts for the weighted risks to both the smoking and non-smoking populations collectively. In addition, because both chrysotile and amphibole have been detected at the site and in the general area (for example, from the City of Henderson wastewater reclamation facility [WRF] sampling), both could be expected to occur at the Site. Therefore, both amphibole and chrysotile fibers were conservatively evaluated in the HHRA, regardless as to whether either was detected (as calculated using the 95 percent UCL on the mean of the assumed underlying Poisson distribution).

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 (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 2007c) and the Health Effects Assessment Summary Tables (HEAST; USEPA 1997b). CSFs are chemical-specific, experimentally-derived potency values used to calculate the risk of cancer resulting from exposure to carcinogenic chemicals. A higher value implies a more potent carcinogen. Reference doses (RfDs) are experimentally derived "no-effect" values used to quantify the extent of adverse non-cancer health effects from exposure to chemicals. Here, a lower RfD implies a more potent toxicant. These criteria are generally developed by USEPA risk assessment work groups and listed in USEPA risk assessment guidance documents and databases. The following hierarchy for selecting toxicity criteria was used (from USEPA 2003c):

1. IRIS
2. USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs)
3. National Center for Environmental Assessment (NCEA, or other current USEPA sources)
4. HEAST
5. Cal/EPA Office of Environmental Health Hazards Assessment (OEHHA) Toxicity Criteria Database
6. USEPA Criteria Documents (*e.g.*, drinking water criteria documents, drinking water Health Advisory summaries, ambient water quality criteria documents, and air quality criteria documents)
7. ATSDR toxicological profiles
8. USEPA's Environmental Criteria and Assessment Office (ECAO)
9. Peer-reviewed scientific literature

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 stated 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, the oral-gastrointestinal absorption efficiencies are greater than 50 percent, with two exceptions. One exception is cadmium, which has a reported oral absorption of 2.5 percent (USEPA 2004e). This value was utilized to adjust the oral reference dose for dermal exposures.

The other exception is arsenic, where an oral absorption value of less than 30 percent was used. This value is based on oral bioavailability studies of monkeys administered arsenic in a soil matrix (Roberts *et al*. 2001; cited in USEPA 2001c). The arsenic oral RfD and CSF are based on a human drinking water study, which also includes some contribution of arsenic in food (USEPA 2007c). The matrix differences between the critical study (drinking water/food) versus the oral bioavailability studies contribute to the uncertainty in the risk/hazard estimates. However, it is generally assumed that oral absorption from water is essentially complete (100 percent). In addition, Wester *et al*. (1993) demonstrated that there is no statistical difference in the dermal absorption from water and soil in monkeys (USEPA 2001c). Therefore, the USEPA indicated adjustment of the oral toxicity criteria to generate dermal criteria was unnecessary. Thus, oral toxicity values were also used for assessing dermal exposures.

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 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, 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 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. 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, 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. An understanding of the uncertainties associated with RfDs is important in evaluating the significance of the hazard indices calculated in the risk characterization portion of the risk assessment. When available sub-chronic RfDs were used to evaluate construction worker exposures. The COPCs in this assessment with USEPA-established oral/dermal and inhalation RfDs are presented in Table 10.

6.3.3 Carcinogenic Effects

USEPA develops CSFs 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 are typically derived from the upper 95th percentile confidence limit of the slope, and thus the actual risks are unlikely to be higher than those predicted using the CSF, and may be considerably lower. The COPCs in this assessment with USEPA-established oral/dermal and inhalation CSFs are presented in Table 11.

6.3.4 Radionuclides

Radionuclides toxicity criteria were obtained from the USEPA's *Preliminary Remediation Goals for Radionuclides* (USEPA 2007b). For some radionuclides, two different toxicity criteria were available from this table: one for the specific radionuclide only and one for the radionuclide and associated short-lived radioactive decay products (*i.e.*, those decay products with radioactive half-lives less than or equal to six months). To be conservative, the toxicity criteria that include radioactive decay products were used. If the decay product is out of equilibrium with its parent, the daughter's toxicity is evaluated separately. The radionuclide CSFs are presented in Table 12.

6.3.5 Asbestos

For assessing asbestos risks, toxicity criteria were obtained from Table 8-2 (Based on Optimum Risk Coefficients) of USEPA (2003a). Population averaged risks were evaluated based on Equation 8-1 of USEPA (2003a).

$$URF = 0.5 \times ((0.786 \times (NSM + NSF)) + ((0.214 \times (SM + SF)) \times 0.00001/0.00010$$

where:

URF = Population Averaged Unit Risk Factor $[s/cm^3]^{-1}$;*.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
0.00001/0.00010 = factor to convert risk from risk per 100,000 to risk per 1,000,000

As stated above and in USEPA (2003a), Equation 8-1 above is derived based on the assumption that 21.4% of the general population smokes (and subsequently 78.6% are non-smokers). The equation above creates a population averaged risk by weighting individual male and female smoker and non-smoker risks by the percent of each assumed present in the potentially exposed populations. The resulting unit risk factors (structures/cubic centimeter) are presented in Appendix G.

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 as the incremental probability of an individual developing cancer over a lifetime as a result of a chemical exposure. Carcinogenic risks were evaluated by multiplying the estimated average exposure rate (*i.e.*, LADD calculated in the exposure assessment) by the chemical's CSF. 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 will result 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. According to USEPA (1989), this approach is appropriate for theoretical upper-bound ILCRs of less than 1×10^{-2}. The following equations were used to calculate COPC-specific risks and total risks:

$$Risk = LADD \times CSF$$

where:

LADD = lifetime average daily dose (mg/kg-d)
CSF = cancer slope factor $(mg/kg\text{-}d)^{-1}$

and

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

It is assumed that cancer risks from various exposure routes are additive. Thus, the result of the assessment is a high-end estimate of the total carcinogenic risk. High-end carcinogenic risk estimates were compared to the USEPA acceptable risk range of 1 in 10,000 (10^{-4}) and 1 in 1 million (10^{-6}) and NDEP's acceptable level of 10^{-6}. If the estimated 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 1×10^{-5} (1 E-5) represents 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.

The equation used to calculate asbestos risks, which were evaluated separately, was:

$$Risk = Estimated\ Airborne\ Concentration\ (s/cm^3) \times Adjusted\ URF\ (s/cm^3)^{-1}$$

6.4.2 Methods for Assessing Non-Cancer Health Effects

Non-cancer adverse health effects were 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 (*i.e.*, the RfDs).

ADDs and RfDs were compared by dividing the ADD by the RfD to obtain the ADD:RfD ratio, as follows:

$$Hazard\ Quotient = \frac{ADD}{RfD}$$

where:

ADD = average daily dose (mg/kg-d)
RfD = reference dose (mg/kg-d)

The ADD-to-RfD ratio is known as a hazard quotient (HQ). If a person's average exposure is less than the RfD (*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, 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 the 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.

6.4.3 Risk Assessment Results

The calculation of chemical theoretical upper-bound ILCRs and non-cancer health effects are presented by receptor in Tables 13 through 15. Radionuclide risk calculations are presented by receptor in Tables 16 through 18. Asbestos risk calculations are presented in Table 19 and Appendix G. These tables present the theoretical upper-bound cancer risk estimates and non-cancer health effects calculations for all receptors. All calculation spreadsheets for this risk assessment are included in Appendix B, hardcopy tables for asbestos and background risks are presented in Appendices G and H, respectively. The results are summarized in Chapter 8.

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. In this Chapter, a qualitative discussion of the uncertainties associated with the risk assessment for the Site is presented.

Risk assessments are not intended to estimate actual risks to a receptor associated with exposure to chemicals in the environment. In fact, estimating actual risks is impossible because of the variability in the exposed or potentially exposed populations. 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 multitude of conservative assumptions used in risk assessments guard against 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 risk assessment can be grouped into four main categories that correspond to these steps:

- Uncertainties in environmental sampling and analysis
- Uncertainties in fate and transport modeling
- Uncertainties in assumptions concerning exposure scenarios
- Uncertainties in toxicity data and dose-response extrapolations

The uncertainties associated with the risk assessment for the Site are summarized below and in Table 20.

7.1 ENVIRONMENTAL SAMPLING AND ANALYSIS

The risk assessment for the Site was based on the sampling results obtained from several investigations conducted by GES (2000 2003a,b), MWH and Aeolus (2003b), and the 2006 MWH and BRC investigation. Errors in sampling results can arise from the field sampling, laboratory analyses, and data analyses. Errors in laboratory analysis procedures are possible, although the impacts of these sorts of errors on the risk estimates are likely to be low. The environmental sampling at the Site is one source of uncertainty in the evaluation. However, the number of sampling locations and events is large and widespread, and sampling was performed

using approved procedures; therefore, the sampling and analysis data is sufficient to characterize the impacts and the associated potential risks.

7.1.1 Sampled Media

Because the objective of this risk assessment is to determine whether Borrow Area material would pose a potential risk to current and future receptors during its excavation and placement in support of future commercial development projects, sampling at the Site consisted of soil sampling only. Air, soil vapor, and groundwater samples were not collected because these media would not be relevant to assessing risks from borrow area material excavation and placement. Therefore, given that the only anticipated exposures are from soils, and sufficient samples have been collected for the purposes of characterizing chemical concentrations within the Borrow Area, the risk assessment is considered adequate for assessing Site-related risks.

Only validated data are included in the HHRA, therefore, several sample locations collected during the Parsons 2000 investigation that are located within the current definition of the Borrow Area boundary are not included in the HHRA dataset because these data were not subjected to data validation. All of the detected concentrations of COPCs associated with these samples are consistent with concentrations from other datasets included in the HHRA with the exception of beta-BHC. Although the concentrations associated with beta-BHC for these two samples are the largest detected in the Borrow Area (1.9 and 2.4 mg/kg), estimation of a 95 percent UCL associated with addition of these concentrations (0.25 mg/kg) would not result in risks that would alter the overall estimated risk for the Borrow Area soils. Therefore, exclusion of these two locations is considered unlikely to affect the outcome of the HHRA.

7.1.2 Analyte Quantification

A number of samples (as discussed in Section 3.1.7.2) had qualified results for a number of VOCs, and three removed or rejected samples for organochlorine pesticides and hexavalent chromium due to holding time, and numerous samples were qualified due to sample receipt temperature. For organochlorine pesticides and hexavalent chromium, the remaining number of samples is large and considered sufficient for estimating risks associated with the Borrow Area soils. The qualified data may potentially yield reduced risk estimates for VOCs. However, arsenic is the largest contributor to the chemical risk estimates, which makes up more than 90 percent of the total ILCR. The conservative nature of the exposure point concentrations for air (volatilization factor discussed below), the low contribution to total risk from VOCs compared to

other compounds, and the large number of samples available for SVOCs and pesticides is suggestive that the data are sufficient for risk assessment purposes.

Most of the spike recoveries that were outside control limits are slightly outside the control limits and only represent a minor potential to underestimate risks for 1,2,4-trichlorobenzene, 2-hexanone, 2,3,7,8-tetrachlorodibenzofuran, 4,4'-DDE, acenaphthylene, aluminum, antimony, barium, calcium, chromium (total), copper, cyanide (total), dichlorodifluoromethane, dieldrin, endosulfan I, endrin aldehyde, heptachlor, iron, manganese, magnesium, nickel, niobium, octachlorodibenzodioxin, perchlorate, phosphorus (as P), silicon, strontium, thallium, titanium, tungsten, vanadium, vinyl acetate, zinc, and zirconium.

As such these results were considered for use in the risk assessment. Only the matrix spike results for total cyanide, 4,4'-DDE, endosulfan I, endrin aldehyde, and heptachlor show the potential for a significant underestimation of a soil concentration at locations BP-01 (cyanide), BP-02 (cyanide), BP-03 (cyanide), BP-04 (cyanide), and BP-09 (pesticides). However, the inability to recover measurable levels of these constituents is likely due to matrix interferences and correcting for initial soil concentrations of the samples.

7.1.3 Detection Limits

In some instances, analytical detection limits were above typical risk assessment screening levels (*e.g.*, USEPA Region 9 PRGs) for some chemicals not evaluated in the risk assessment because the chemical was not-detected in any of the investigation samples. This data gap presents an uncertainty of whether these chemicals are present at levels above acceptable risk levels. However, these instances are relatively few, and given the limited exposures expected, this may possibly cause some underestimation of risk. Overall, the risk assessment overestimates Borrow Area material-related risks.

Long asbestos amphibole fibers were not detected but were assessed at the analytical detection limit. A single short amphibole fiber was detected. However, short fibers are not used to quantitate asbestos risks. Zero long structures detected yields a 95 percent UCL of the Poisson distribution of three. Based on this, the assumption that amphibole fibers were present in non-detect samples resulted in risk estimates that exceed the risk goal of 1×10^{-6}. However, given that amphibole has been detected at the site and in the general area, this assumption is not unreasonable.

7.1.4 Exposure Point Concentrations

The exposure point concentrations used in the risk assessment are intended to overestimate mean concentrations. The 95 percent UCLs were calculated using three options for non-detects; use of the detection limit directly, use of one-half the detection limit, and a random number between zero and the detection limit for each non-detect. Because 95 percent UCLs were calculated using three options for non-detects three different sets of 95 percent UCL statistical calculations were performed for each COPC resulting in three estimates of a normal 95 percent UCL for normally distributed data and nine estimates of a bootstrap 95 percent UCL for non-normally distributed data. For normally distributed data the maximum of the three normal 95 percent UCLs was selected. For non-normal data the maximum of the nine bootstrap 95 percent UCLs was selected. If the selected 95 percent UCL did not exceed the maximum value (including detects and detection limits) it was selected as the exposure point concentration, otherwise the maximum value was used as an exposure point concentration. Use of the maximum non-detect result adds a significant source of uncertainty. For example, the maximum detected concentration for hexacholobenzene is 0.072 mg/kg. However due to elevated detection limits, the maximum detection limit is 1.1 mg/kg, the 95 percent UCL and exposure point concentration for hexachlorobenzene is 0.46 mg/kg. Thus because of the elevated detection limits for hexachlorobenzene, the exposure point concentration is over six times greater than the maximum detected concentration.

7.2 FATE AND TRANSPORT MODELING

Where possible, measured data were used in the risk assessment. However, fate and transport modeling was necessary in order to quantify estimated risks associated with media for which measured data were not available (*i.e.*, air). When available, site-specific data were used in the modeling. Where site-specific data were unavailable, input parameters were selected such that modeling concentrations were conservatively estimated.

7.2.1 Volatilization Factors

Volatilization factors were calculated based upon USEPA volatilization factor approach (USEPA 2002a). The same volatilization factors were used for all exposed receptor scenarios. The construction worker volatilization factors were not adjusted to account for soil intrusion activities. Soil intrusion associated with construction activities could results in increased

volatilization from the subsurface to outdoor. However, the volatilization factors used are conservative and are not likely to underestimate exposures.

7.2.2 Particulate Emission Factors

Particulate emission factors were calculated based upon USEPA particulate emissions factor approaches for both the wind erosion fugitive dust generation as well as construction activities fugitive dust generation (USEPA 2002a). The wind erosion fugitive dust particulate emissions factors were used for the maintenance worker and trespasser receptors. The construction activities fugitive dust particulate emissions factors were used for the construction worker receptors.

7.3 HUMAN HEALTH RISK ASSESSMENT

Below is a discussion of the uncertainties inherent in each step of the risk assessment process.

7.3.1 Exposure Assessment

In this report, the exposure assessment is based on a number of assumptions with varying degrees of uncertainty (USEPA 1992a). Uncertainties can arise from the types of exposures examined, the points of potential human exposure, the concentrations of COPCs at the points of human exposure, and the intake assumptions. These factors and the ways in which they contribute to the risk estimation are discussed below.

7.3.1.1 Types of Exposures Examined

The selection of exposure pathways is a process, often based on professional judgment, which attempts to identify the most probable potentially harmful exposure scenarios. 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 evaluation, potential risks were estimated for current/future on-site trespassers and various worker exposure scenarios. Risks to potential receptors were estimated for a number of different exposure pathways (*e.g.*, inhalation of volatiles). While other exposure routes could exist for a particular receptor, these exposures are expected to be lower than the risks associated with the pathways considered.

An exposure route that was not quantitatively evaluated is the inhalation of volatiles in indoor air due to volatilization and upward migration from soil. While the constraints for borrow soil

placement excludes the use as fill for residential development, the soil could be used for commercial development where the volatiles could potentially migrate from soil into commercial buildings. These exposures are expected to be negligible compared to the risks associated with the pathways considered in this risk assessment for the following reasons:

- Volatile COPCs were infrequently detected at low levels in soils, ranging from 6 to 33 percent detection frequencies.

- The potential indoor pathway is based on the future use of the Borrow Area soil as fill. The physical processing of the soil during excavation is expected to significantly further reduce the concentrations of volatile COPCs in the Borrow Area soil. Under this scenario the soil will be excavated, handled, and transported to placement areas as fill or foundational materials.

7.3.1.2 Points of Human Exposure

Another source of uncertainty in the exposure assessment is the assumption made regarding the locations where individuals could be exposed to impacted media. Because the intended use of the excavated material is only for commercial development and precludes use in residential developments or placement in environmentally sensitive areas, the assessment of current/future on-site trespasser and worker related exposures is considered sufficient.

Other potential receptors may be exposed to COPCs in the Borrow Area soils during the excavation and placement activities and could include commercial workers and visitors to properties adjacent to the excavation and placement areas. However, the receptors assessed are those anticipated to engage in activities with the highest exposure potential because the quantified exposures include direct contact with the Borrow Area soils over a prolonged period of time (future off-site maintenance worker) and exposure to conservative estimates of dust generated during the excavation and placement activities (future on-site/off-site construction workers). Therefore, it may be concluded that if the risk and hazard estimates for the receptors with the greatest anticipated exposures are within acceptable limits, then those associated with lesser exposures (pathways, duration) should also be within or below these acceptable limits.

7.3.1.3 Intake Assumptions Used

The risks calculated depend largely on the assumptions used to calculate the rate of COPC intake. For this assessment, reasonable maximum exposures were used. In the absence of a value for a particular exposure parameter, professional judgment based on Site conditions was used.

The uncertainties associated with the parameters used in this risk assessment are described below.

Individuals can come into contact with chemicals via a number of different exposure routes. For the reasonable maximum exposure scenarios, standard default rates were used for these exposures. These represent upper-bound values and provide reasonable maximum activity assumptions. The use of these standard default and upper-end values makes it likely that the risk is not underestimated, and may in fact be overestimated.

The amount of COPCs the body absorbs may be different from the amount of a COPC contacted. In this assessment, absorption of ingested and inhaled COPCs is conservatively assumed to be 100 percent (except for arsenic oral bioavailability). Actual chemical and site-specific values are likely less than this default value.

Standard default values developed by USEPA are used for reasonable maximum exposures frequency and exposure duration for restaurant patrons and workers. These estimates are conservative values, and the possibility that they underestimate the risk is low.

7.3.2 Toxicological Data and Dose Response Extrapolations

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. USEPA assigns each carcinogen a designation of A through E, dependent upon the strength of the scientific evidence for carcinogenicity. In the establishment of the non-carcinogenic criteria, conservative multipliers, known as uncertainty and modifying factors, are used.

7.3.2.1 COPCs Lacking Toxicological Data

Toxicity criteria have not been established for some of the chemicals identified as COPCs for the risk assessment. Although included as COPCs, these chemicals were not quantitative evaluated in the risk assessment. These chemicals include organic TICs (cyclic octaatomic sulfur, o,o'-diethyl s-methyl thiophos, diethyl phosphorodithioic acid, phosphorothioic acid s-[2-[(1, S-methyl methanethiosulphonate), several organic compounds (O,O,O-triethyl phosphorothioate, p-chlorothiophenol), and metals (calcium, magnesium, niobium, potassium, sodium, tungsten, zirconium). Because of the inconclusive nature of TICs as potentially 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.

7.3.2.2 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 and CSFs, which results in the likelihood that the risk is overstated.

Typically, animals are administered high doses (*e.g.*, maximum tolerated dose) of a chemical in a standard diet or in air. Humans may be exposed to much lower doses in a highly variable diet, which may affect the toxicity of the chemical. In these studies, animals, usually 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 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.

Dermal toxicity criteria are not available from the USEPA. Typically, a simple route-to-route (oral-to-dermal) extrapolation is assumed such that the available oral toxicity criteria (RfD and CSF) are used to quantify potential systemic effects associated with dermal exposure. However, as noted in USEPA's RAGS Part E (USEPA 2004e), there is uncertainty associated with this approach because the oral toxicity criteria are based on an administered dose and not an absorbed dose. In general, USEPA (2004e) recommends an adjustment to the oral toxicity criteria to convert an administered dose into an absorbed dose. The adjustment accounts for the absorption efficiency of the chemical in the "critical study" that is the basis of the oral toxicity criterion. If the oral absorption in the critical study is 100 percent, then the absorbed dose is equivalent to the administered dose and no adjustment is necessary. If the oral absorption of a chemical in the critical study is poor (less than 50 percent), then the absorbed dose is much smaller than the administered dose. In this situation, an adjustment to the oral toxicity criteria is recommended.

Arsenic and cadmium are the only COPCs evaluated in this risk assessment that have oral absorption values of less than 50 percent. For cadmium, a gastrointestinal absorption value of 2.5 percent is published by USEPA (2004e), and was used to create an adjusted RfD used for dermal

exposures. This gastrointestinal absorption value is employed only to adjust the results of study utilized to develop the oral RfD for cadmium in order to produce a dermal RfD, as per USEPA guidance (USEPA 2004e). The gastrointestinal absorption value was not utilized to adjust oral intakes of cadmium in soils for this risk assessment (*i.e.*, an oral absorption value of 100 percent was used for cadmium).

A value of 30 percent was used for arsenic and it is based on oral bioavailability studies of monkeys administered arsenic in a soil matrix (Roberts *et al*. 2001; cited in USEPA 2001c). The arsenic oral RfD and CSF are based on a human drinking water study, which also includes some contribution of arsenic in food (USEPA 2007c). The matrix differences between the critical study (drinking water/food) versus the oral bioavailability studies contribute to the uncertainty in the risk characterization. However, it is generally assumed that oral absorption from water is essentially complete (100 percent). Therefore, no adjustment to the oral toxicity criteria is necessary (USEPA 2004e). In addition, Wester *et al*. (1993) has demonstrated that there is no statistical difference in the dermal absorption from water and soil in monkeys (USEPA 2001c). Thus, the magnitude of arsenic absorption is considered equivalent and no adjustment to the oral toxicity criteria is necessary for dermal exposures. Therefore, the uncertainty associated with the dermal risks/hazards presented in this risk assessment is considered low and are not likely underestimated.

7.3.2.3 Non-Carcinogenic Toxicity Criteria

In the establishment of the non-carcinogenic criteria, conservative multipliers, 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 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 insure the protection of sensitive individuals.

7.3.2.4 Sub-Chronic Non-Carcinogenic Toxicity Criteria

Future on-site/off-site construction worker exposures are evaluated for an exposure duration of one-year, which is more representative of a sub-chronic exposure rather than a chronic exposure. As such, where available, sub-chronic RfD were used to characterize non-cancer effects for the future on-site/off-site 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 future on-site/off-site construction worker.

7.3.2.5 Carcinogenic Toxicity Criteria

Uncertainty due to extrapolation of toxicological data for potential carcinogens tested in animals to human data is more prominent for potentially carcinogenic chemicals than non-carcinogenic ones. USEPA uses the LMS model to extrapolate the toxicological data. The LMS assumes that there is no threshold for carcinogenic substances; that is, exposure to even one molecule 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 the effect occurs via a threshold mechanism or not. An animal bioassay 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, 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, which assumes that there is no threshold of response. The dose-response curve generated by the model is known as the maximum likelihood estimate (MLE). 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 federal government, including USEPA itself, has acknowledged the limitations of the high-to-low dose extrapolation models, particularly the LMS (USEPA 1991b). 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: (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 MLE. The inherent conservatism at low doses is due in part to the fact that the LMS 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 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) 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.

7.3.2.6 Uncertainties with the Asbestos Risk Assessment

For the risk assessment, asbestos concentrations were presented two ways, as a best estimate and upper bound. The best estimate utilized the actual measurement results for asbestos fibers at the Borrow area multiplied by the analytical sensitivity, whereas the upper bound estimate is based upon the 95 percent UCL of the Poisson distribution. This is considered particularly conservative in the case of amphibole fibers, because there were no detections of amphibole fibers, but the risks calculated based on the 95 percent UCL of the Poisson distribution which resulted in assumption of three fibers being present.

Two sets of URFs were presented by USEPA (2003a), the optimum risk coefficients (Table 8-2) and conservative risk coefficients (Table 8-3). The values in Table 8-2 (optimum) were selected for use because they are the authors' best estimates of fiber potency and risk based upon the available data, whereas the conservative values in Table 8-3 are overestimates incorporating additional health protective assumptions by presenting values based upon only the most conservative (highest response), and best "behaved" data. While the use of the optimum risk coefficients is considered to produce the best risk estimates for decision making because they take into account a number of appropriate studies, greater risks could be estimated using the conservative URFs and needs to be acknowledged. Furthermore, both sets of URFs are based on only a limited number of focused studies, and some of the data sets included acting purportedly in a "not well behaved" fashion (*i.e.*, non-monotonic). While the URFs are robust in that they separate the potency effects based on fiber types and size, cancer type (mesothelioma and lung cancer) and receptor-specific traits (gender and smoking behavior), further study may reveal

additional data that would change the interpretations of the complete data set to perhaps produce more or less conservative risk estimates.

Additionally, it should be noted that unlike URFs for chemical cancer risk estimation (that is, ILCRs), the risks generated by the asbestos URFs are not directly comparable because they are not a risk of contracting cancer, but rather an estimate of additional deaths from lung cancer or mesothelioma per 100,000 persons (or 1,000,000 persons as modified for use the HHRA) from constant lifetime exposure. Asbestos risks estimated herein are therefore an estimate of increased mortality rate rather than an increased risk of morbidity.

Lastly, the URFs as presented in USEPA (2003a) are estimated increase in mortality resulting from a lifetime of exposure, these URFs are modified and applied to less than lifetime exposure estimates in the HHRA which may overestimate calculated risks.

7.3.3 Combinations of Sources of Uncertainty

Uncertainties from different sources are compounded in the risk assessment. 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 will all be expressed in the result. Therefore, by combining all upper-bound numbers, the uncertainty is compounded.

8.0 SUMMARY OF RISK ASSESSMENT RESULTS

This risk assessment has evaluated potential risks to human health associated with chemicals detected in soil at the Borrow Area located within the BRC proposed CAMU in Clark County, Nevada. In this Chapter, the risks presented as the HI and ILCR are provided for all receptors assessed (as described in Section 6.5). Background risks are presented separately in Appendix H.

These 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 calculation of theoretical upper-bound ILCRs and HIs are presented by receptor in Tables 13 through 15. Radionuclide ILCRs are presented by receptor in Tables 16 through 18. Asbestos estimated deaths from lung cancer or mesothelioma are presented by receptor in Table 19. A summary of the results of this assessment are presented in Table 21. The following summarizes the results for each of the receptors evaluated in this risk assessment.

8.1 FUTURE ON-SITE/OFF-SITE CONSTRUCTION WORKER

The HI for the future on-site/off-site construction worker at the Site is 0.3, which is below the target HI 1.0. The theoretical upper-bound ILCR for the future on-site/off-site construction worker at the Site is 7×10^{-7} for chemical exposures. This ILCR is below the risk goal of 1×10^{-6} and the USEPA acceptable risk range (10^{-6} to 10^{-4}). The theoretical upper-bound ILCR for radionuclide exposures for the future on-site/off-site construction worker at the Site is 6×10^{-6}. This ILCR is above the risk goal of 1×10^{-6}, but is consistent with the radionuclide background soil cancer risk of 2×10^{-6} and within the USEPA acceptable risk range (10^{-6} to 10^{-4}).

The estimated risks for death from lung cancer or mesothelioma for the best estimate and upper bound concentrations of asbestos range from 5×10^{-8} to 1×10^{-7} for chrysotile fibers, and from zero to 6×10^{-6} for amphibole fibers. It should be noted that zero risks are associated with long amphibole structures. Only a single short amphibole structure has been detected at the Site. The upper bound estimated risk for death from lung cancer or mesothelioma is associated with the UCL of the Poisson distribution which assumes the mean amphibole concentration is equal to three long amphibole structures per cubic centimeter. These risk estimates for deaths from lung cancer or mesothelioma range from above to below the risk goal of 1×10^{-6} and below or within the USEPA acceptable risk range (10^{-6} to 10^{-4}). However, the high-end risk estimate for deaths from lung cancer or mesothelioma of 6×10^{-6} is an overly conservative value for the following reasons:

- 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; and

- The values from Tables 8-2 of USEPA (2003a) should only be used for structures longer than 10 µm and thinner than 0.4 µm; and are recommended only for constant lifetime exposures, not short term exposures such as construction activities.

These results indicate that exposures to COPCs in soil at the Site should not result in adverse health effects to future construction workers.

8.2 FUTURE OFF-SITE MAINTENANCE (OUTDOOR) WORKER

The HI for the future off-site maintenance worker at the whole Site is 0.08, which is below the target HI 1.0. The theoretical upper-bound ILCR for the future off-site maintenance worker is 3×10^{-6}. This ILCR is above the risk goal of 1×10^{-6} and within the USEPA acceptable risk range (10^{-6} to 10^{-4}). The theoretical upper-bound ILCR for radionuclide exposures for the future off-site maintenance worker is 1×10^{-4}. This ILCR is above the risk goal of 1×10^{-6}, but is consistent with the radionuclide background soil cancer risk of 5×10^{-5} and within the USEPA acceptable risk range (10^{-6} to 10^{-4}).

The estimated risks for death from lung cancer or mesothelioma for the best estimate and upper bound concentrations of asbestos range from 8×10^{-10} to 2×10^{-9} for chrysotile fibers, and from zero to 9×10^{-8} for amphibole fibers. It should be noted that zero risks are associated with long amphibole structures. Only a single short amphibole structures has been detected at the Site. The upper bound estimated risk for death from lung cancer or mesothelioma is associated with the 95 percent UCL of the Poisson distribution which assumes the mean amphibole concentration is equal to three long amphibole structures per cubic centimeter. These risk estimates for deaths from lung cancer or mesothelioma are below the risk goal of 1×10^{-6} and below the USEPA acceptable risk range (10^{-6} to 10^{-4}). As described above for the future on-site/off-site construction worker, the high-end cancer risk estimate is an overly conservative value.

These results indicate that exposures to COPCs in soil at the Site should not result in adverse health effects to future off-site maintenance workers.

8.3 CURRENT/FUTURE ON-SITE TRESPASSER

The HI for the current/future on-site trespasser is 0.02, which is below the target HI 1.0. The theoretical upper-bound ILCR for the current/future on-site trespasser is 2×10^{-7} for chemical

exposures. This ILCR is below the risk goal of 1×10^{-6} and below the USEPA acceptable risk range (10^{-6} to 10^{-4}). The theoretical upper-bound ILCR for radionuclide exposures for the current/future on-site trespasser is 3×10^{-6}. This ILCR is above the risk goal of 1×10^{-6}, but is consistent with the radionuclide background soil cancer risk of 1×10^{-6} and within the USEPA acceptable risk range (10^{-6} to 10^{-4}).

The estimated risks for death from lung cancer or mesothelioma for the best estimate and upper bound concentrations of asbestos range from 2×10^{-11} to 6×10^{-11} for chrysotile fibers, and from zero to 2×10^{-9} for amphibole fibers. It should be noted that zero risks are associated with long amphibole structures. Only a single short amphibole structure has been detected at the Site. The upper bound estimated risk for death from lung cancer or mesothelioma is associated with the 95 percent UCL of the Poisson distribution which assumes the mean amphibole concentration is equal to three long amphibole structures per cubic centimeter. These risk estimates for deaths from lung cancer or mesothelioma are below the risk goal of 1×10^{-6} and below the USEPA acceptable risk range (10^{-6} to 10^{-4}). As described above for both the future off-site maintenance and future on-site/off-site construction workers, the high-end cancer risk estimate is an overly conservative value.

These results indicate that exposures to COPCs in soil at the Site should not result in adverse health effects to current/future on-site trespassers.

9.0 POTENTIAL IMPACTS TO GROUNDWATER

This Chapter presents the evaluation of the potential impacts to groundwater considering the use of Borrow Area soil as off-site fill material. This evaluation has been conducted using the VLEACH vertical migration model and site-specific analytical results of soil samples collected from the Borrow Area. The VLEACH modeling was conducted for all COPCs identified in the HHRA. The evaluation was conducted using the USEPA VLEACH model as distributed by Waterloo Hydrogeologic, Inc. in the model software package WHI UnSat Suite Plus 2.2.0.2.

9.1 MODEL APPROACH AND INPUT PARAMETERS

VLEACH was run separately for each of the distinctly different soil layers (that is, Borrow Area fill material and underlying native soil). In order to evaluate heterogeneous soil layers using VLEACH, multiple iterations of VLEACH were performed, where the output of one run (Borrow Area fill material) was used as the input into another run (underlying native soil). For each VLEACH run the user is allowed to input an initial recharge water concentration that comes in the top of the soil layer. At the end of a run, VLEACH provides the concentration in the bottom soil layer and the recharge (or soil moisture) leaving the bottom of the soil layers. Hence from the first VLEACH run for the upper Borrow Area fill material, the output of soil moisture concentration at the bottom of this soil layer was then used as the input concentration of recharge for the VLEACH evaluation of the subsequent native soil layer below. Likewise the estimated contaminant soil concentration at the bottom of the Borrow Area fill material was used as the initial soil concentration for the upper cell of the underlying native soil VLEACH run. Although the use of the model in this fashion is not explicitly mentioned in the VLEACH manual (Model Version 2.2a, USEPA 1997c), staff at the USEPA Robert S. Kerr Environmental Research Laboratory, Center for Subsurface Modeling Support in Ada, Oklahoma have indicated that this is an appropriate use of the model to account for heterogeneous soil layers.[4]

VLEACH model input values are presented in Appendix I. The intent of this evaluation is to predict impacts to groundwater considering the use of Borrow Area soils as off-site fill material. The evaluation was conducted with the following conservative input parameters:

- depth to groundwater was assumed to be 25 feet bgs, the shallowest depth to groundwater for any of the placement sites (see Section 2.3.5);

[4] Personal communications between Ken Kiefer (MWH) and Robert Earle (USEPA), September 27, 2006.

- fill material is assumed to be placed at a thickness of 20 feet above the native soil. A thicker fill material depth results in more conservative model estimates. It is not considered likely that fill material greater than this thickness would be placed at any one location;
- an infiltration rate of 4 inches per year (equivalent to 100 percent of local rainfall, Table I-1);
- The exposure point concentrations for each of the COPCs (see Table 5) were used as input concentrations for the fill material soil. Native soils at each placement site were assumed to be unimpacted for modeling purposes; and
- USEPA Soil Screening Guidance default chemical properties were used (Table I-2).

The VLEACH model is based on several assumptions that typically result in conservative evaluations of migration potential. These assumptions include:

- The model simulates one-directional flow only;
- liquid phase dispersion is neglected. Hence, the migration of the chemical will be simulated as a plug. This assumption causes higher dissolved concentrations and lower travel time predictions than would occur in reality and;
- instantaneous equilibrium between phases is assumed within each cell. After the mass is exchanged between the cells, the total mass in each cell is recalculated and re-equilibrated between the different phases and applied to the full depth of each cell. Thus assuming that some portion of the mass transferred into the top of one cell instantaneously reaches the bottom of the cell.

In addition to the concentrations of soil COPCs, which are the representative exposure point concentrations used in the HHRA, VLEACH requires the following soil input parameters: bulk density; effective porosity, moisture content, and organic carbon content.

Soils present in the Borrow Area will be separated into Type II and sand fractions. Each of these materials will then be used in industrial/commercial situations subject to certain other conditions discussed previously (Section 4.3). It is expected that the Type II material will be compacted to approximately 85 to 95 percent compaction during use. Sand will not be compacted.

Site-specific input parameters for the four soil parameters listed above were obtained by collecting samples from existing stockpiles of Type II and sand that were processed from Borrow

Area soil during 2004. These piles were created when certain of the Borrow Area soil from roughly surface to six feet deep or so were processed.

It should be noted that the entire Borrow Area is part of a uniform geological alluvial fan whose characteristic is homogeneous except for presence of occasional calcified materials (caliche) which will be separated during screening operations. Upon separation, the Type II and reject sand materials are themselves homogeneous since the Type II materials have to meet certain size distribution specifications. In other words, once separated, the Type II and sand materials exhibit homogeneous characteristics irrespective of the condition in which the Borrow Area soil are present. The size of the piles of these materials should also not affect their homogeneity. Also, with the exception of organic carbon content, the three other parameters required for VLEACH (namely bulk density, porosity and moisture content) depend more on the compaction (for bulk density and porosity) and exposure to water (for moisture) of these materials, rather than the source of these materials. Regarding organic carbon content, while that can vary with depth of materials excavated, it should be noted that there is scarce vegetation in the Borrow Area and it is not expected that organic carbon will vary significantly for Borrow Area soil with depth.

Composite samples were collected from the Type II and sand piles using the methodology discussed in ASTM D 75-03 for sampling soil stockpiles and analyzed for the various parameters as discussed above. In addition, to these samples, soil parameter data were collected for seven of the eight potential placement sites. Site-specific soil properties for both the fill materials and placement site soils are provided in Appendix I (Table I-3). The laboratory results for each of these samples are also provided in Appendix I, Attachment I-2.

9.2 RESULTS

VLEACH results are the maximum pore water concentrations in the vadose zone at the groundwater interface and do not take into account groundwater mixing. The VLEACH outputs provided electronically in Appendix I contain the results of the evaluation for each of the COPCs. VLEACH modeling was performed for four of the seven sites for with soil properties were available. The three sites selected were determined to be the sites with the worst-case modeling results through a sensitivity analysis assessing all seven sites (Table I-7). VLEACH outputs are provided in Appendix I, Attachment I-1. A summary of the VLEACH model results are presented in Table 22. VLEACH model results indicate that none of the COPCs should adversely impact groundwater quality above maximum contaminant levels (MCLs) within the next thirty years. The model does indicate that the modeled concentrations of iron and methylene chloride may exceed USEPA residential tap water PRGs within thirty years. However, the

concentrations of iron in the site soils evaluated were comparable to background levels. In addition, the potential migration to groundwater pathway is based on the future use of the Borrow Area soil as fill. This physical processing of the soil is expected to significantly reduce the concentrations of volatile COPCs, such as methylene chloride, in the Borrow Area soil. Under this scenario the soil will be mass-graded, crushed, potentially segregated into Type II aggregate and reject sand prior to being transported and placed as construction fill material. Therefore, the potential impacts of methylene chloride predicted by the model are unlikely.

9.3 DISCUSSION

The VLEACH results represent very conservative evaluation of the potential migration of COPCs in Borrow Area fill material to groundwater. Using conservative assumptions, for example 100 percent rainfall infiltration rate and no groundwater dilution, the results indicate minimal potential to significantly impact groundwater. The conservativeness of the evaluation results in estimates that will likely over estimate potential impacts.

As indicated in the VLEACH manual (USEPA 1997c) contaminant organic carbon partition coefficient (based on USEPA values); infiltration rate; and the fraction organic carbon in soil (obtained from field measurements). have the most influence on the model results. Use of site-specific values for these parameters, where available, should add to the applicability of the modeling for the site. Also, according to the VLEACH manual (Figure 8-14), soil porosity is not a sensitive parameter with regards to groundwater impact prediction. Although the range site specific porosity (24% to 37%) is outside the range of porosity (35% to 45%) included in the sensitivity analysis presented in the VLEACH manual, the use of site-specific values of porosity should add to the applicability of the VLEACH modeling for the site. In order to evaluate the impact that the rainfall infiltration rate has on the model results, a sensitivity analysis was performed by varying the infiltration rate from 2 to 6 inches per year. This sensitivity analysis range is inclusive of the infiltration rate evaluated for the site (4 inches per year). In addition, the mass balance for the model was checked to confirm that the timestep and number of cells used provided a stable solution.

A number of limitations exist for the VLEACH model. These include:

- Data gaps/uncertainties
- Omission of certain chemical and physical processes
- Lack of an appropriate model validation opportunity

Data gaps or uncertain input values that may exist for the site include:

- Accurate site-specific infiltration parameter measurements incorporated in the model
- Limited field sampling data (*e.g.*, the future model scenario is for Borrow Area soil being placed as fill and the modeling is based on soil samples collected from in place Borrow Area soil prior to excavation and placement)
- Site-specific chemical data (*e.g.*, degradation rates)

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 is not taken into account in the model (*e.g.*, COPC mobility may decrease or increase in the presence of other solvent-related COPC components). Every effort has been made to obtain results that provide reasonable estimates of actual site conditions. Uncertain input values were selected based on available scientific information to err on the conservative side.

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REDLINE VERSION

BRC HUMAN HEALTH RISK ASSESSMENT REPORT

BORROW AREA
CLARK COUNTY, NEVADA

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MARCH 2007

~~DECEMBER 2006~~

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 were generated by a laboratory certified by the NDEP for each constituent and media presented herein.

March 26, 2007~~December 14, 2006~~

Dr. Ranajit Sahu, C.E.M. (No. EM-1699, Exp. 10/07/2007) Date
BRC Project Manager

I hereby certify that I also reviewed the document for quality control purposes myself.

Mark K. Jones
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Mark A. Bowland
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Note: The December 2006 revision of this report was prepared and submitted by MWH. Subsequent to that submittal, the MWH staff who prepared this report joined Environmental Resources Management (ERM). The style and format of the original version of the report have been retained to promote consistency for reviewers.

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ACRONYMS AND ABBREVIATIONS

ADD	average daily dose
AF	absorption fraction
AT	averaging time
ATSDR	Agency for Toxic Substances and Disease Registry
BRC	Basic Remediation Company
bgs	below ground surface
BIO	oral bioavailability
BW	body weight
CAMU	Corrective Action Management Unit
CFR	Code of Federal Regulations
COPCs	chemicals of potential concern
CSF	cancer slope factor
CSM	conceptual site model
DBS&A	Daniel B. Stephens & Associates, Inc.
DOE	U.S. Department of Energy
DQIs	data quality indicators
DVSR	Data Validation Summary Report
ECAO	Environmental Criteria and Assessment Office
ED	exposure duration
EF	exposure frequency
FSSOP	Field Sampling and Standard Operating Procedures
ft/ft	foot per foot
GES	Geotechnical & Environmental Services, Inc.
GISdT	Guided Interactive Statistical Decision Tools
HI	hazard index
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HQ	hazard quotient
IEUBK	Integrated Exposure Uptake Biokinetic Model
ILCR	incremental lifetime cancer risk
IR	intake rate
IRIS	Integrated Risk Information System
LCS	laboratory control sample
LCS/LCSD	laboratory control sample/ laboratory control sample duplicate

~~LADD lifetime average daily dose~~

ACRONYMS AND ABBREVIATIONS (Continued)

LADD	lifetime average daily dose
LMS	linearized multi-stage
LOAEL	lowest-observed-adverse-effect-level
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter
mph	miles per hour
MS	matrix spike
MSD	matrix spike duplicate
MLE	maximum likelihood estimate
msl	mean sea level
MWH	MWH Americas, Inc.
NCEA	National Center for Environmental Assessment
NDEP	Nevada Division of Environmental Protection
NOAEL	no-observable-adverse-effect-level
NRS	Nevada Revised Statutes
OEHHA	California Office of Environmental Health Hazards Assessment
PAHs	polycyclic aromatic hydrocarbons
PARCC	precision, accuracy, representativeness, comparability, and completeness
Parsons	Parsons Engineering Science, Inc.
PBT	persistent, bioaccumulative, and toxic
PCBs	polychlorinated biphenyls
PEF	Particulate Emission Factor
PPRTVs	Provisional Peer Reviewed Toxicity Values
ppt	parts per trillion
PR	percent recovery
PRGs	Preliminary Remediation Goals
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RAGS	Risk Assessment Guidance for Superfund
RBSL	risk based screening level
RfD	Reference dose
RPD	relative percent difference

SNWA	Southern Nevada Water Authority
	ACRONYMS AND ABBREVIATIONS (Continued)
SOPs	Standard Operating Procedures
STL	Severn Trent Laboratories, Inc.
	~~**ACRONYMS AND ABBREVIATIONS (Continued)**~~
SVOCs	semi-volatile organic compounds
TCDD	tetrachlorodibenzo-*p*-dioxin
TEQ	toxic equivalency
TICs	tentatively identified compounds
TIMET	Titanium Metals Corporation
UCL	upper confidence limit
URF	Unit Risk Factor
USEPA	U.S. Environmental Protection Agency
VOCs	volatile organic compounds
WRF	wastewater reclamation facility

EXECUTIVE SUMMARY

On behalf of Basic Remediation Company (BRC), Environmental Resources Management (ERM~~MWH Americas, Inc. (MWH~~) has prepared this Human Health Risk Assessment (HHRA) for the Borrow Area located within the area proposed for the BRC Corrective Action Management Unit (CAMU) (Site) in Clark County, Nevada. Findings of the HHRA are intended to support the use of excavated Borrow Area soils as off-site fill material. This risk assessment evaluates use scenarios that include placement of the excavated soils in non-residential areas subject to constraints as discussed in the *Human Health Risk Assessment Work Plan*. The risk assessment report was conducted using validated data collected during a number of investigations from 1999 to 2006.

This risk assessment conforms with Revision 3 of the *Human Health Risk Assessment Work Plan*, which incorporates Nevada Division of Environmental Protection (NDEP) comments dated May 19, 2006 on the April 2006 revision (Revision 0) of the Work Plan; NDEP comments dated July 10, 2006 on the June 2006 revision (Revision 1) of the Work Plan; NDEP comments dated August 25, 2006 on the June 2006 revision (Revision 2) of the Work Plan; and NDEP comments dated November 9, 2006 and November 16, 2006 on the October 2006 revision (Revision 3). Revision 3 of the Work Plan was accepted by the NDEP on November 17, 2006. In addition, this revision of the risk assessment (Revision 1) also incorporates NDEP comments on the December 2006 *Human Health Risk Assessment* dated March 4, 2007, as well as issues resolved with NDEP and their consultants concerning data usability, and incorporates NDEP supplemental comments concerning VLEACH modeling dated March 13, 2007, as well as comments on background comparison statistics and exposure point concentrations received via email on March 18, 2007. The basic procedures outlined by the U.S. Environmental Protection Agency (USEPA) were followed. Because the anticipated use of the fill material is for non-residential commercial purposes, the risk assessment did~~does~~ not evaluate a hypothetical future residential exposure scenario.

This report is composed of several chapters that include: a discussion of the history of the Site including site characterization findings (Chapter 2); an evaluation of the data to ensure data quality objectives were met for risk assessment and an overview of the data validation with respect to the data usability of the dataset (Chapter 3); a detailed conceptual site model (CSM) including fate and transport analyses of chemicals of potential concern (COPCs) (Chapter 4); the selection of COPCs (Chapter 5); the human health risk assessment (Chapter 6); the uncertainties associated with the risk estimates are discussed (Chapter 7), followed by a summary of results

for the risk assessment (Chapter 8), and finally, the analysis of potential impacts to groundwater associated with the proposed fill placement scenarios is discussed (Chapter 9).

BACKGROUND

The Site is comprised of the north and south Borrow Areas, excluding the portion of the Western Ditch that separates these areas. The north Borrow Area is in the southwest portion of the CAMU, north of the Western Ditch, and encompasses an area of approximately 9.3 acres. The north Borrow Area is bordered on the west by the western CAMU boundary along Eastgate Road, on the north by the westernmost portion of the existing landfill (approximately 300 feet north of the Borrow Area), on the east by the southern lobe of the existing landfill, and to the south by the Western Ditch.

The south Borrow Area is in the southwest portion of the CAMU, south of the Western Ditch, and encompasses an area of approximately 8.5 acres. The south Borrow Area is bordered on the west by the western CAMU boundary along Eastgate Road, on the north by the Western Ditch, on the east by vacant land, and to the south by southern CAMU boundary.

Use of excavated Borrow Area soils is intended as off-site fill material. This risk assessment evaluates on-site ~~current~~ scenarios that include current or future trespassers as well as the presence of future construction workers involved in the excavation of borrow material, and off-site ~~future~~ scenarios that include planned non-residential development conditions at off-site locations as well as commercial/industrial use scenarios at off-site locations subject to the constraints discussed in the accepted Work Plan. Therefore, potentially exposed current and future receptors would include future on-site/off-site construction workers, current/future on-site trespassers, and future off-site maintenance workers.

SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The objective of the COPC selection process was to identify and focus on those substances that contribute the greatest to the incremental~~overall~~ risk to human health. COPCs identified in soils at the Site included inorganic chemicals (for example, arsenic), volatile organic compounds (VOCs; for example, benzene), semi-volatile organic compounds (SVOCs; hexachlorobenzene), organochlorine~~organochlorine~~ pesticides (for example, 4,4'-DDT), dioxins/furans, asbestos, and radionuclides. The procedures used to eliminate detected chemicals as COPCs for evaluation in the risk assessment include:

- identification of chemicals with detected levels which are statistically comparable to~~at or below~~ background concentrations (where applicable), and

- identification of chemicals that are infrequently detected at the Site, with the exception of metals, known human carcinogens, and persistent, bioaccumulative, and toxic (PBT) chemicals. Prior to eliminating a COPC based on the frequency of detection criteria, (1) any elevated detection limits are addressed, and (2) data distributions within the Site are considered.

HUMAN HEALTH RISK ASSESSMENT

The human health risks associated with the Borrow Area soils for a given individual are dependent upon the degree to which that individual is likely to be exposed. Exposure is influenced by the types and duration of activities that will be conducted on the property. In the future the soils will be used in areas planned for non-residential development conditions as well as commercial/industrial use scenarios commercial development purposes. Therefore, future on-site and off-site construction workers, future off-site outdoor maintenance workers, and current/future on-site trespassers are the populations that might be potentially exposed to chemicals in Borrow Area soils.

In evaluating the exposure of chemicals to future on-site/off-site construction workers, future off-site maintenance workers, and current/future onsite trespassers, a series of assumptions were developed. Many of the exposure assumptions in this evaluation were developed by USEPA and reflect activities expected to result in a reasonable maximum exposure to chemicals. Default values are not defined by USEPA for the trespasser. The current/future on-site trespasser exposure parameters were developed taking into account site-specific conditions and professional judgment as discussed in the accepted Work Plan. The use of reasonable maximum exposure assumptions is conservative and the risk estimates calculated in this risk assessment are likely to overestimate risks for the potentially exposed populations.

RISK CHARACTERIZATION RESULTS

This section summarizes the major findings of the risk assessment. A summary of the results of this assessment are presented in Table ES-1. Consistent with USEPA guidance, non-cancer health effects and theoretical upper-bound incremental lifetime cancer risks (ILCRs)[1] were

[1] From USEPA (1989), "For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen (*i.e.*, incremental or excess

evaluated separately. ILCRs are expressed as an estimate of the probability that a person could develop cancer from exposure to the carcinogenic chemical. A risk level of 1×10^{-6} represents an incremental probability of one in a 1,000,000 that an individual could develop cancer due to the carcinogen under the defined set of exposure conditions. A risk range of 10^{-4} to 10^{-6} (one in 10,000 to one in 1,000,000) is defined by USEPA as the acceptable risk range.~~regulatory benchmark.~~ According to USEPA, "…acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response." (*National Oil and Hazardous Substances Pollution Contingency Plan*; 40 Code of Federal Regulations [CFR] 300.430). NDEP considers a cumulative theoretical upper-bound incremental carcinogenic risk level of 1×10^{-6} as the regulatory point of departure. Non-cancer health effects are expressed as a hazard index (HI). Hazard indices less than one are not considered to be associated with adverse health effects.

EVALUATION OF UNCERTAINTIES

Each of the risk estimates calculated in this report is associated with some degree of uncertainty. Uncertainties arise at each of the steps of the risk assessment including the environmental sampling, selection of COPCs, exposure assessment, and toxicity assessment. Uncertainties associated with the environmental sampling and the selection of COPCs depend on the degree to which samples collected and analyzed in the risk assessment are representative of Site chemical and radiological conditions. In this assessment, the environmental sampling was conducted for a broad suite of analytes, and the COPCs were selected using conservative criteria. Therefore, it is unlikely that significant risks were missed or underestimated.~~Therefore, the environmental sampling and selection of COPCs should not introduce appreciable uncertainty in this assessment.~~

Uncertainties related to the receptor selected to represent the populations chosen for evaluation and their assumed extent of exposure are also found in a risk assessment. In this assessment, several different populations with different levels of exposure were considered, and for each population conservative assumptions (often the 95th percentile of exposure activity parameters) regarding the extent of exposure were made. Use of these reasonable maximum exposure

individual lifetime cancer risk)." The term "incremental" here means site-related cancer risk in addition to/above and beyond the "normal" background probability of cancer expected as a result of other factors such as other exposures, diet and genetic predisposition.

assumptions will overestimate the risks for most exposure scenarios. For example, skin contact risks estimated with reasonable maximum exposure assumptions are two to three orders of magnitude higher than skin contact risks using average assumptions.

There are also uncertainties associated with the toxicity parameters used in the risk characterization. When data are lacking, the toxicity criteria incorporate conservative assumptions and are intended to overestimate risk. In some cases in this assessment, toxicity criteria were unavailable for some COPCs. Therefore, a quantitative estimation of risk was not conducted for certain chemicals and the risks presented in this assessment could be underestimated as a result.

In general, because conservative assumptions were made at many different steps and are compounded in the risk estimate, the values calculated in this report are more likely to overestimate rather than underestimate the true risk associated with the Site.

SUMMARY OF RESULTS

Workers. Chemical risks to future on-site/off-site construction workers are below the USEPA acceptable cancer risk range (10^{-6} to 10^{-4}), and for future off-site maintenance workers are within the acceptable risk range, and for both receptors below the non-cancer target HI of 1.0. The asbestos risks to the future off-site maintenance worker are below the acceptable cancer risk range (10^{-6} to 10^{-4}), and the risks to the future on-site/off-site construction worker are within the acceptable risk range. However, this risk is for amphiboles which had no detections of long fibers. Risks to amphiboles were conservatively calculated as there was a detection of a single short fiber at the site. In addition, risks to workers for radionuclide exposures are generally consistent with the background soil cancer risk and within the USEPA acceptable cancer risk range (10^{-6} to 10^{-4}) for each receptor. These results indicate that exposures to COPCs in Borrow Area soil are not likely to result in adverse health effects to future workers.

Current/Future On-site Trespassers. Chemical risks to current/future on-site trespassers are below the USEPA acceptable cancer risk range (10^{-6} to 10^{-4}) and below the non-cancer target HI of 1.0. The asbestos risks to the current/future on-site trespasser are below the acceptable cancer risk range (10^{-6} to 10^{-4}). In addition, risks to current/future on-site trespassers for radionuclide exposures are consistent with the background soil cancer risk and within the USEPA acceptable cancer risk range (10^{-6} to 10^{-4}). These results indicate that exposures to COPCs in Borrow Area soil are not likely to result in adverse health effects to current/future on-site trespassers.

Table ES-1. Risk Summary

Receptor	Borrow Area			Background	
	Chemical		Radiation	Soil Chemical	Soil Radiation
	Total HI	Total ILCR	Cancer Risk	Cancer Risk	Cancer Risk
Future On-Site/Off-Site Construction Worker	0.3	7×10^{-7}	6×10^{-6}	3×10^{-7}	2×10^{-6}
Future Off-Site Maintenance Worker	0.08	3×10^{-6}	1×10^{-4}	1×10^{-6}	5×10^{-5}
Current/Future On-Site Trespasser	0.02	2×10^{-7}	3×10^{-6}	7×10^{-8}	1×10^{-6}

HI = hazard index
ILCR = incremental lifetime cancer risk

Table ES-1. Risk Summary

Methodology	Asbestos					
	Estimated Chrysotile Mean Risks			Estimated Amphibole Mean Risks		
2003 Methodology	Expected		Upper Bound	Expected		Upper Bound[b]
Future On-Site/Off-Site Construction Worker	5×10^{-8}	-	1×10^{-7}	0[a]	-	6×10^{-6}
Future Off-Site Maintenance Worker	8×10^{-10}	-	2×10^{-9}	0[a]	-	9×10^{-8}
Current/Future On-Site Trespasser	2×10^{-11}	-	6×10^{-11}	0[a]	-	2×10^{-9}

[a]Zero risks are associated with those scenarios that utilize measured long amphibole structure concentrations. Long amphibole have not been detected at the property, therefore, expected risks are zero.
[b]The high-end cancer risk estimate is based on a UCL of the Poisson distribution of three amphibole structures per cm^3; the 95 percent UCL of the Poisson is presented because although long structures have not been detected at the Site, a single short fiber was detected at the site

Receptor	Borrow Area			Background
	Chemical		Radiation	Soil Radiation
	HI	ILCR	ILCR	Cancer Risk
Construction Worker	0.3	9 E-7	7 E-6	5 E-6
Maintenance Worker	0.07	2 E-6	9 E-5	5 E-5
Trespasser	0.018	2 E-7	3 E-6	2 E-6

HI = hazard index
ILCR = incremental lifetime cancer risk

Asbestos

Methodology	Estimated Chrysotile Risk Range			Estimated Amphibole Risk Range	
2003 Methodology	Expected		Upper Bound	Expected	Upper Bound[b]
Construction Worker	5 E-8	-	1 E-7	0 E+0[a]	6 E-6
Maintenance Worker	8 E-10	-	2 E-9	0 E+0[a]	9 E-8
Trespasser	2 E-11	-	6 E-11	0 E+0[a]	2 E-9

Note: The calculation of risks to asbestos are presented in Appendix F.
[a]Zero risks are associated with those scenarios that utilize measured long amphibole structure concentrations. Long amphibole have not been detected at the property, therefore, expected risks are zero.
[b]Although not detected, the high-end cancer risk estimate is based on a UCL of the Poisson distribution of three amphibole structures; the 95% UCL of the Poisson is presented because although long structures have not been detected at the Site, they have been detected in the general area.

POTENTIAL IMPACT TO GROUNDWATER

An evaluation of the potential impacts to groundwater considering the use of Borrow Area soil as off-site fill material was conducted using the VLEACH vertical migration model and site-specific soil analytical results. The VLEACH modeling was conducted for all COPCs identified in the HHRA. The evaluation was conducted using the USEPA VLEACH model (Version 2.2a). VLEACH was run separately for each of the distinctly different soil layers (that is, Borrow Area fill material and underlying native soil). In order to evaluate heterogeneous soil layers using VLEACH, multiple iterations of VLEACH were performed, where the output of one run (Borrow Area fill material) was used as the input into another run (underlying native soil). VLEACH results are the maximum pore water concentrations in the vadose zone at the groundwater interface and do not take into account groundwater mixing. VLEACH model results indicate that none of the COPCs should adversely impact groundwater quality.

1.0 INTRODUCTION

On behalf of Basic Remediation Company (BRC), Environmental Resources Management (ERM~~MWH Americas, Inc. (MWH~~) has prepared this Human Health Risk Assessment (HHRA) for the Borrow Area. The Borrow Area is within the area proposed for the BRC Corrective Action Management Unit (CAMU) in Clark County, Nevada. Figure 1 shows the location and configuration of the Borrow Area. One of the constraints on the future use of Borrow Area soil is that such soils cannot be placed in environmentally sensitive areas, nor be exposed to ambient conditions. This is to ensure the protection of the environmental following soil placement. Therefore, this risk assessment focuses on estimating the potential risks to human health. The constraints on the use of Borrow Area soil as fill material are discussed in Section 4.3.

1.1 PURPOSE OF THE RISK ASSESSMENT

The purpose of the risk assessment is to determine whether human health risks or a threat to groundwater are anticipated from use of the soils as fill material for various non-residential construction projects in non-environmentally sensitive areas.~~,~~ The objective is to obtain a determination from the Nevada Division of Environmental Protection (NDEP) that allows the use of excavated Borrow Area soils as off-site fill material. The results of the risk assessment will provide risk managers an understanding of the potential human health risks associated with background conditions and additional risks associated with constituents that may be present in Borrow Area soils. The overall goal is to identify if chemical concentrations in Borrow Area soils are: (1) either representative of background conditions; or (2) do not pose an unacceptable risk to human health and the environment under current and anticipated future use conditions.

Human health risks are represented by estimated theoretical upper-bound cancer risks and non-cancer hazards derived in accordance with standard U.S. Environmental Protection Agency (USEPA) methods. If the carcinogenic risks or non-cancer hazards exceed USEPA acceptable levels or NDEP risk goals, then alternatives to use of the Borrow Area soils as fill material must be considered. The acceptable risk levels defined by USEPA for the protection of human health, and following those discussed previously with NDEP, are:

1. For non-carcinogenic compounds, ~~concentrations to which~~ the acceptable criterion is~~human population, including sensitive subgroups, may be exposed without adverse effect during~~ a cumulative hazard index~~lifetime or part~~ of one or less~~a lifetime, incorporating factors related to uncertainty~~; and

2. For known or suspected carcinogens, the acceptable ceiling for a cumulative incremental ~~concentrations that represent an excess theoretical upper bound~~ lifetime cancer risk (ILCR) ranges from ~~to an individual of between~~ 10^{-6} to 10^{-4} ~~and 10^{-6} using information on the relationship between dose and response (USEPA 1990)~~. The ~~10^{-6}~~ risk goal established ~~level is typically applied~~ by the ~~regulatory agencies, including~~ NDEP is 10^{-6}, ~~as the point of departure for determining remediation goals~~.

3. Radionuclides in Site soils are to have risks no greater than those associated with background conditions, or the NDEP's risk goal of ~~1 ×~~ 10^{-6}, whichever is greater.

4. For lead, the target goal is 400 milligrams per kilogram (mg/kg), which is a soil concentration identified by USEPA (based on the Integrated Exposure Uptake Biokinetic Model [IEUBK]) as protective of a residential scenario.

5. For asbestos, calculations are based upon cancer criterion and a risk goal of 10^{-6}.

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). Other guidance documents consulted for the risk assessment include:

- ~~USEPA. 1991a. *Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual. Supplemental Guidance.*~~
- USEPA. 1992a. *Guidelines for Exposure Assessment.*
- USEPA. 1997a. *Exposure Factors Handbook.*
- USEPA. 2000. *Soil Screening Guidance for Radionuclides.*
- USEPA. 2002a. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.*
- USEPA. 2003a. *Technical Support Document for a Protocol to Assess Asbestos-Related Risk. Final Draft.*

This risk assessment conforms with Revision 3 of the *Human Health Risk Assessment Work Plan* (MWH 2006) which incorporates NDEP comments dated May 19, 2006 on the April 2006

revision (Revision 0) of the Work Plan; NDEP comments dated July 10, 2006 on the June 2006 revision (Revision 1) of the Work Plan; NDEP comments dated August 25, 2006 on the June 2006 revision (Revision 2) of the Work Plan; and NDEP comments dated November 9, 2006 and November 16, 2006 on the October 2006 revision (Revision 3). In addition, this revision of the risk assessment (Revision 1) also incorporates NDEP comments on the December 2006 *Human Health Risk Assessment* dated March 4, 2007, as well as issues resolved with NDEP and their consultants concerning data usability, and incorporates NDEP supplemental comments concerning VLEACH modeling dated March 13, 2007, as well as comments on background comparison statistics and exposure point concentrations received via email on March 18, 2007. The Work Plan, including ~~and~~ all NDEP comments and BRC response to comments~~,~~ and NDEP's acceptance of the Work Plan, and all NDEP comments and BRC response to comments on the December 2006 revision of the risk assessment are provided in Appendix A.

1.3 REPORT ORGANIZATION

The risk assessment is composed of several chapters that are outlined below. This chapter presents the purpose of the risk assessment, and the methods used in this assessment. Chapter 2 presents background on the Site, the environmental setting for the Site, and a summary of previous investigations.

Chapter 3 presents the data evaluation procedures used, including determination of background concentrations, and data usability and adequacy. Chapter 4 presents the conceptual site model (CSM) for the risk assessment including fate and transport analyses. This includes identification of potentially exposed populations, and the potential pathways of human exposure.

Chapter 5 presents the selection of chemicals of potential concern (COPCs) recommended for further assessment. Chapter 6 presents the human health risk assessment. This includes relevant statistical analyses, determination of representative exposure point concentrations, applicable fate and transport modeling, exposure assessment, toxicity assessment, and risk characterization.

In Chapter 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 Chapter 8. The results of the analysis of potential impacts to groundwater are presented in Chapter 9. A list of references is provided in Chapter 10, followed by tables, figures, and appendices. An electronic version of the entire risk assessment report, including all calculation spreadsheets, is provided in Appendix B.

2.0 SITE DESCRIPTION

Chapter 2 presents a description of the Site, including site background and history, the environmental setting, and a summary of previous investigations.

2.1 SITE DESCRIPTION

The following description of the Site was obtained from the *Revised Sampling and Analysis Plan to Conduct Soil Characterization of Borrow Areas* (Daniel B. Stephens & Associates, Inc. [DBS&A] 2006a) submitted to NDEP on February 13, 2006, and the draft CSM for the CAMU being prepared by DBS&A (2006b, in revision, per NDEP comments).

The proposed BRC CAMU is located within a 113-acre area northwest of the active plant area of the BMI Complex (Figure 1). Approximately 55 acres, the footprint of the BRC CAMU consists of two contiguous landfill areas, known as the North Mesa and South Mesa. The separate, distinct, and existing BMI Landfill occupies approximately 66 acres of this area and was initially used as effluent disposal ponds for the Basic Magnesium, Inc. magnesium refinery since its inception. Following shut-down of the refinery in November 1944, most of the two western-most ponds were converted to a solid waste disposal area which became known as the BMI Landfill. Plans have been developed to mine the Borrow Area for borrow materials and to create a portion of the space for the proposed CAMU.

The Site is comprised of the north and south Borrow Areas, excluding the portion of the Western Ditch that separates these areas. As currently envisioned, soils from the Borrow Area will be used as general backfill material for commercial projects in non-sensitive areas, subject to the constraints discussed in Section 4.3 below and Section 2.1.3 of the accepted Work Plan (see Appendix A).

The north Borrow Area is in the southwest portion of the CAMU, north of the Western Ditch, and encompasses an area of approximately 9.3 acres. The north Borrow Area is bordered on the west by the western CAMU boundary along Eastgate Road, on the north by the westernmost portion of the existing landfill (approximately 300 feet north of the Borrow Area), on the east by the southern lobe of the existing landfill, and to the south by the Western Ditch. The north Borrow Area is shown on Figure 2.

The south Borrow Area is in the southwest portion of the CAMU, south of the Western Ditch, and encompasses an area of approximately 8.5 acres. The south Borrow Area is bordered on the west by the western CAMU boundary along Eastgate Road, on the north by the Western Ditch,

on the east by vacant land, and to the south by southern CAMU boundary. The south Borrow Area is shown on Figure 2.

~~As shown in Figure 2, the two areas are bisected by the known contaminated area of the previous Western Ditch, which will not be used as the source of any of the borrow materials. Even though there is no evidence of disposal of any waste materials in the proposed Borrow Area, because the area, in general, lies in the midst of other waste disposal areas, it is possible that some surface contamination due to water run-off and airborne deposition may have occurred. Historically, there have been drainage channels in the Borrow Area created by storm water runoff from adjoining CAMU and plant areas. It is possible that the soil in the Borrow Area has been impacted by runoff from neighboring sites.~~

Groundwater underlying the Site is known to be contaminated. As discussed in Section 4.3 below, exposure pathways associated with groundwater were not evaluated in this HHRA. Excavations within the Borrow Area will stop prior to reaching groundwater. ~~-~~The objective of the various investigations and assessments within the Borrow Area were to demonstrate to NDEP that it is acceptable to use soil within this area as off-site fill material. Because locations for placement of Borrow Area soil as off-site fill material have not been determined for certain, groundwater quality at these locations is unknown. ~~-~~It is expected that most, if not all of the Borrow materials will be used in the BMI industrial complex, including for CAMU construction. Eight potential~~Potential~~ Borrow Area material use sites within the BMI industrial complex are shown on Figure 3.

2.2 EXCAVATION AND PROCESSING OF BORROW AREA MATERIAL

Excavation and processing of Borrow Area material will require activity both in the two portions (northern and southern) of the Borrow Area and in the loading~~processing~~ yard adjacent to the Borrow Area. ~~Various grades of materials will then be used on and off-site depending on customer needs.~~

In each of the two portions (northern and southern), material will be mass-graded and gathered using a bulldozer and belly scraper in tandem. The bulldozer will cut or rake the material, creating a soft bed of dirt that can be easily gathered by the belly scraper. Once the material is gathered by the scraper, it will be transported to a central location along the boundary between the Area and the loading~~processing~~ center. There, the material will be dumped into trucks and transported.

Based on current disposal options, it is likely that all of ~~a pile to be located into~~ the material will be disposed as "pit run" – thereby not requiring separation into two different grades of materials. However, even if the material were separated into two grades, it is BRC's professional judgment that, given the other conservative assumptions being made in estimating potential risks, the potential risks estimated in this report will not underestimate any actual risk. Please note also with regards to differences in concentration between coarse and fine grained separated materials, it is BRC's belief that the sample preparation step prior to analysis involves grinding the material – making this difference moot for the samples gathered and used in this risk assessment~~crusher. A front loader will place the material on a crusher conveyor belt to be dumped in the actual crusher~~.

The following discussion is provided in~~As~~ the event that materials are segregated, for the sake of completeness.

If the pit-run material is processed it will be transported using a front loader onto a crusher conveyer belt and then onto a crusher, where it will be separated into two piles. The first pile will be ~~is~~ Type II aggregate material. Type II aggregate is a granular, structure material used to construct building pads and roadway beds. This material is of high value and is structural in nature. The second pile will be ~~is~~ reject sand. This is material that is too small to be included in the Type II material. This material has a smaller granular consistency and is typically used as~~at~~ bedding material for pipeline construction and in landscape applications. However, BRC will not use reject sand for landscape applications or for pipeline bedding. Any material used in the CAMU construction, will be used in the "ops" layer and not in the cover or in the leachate collection layer.~~Rejected sand will be stockpiled for use in CAMU construction or in off-site uses such as pipeline bed or landscape applications.~~ Should rejected sand be needed for off-site uses, its use will be subject to the same constraints as Type II material.

The definition of Type II is as follows (Ref: Section 704.03.04, found at http://www.rtcsouthernnevada.com/streets/streets_specsindex.htm). Type II can consist of a distribution of sizes, within acceptable ranges as indicated below. For example, Type II materials can contain materials that pass sieve size No. 16 but only as long as such materials do not comprise less than 15 percent or more than 40 percent of the material.

Sieve Sizes	Nom. Sieve Opening (mm)	% of Dry Weight Passing Sieve
1”	25.4	100
¾”	6.35	90-100
No. 4	4.76	35-65
No. 16	1.19	15-40
No. 200	0.074 (74 microns)	2-10

2.3 ENVIRONMENTAL SETTING

The summary provided below is focused toward Site features that pertain to the risk assessment. Some of this summary was obtained from various sources including DBS&A’s draft CSM for the CAMU (DBS&A 2006b, in preparation) and Tetra Tech’s *Draft Final Sampling and Analysis Plan, Hydrogeologic Characterization, Titanium Metals Corporation Facility* (Tetra Tech 2005).

2.3.1 Climate

The Site is located in a natural desert area, where evaporation/evapotranspiration rates are very high, due to influence by high temperatures, high winds, and low humidity. Average monthly temperatures fall within a range of 45.4 to 91.1 degrees Fahrenheit during 2001. Total 2001 precipitation measured at McCarran International Airport was 3.74 inches. Rainfall was highest in the winter months (January and February). However, the months with the highest evaporation coincide with those months with the highest intensity of rainfall.

Wind flow patterns were fairly consistent from one month to another, but vary slightly between measurement stations (McCarran International Airport and a station 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). The mean annual wind velocity is 9 miles per hour (mph), but velocities in excess of 50 mph are known to occur.

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-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 development (*i.e.*, vegetation destruction, pavement extent, and construction).

2.3.2 Surface Water

The Las Vegas Wash collects storm water, shallow groundwater, urban runoff, and treated 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 City of Henderson contributes a smaller amount (8.4 million gallons per day) (Las Vegas Wash Coordination Committee 2000). TIMET discharges permitted stormwater and once-through non-contact cooling water via the Pittman By-Pass (NDEP 2002). 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 create high run-off conditions which coincide with the highest evaporation rate for the year. 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).

2.3.3 Physical Attributes

The Borrow Area is 17.8 acres, in a commercial/industrial area. The ground surface slopes gradually to the north-northeast toward the Las Vegas Wash at a gradient of approximately 0.02 foot per foot (ft/ft). Ground surface elevations across the Site range from approximately 1,775 feet above mean sea level (msl) on the southern boundary to approximately 1,750 feet msl at the northern boundary.

2.3.4 Geology

The general geologic model of the CAMU site consists of two geologic formations: Quaternary alluvium associated with alluvial fan deposits shed from McCullough Range Mountains, which unconformably overlies the Muddy Creek Formation.

The Site is located near the southeastern margin of Las Vegas Valley on Quaternary-age alluvial fan deposits deposited northeast of the McCullough Range. The Quaternary alluvium, which is the present-day land surface at most of the BMI Industrial Complex and throughout much of the Henderson area, slopes north toward the Las Vegas Wash. On the CAMU site, the slope gradient is 0.02 ft/ft. In wells and borings advanced at the CAMU site, the average thickness of the Quaternary alluvium is about 50 to 60 feet. Therefore, the Quaternary alluvium likely extends below the proposed limit of excavation. The Quaternary alluvium is predominantly sands and gravels that consist mainly of volcanic detritus (Carlsen *et al*. 1991). More than 500 borings and monitor wells have been drilled into the Quaternary alluvium at the BMI Industrial Complex and Common Areas, and lithologic descriptions show that the unit is typically logged as silty or sandy gravel, sand, or silty sand.

2.3.5 Groundwater

In the vicinity of the CAMU site, first groundwater is typically encountered in the Quaternary alluvium under unconfined conditions. Under current hydrologic conditions, the direction of the unconfined groundwater flow in the Quaternary alluvium is approximately parallel to the slope of the land surface. Shallow groundwater in the Quaternary alluvium at and near the CAMU site flows generally to the north-northeast, toward Las Vegas Wash. The depth to groundwater in the vicinity of the CAMU as measured in BRC monitoring wells in 2005, ranged from 34 to 53 feet below ground surface (bgs). The shallowest depth to groundwater for the seven soil placement sites, as shown on Figure 3, is approximately 25 feet bgs as measured by Kerr-McGee in 2005 at monitoring well PC-40 in the north portion of the northernmost placement site (Kerr-McGee 2005).

2.4 SUMMARY OF PREVIOUS INVESTIGATIONS

From 1999 to 2006, BRC installed borings in the Borrow Area from which soil samples were collected and analyzed for a suite of analytes including metals, radionuclides, organochlorine and organophosphorus pesticides, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), dioxins/furans, perchlorate and asbestos. The results of these sampling and analysis events were presented in the following reports:

- 2000 Environmental Assessment by Parsons Engineering Science, Inc. (Parsons) (Dataset 10);
- 2000 Implementation of Sampling Plan for the Proposed Gravel Pit Site, Henderson, Nevada. by Geotechnical & Environmental Services, Inc. (GES) (Dataset 13a)
- 2003a Implementation of Sampling Plan (GES) (Dataset 26a);
- 2003b Limited Environmental Phase II Investigation (GES) (Dataset 26b);
- 2003 Asbestos Evaluation by MWH Americas, Inc. (MWH) and Aeolus, Inc.; and
- 2006 Soil Investigation by BRC and MWH (Dataset 36).

Sample locations from each of these investigations are shown on Figure 2. A summary of each of the investigations and assessments listed above are provided in the following sections.

2.4.1 2000 Environmental Assessment by Parsons (Dataset 10)

In 1999, as reported in Parsons (2000), a limited environmental investigation was performed to assess conditions at the Borrow Area. The purpose of the environmental sampling was to provide a preliminary indication regarding the presence of contamination on the Site.

Soil and groundwater sampling activities were conducted in September 1999. Soil samples were collected at various depths from six boreholes (B-1, B-4, B-5, B-8, B-10, and B-12; see Figure 2) advanced using hollow-stem auger drilling. Samples were analyzed for VOCs, SVOCs, organochlorine pesticides, perchlorate, gross alpha, nonvolatile beta, and metals. Groundwater samples were collected from two of the borings and analyzed for the same constituents.

Near-surface and subsurface soils observed during this investigation consisted primarily of alluvial granular soils overlying fine-grained soils, the top of which generally coincides with the groundwater table. Groundwater at the time of this investigation (1999) was encountered at depths ranging from approximately 38 to 58 feet bgs. No VOCs or SVOCs were detected in the soil samples, although low levels of pesticides and perchlorate were detected in several of the samples. No VOCs or SVOCs were detected in the two groundwater samples collected beneath the Site, although pesticides and perchlorate were detected in one of the samples.

2.4.2 2000 Implementation of Sampling Plan by GES (Dataset 13a)

In 2000 GES (2000) collected soil samples from four locations within the Borrow Area (B-13, B-14, B-15, and B-16; see Figure 2). Samples were collected at 0, 5, 10, 20, and 30 feet bgs.

Samples were analyzed for VOCs, SVOCs, organochlorine pesticides, perchlorate, asbestos (surface only) and metals. Results indicated the presence of various VOCs, SVOCs, organochlorine pesticides, perchlorate, and metals. Asbestos was not detected~~non-detect~~ in any~~all~~ samples.

2.4.3 2003 Limited Environmental Phase II Investigation by GES (Datasets 26a and 26b)

In 2003 GES conducted a limited Environmental Phase II investigation at the Borrow Area (GES 2003a). The objective of this investigation was to verify the northern and eastern boundaries of the Borrow Area with the collection of samples from eight locations (EB-1 through EB-8). The investigation was also performed to determine a volume estimate of 'useable' material within the Borrow Area. GES performed a supplemental investigation in June 2003 (GES 2003b). Samples were collected from ten borings (PEB-9 through PEB-18) at new locations, and six borings (EB-3, EB-6, EB-7, EB-8, B-5 and B-10) from previous locations. The supplemental investigation was performed to augment the previous investigations in order to completely evaluate the boundary of the Borrow Area.

The borehole locations from both investigations are presented on Figure 2. No groundwater was encountered during these investigations. Each boring was terminated at a depth of approximately 35-feet bgs. All soil samples analyzed for one or more of the following analyses: VOCs, SVOCs, organochlorine pesticides, organophosphorous pesticides (broad suite), metals~~ (aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium (total and VI), cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, titanium, tungsten, vanadium, and zinc)~~, perchlorate, and radionuclides.

2.4.4 2003 Asbestos Evaluation by MWH and Aeolus

In October 2003, MWH conducted asbestos sampling from within the Borrow Area. The sampling consisted of the collection of surface and shallow sub-surface soil samples from 50 locations (Figure 2), combined into ten soil composites (five from each of two depths). Each composite sample was prepared in the field by weighing, sieving, homogenizing, and combining ten designated, component samples. Sampling recommendations were developed by Aeolus (2003a). Once in the laboratory, samples were prepared and analyzed per the Modified Elutriator Method (Berman and Kolk 2000).

2.4.5 2006 Soil Investigation by BRC (Dataset 36)

At the request of BRC, MWH and GES implemented the *Revised Sampling and Analysis Plan to Conduct Soil Characterization of Borrow Areas*, dated February 13, 2006, prepared by DBS&A. All field work was completed between February 22 and February 28, 2006.

During the soil characterization sampling, 10 soil borings (BP-01 through BP-10) were advanced at locations using a truck-mounted hollow stem auger drill rig operated by Eagle Drilling Company of Las Vegas, Nevada. A total of 49 primary soil samples were collected from depths of 0 to 1 foot below ground surface, 10 to 11.5 feet bgs, 20 to 21.5 bgs, 30 to 31.5 feet bgs, 40 to 41.5 feet bgs, and 50 to 51.5 feet bgs. The maximum total depth of samples collected at each boring varied at each boring location based on the depth of encountered saturated soil.

Select soil samples were collected during the investigation and were submitted to Severn Trent Laboratories, Inc. (STL) in St. Louis, Missouri. STL St. Louis was unable to perform all of the analyses. STL St. Louis performed the analyses of~~and analyzed for~~ general chemistry parameters, moisture determination, metals, hexavalent chromium, perchlorate, ~~radionuclides,~~ VOCs, SVOCs, glycols/alcohols, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), organochlorine ~~and organophosphorus~~ pesticides, chlorinated herbicides. STL West Sacramento performed the dioxin/furan analyses. STL Richland performed the radionuclide analyses. STL Denver performed the organophosphorus analyses.~~, and dioxins/furans.~~ Asbestos soil samples were submitted to EMS Laboratories in Pasadena, California, and prepared and analyzed per the Modified Elutriator Method (Berman and Kolk 2000).

2.4.6 Soil Background Investigation (Datasets 24 and 34)

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 historic site operations or regional anthropogenic conditions. Therefore, it is necessary to establish site-specific background conditions to support the risk assessment.

The soils background dataset presented in the *Background Shallow Soil Summary Report, BMI Complex and Common Area Vicinity* (BRC/TIMET 2007, currently in review by the NDEP) was utilized. This soils background dataset includes both the Environ (2003) dataset and the

BRC/TIMET dataset collected in 2005. This combined background dataset is still draft and has not yet been approved by NDEP. It is BRC's expectation that the final background dataset will not deviate in any material manner from the dataset used in this risk assessment.

3.0 DATA EVALUATION

This Chapter 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 analysis process. Although all samples used in this risk assessment were collected prior to the preparation of the approved Field Sampling and Standard Operating Procedures (FSSOP) manual for the project (BRC and MWH 2006a), established industry standards for sample collection 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.

~~3.1 DETERMINATION OF BACKGROUND CONCENTRATIONS~~

~~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 historic site operations or regional anthropogenic conditions. Therefore, it is necessary to establish site-specific background conditions to support the risk assessment.~~

~~The soils background dataset presented in the draft *Background Soil Summary Report, BMI Complex and Common Area Vicinity* (BRC/TIMET 2006, currently in revision) was utilized. This soils background dataset includes both the Environ (2003) dataset and the BRC/TIMET dataset collected in 2005. This combined background dataset is still draft and has not yet been approved by NDEP. It is BRC's expectation that the final background dataset will not deviate in any material manner from the dataset used in this risk assessment.~~

~~The analytical data were reviewed for applicability and usability following procedures in the *Guidance for Data Usability in Risk Assessment (Part A)* (USEPA 1992b) and USEPA (1989). The details of the data evaluation are provided by Environ (2003) and BRC/TIMET (2006).~~

3.1 DATA USABILITY EVALUATION

The primary objective of the data review and usability evaluation was to identify appropriate data for use in risk assessment. The analytical data were reviewed for applicability and usability following procedures in the *Guidance for Data Usability in Risk Assessment (Parts A and B;)* (USEPA 1992b,c) and USEPA (1989). 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:

- availability of information associated with site data;
- documentation;
- data sources;
- analytical methods and detection limits;
- data review; and
- data quality indicators, including precision, accuracy, representativeness, comparability, and completeness.

A summary of these six criteria for determining data usability in the present risk assessment is provided below. In addition, a Data Usability Worksheet from the *Risk Assessment Guidance for Superfund Part D* (USEPA 2001a), which summarizes the criteria used to identify data usability, is presented in Table 1.

3.1.1 Borrow Area HHRA Datasets

A number of investigations have been performed within the Borrow Area since 2000. These include:

- 2000 Environmental Assessment by Parsons Engineering Science, Inc. (Parsons 2000) (Dataset 10)[2];
- 2000 Implementation of Sampling Plan for the Proposed Gravel Pit Site by GES (2000) (Dataset 13a)
- 2003 Limited Environmental Phase II Investigation by GES (2003a,b) (Datasets 26a and 26b);

[2] Although two sample locations (B-8 and B-12; see Figure 2) from this investigation fall within the Borrow Area boundary, the data from these locations have not been validated; only validated data is included in the risk assessment. The omission of these two locations from the risk assessment are discussed in further detail in the Uncertainty Analysis (Chapter 7).

- 2003 Asbestos Investigation by MWH and Aeolus Inc. (Aeolus 2003b); and
- 2006 Soil Investigation by BRC (Dataset 36).

Since the Work Plan was written and approved, the boundary definition of the area considered for use as Borrow Area soils has changed. The most recent boundary definition is presented in the CSM (shown in Figure 2) for the proposed CAMU prepared by DBS&A (2006b, in preparation). Data within the Borrow Area from the investigations above in the project database and included in this assessment are:

- Borings B-15, and B-16 from the 2000 GES investigation
- Borings PEB-9, PEB-11, PEB-13, PEB-17, and PEB-18 from the 2003 GES investigation;
- Borings EB-1, EB-2, EB-3, EB-7 and EB-8 from the 2003 GES investigations;
- Asbestos samples BEC-1Sb, BEC1Sa through BEC5Sa, and BEC1Da though BEC5Da from the 2003 MWH and Aeolus investigation; and
- Borings BP-01 through BP-10 from the 2006 BRC investigation.

These locations are presented on Figure 2. All valid data from these investigation locations to a depth of 40 feet (the maximum proposed depth of Borrow Area soil excavation) were included in the HHRA. Remaining locations from the Borrow Area investigations excluded from the list above are in areas that are not proposed for use as off-site fill material. These datasets do not include several chemicals that are on the project site-related chemicals list. Discussions of those chemicals that are on the site-related chemicals list but that were not analyzed for are discussed in the Uncertainty Analysis (Chapter 7). Data Validation Summary Reports (DVSRs) for all of the datasets that were used in the risk assessment have been submitted to and approved by NDEP. DVSRs, including laboratory reports, are provided in Appendix C.

3.1.2 Criterion I – 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. The following lists the information sources and the availability of such information for the data usability process associated with this risk assessment:

- A site description provided in Chapter 2 of this report identifies the location and features of the Site, the characteristics of the site vicinity, and contaminant transport mechanisms.

- A site map with sample locations is provided in Figure 2 of this report.

- Sampling design, protocols and results are discussed briefly in Section 2.4 and details are provided in the reports for each of these efforts.
- Analytical methods and detection limits are provided in Table 2 of this report and as part of Appendix B, as well as Appendix D, Attachment D-1.
- A complete dataset is provided in Appendix B of this report.
- 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 each of the DVSRs.
- QC results are provided by the laboratory, including blanks, replicates, and spikes. The laboratory QC results are included as part of each of the DVSRs.
- Data flags used by the laboratory were defined adequately.
- Electronic files containing the raw data made available by the laboratory are provided in AppendicesAppendix B and C.

3.1.3 Criterion II – Documentation Review

The objective of the documentation review is to confirm that the analytical results provided are associated with a specific 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. Based on the documentation review, all samples analyzed by the laboratory were included on the chain-of-custody forms and were correlated to the correct geographic location at the Site. Field procedures included documentation of sample times, dates and locations, other sample specific information such as depth bgs were 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 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 detection limits, and provides the results of appropriate quality control samples such as laboratory control spike samples, sample surrogates and internal standards (organic

analyses only), and matrix spike samples. All laboratory reports, except for asbestos, provided the documentation required by USEPA's Contract Laboratory Program (USEPA 2003b~~2003a~~, 2004a,b) 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. Reported sample analysis results were imported into the project database.

The recommended method for providing asbestos data which are useful for risk assessment purposes was performed by EMS Laboratory in Pasadena, California. This laboratory is not currently certified in the State of Nevada, but has California and national accreditation for asbestos analysis.

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 2003a). 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).

The Modified Elutriator Method incorporates collection of samples that are re-suspended and then forced through an airway and filter. Asbestos structures are isolated and concentrated of 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. These are precisely the dimensions required to combine such measurements with published dust emission and dispersion models to convert them to asbestos emission and dispersion estimates. Thus, because published dust emission and dispersion models can be used to address many of the exposure pathways of interest in this study, these can be combined with measurements from the Modified Elutriator Method to predict airborne exposures and assess the attendant risks.

3.1.4 Criterion III –Data Sources

The review of data sources is performed to determine whether the analytical techniques used in the site characterization process are appropriate to identify the COPCs in the risk assessment. The site data collection activities (Section 2.4) were developed to characterize a broad spectrum of chemicals potentially present on the Site, including VOCs, SVOCs, metals and other

inorganics, radionuclides, dioxins/furans, asbestos, PCBs, PAHs, and pesticides. Site data collection activities have included analyses for soil and appropriately reflect anticipated exposures.

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 the risk assessment.

3.1.5 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 whether the analytical methods used appropriately identify COPCs and 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. Table 2 identifies the USEPA and DOE methods that were used in conducting the laboratory analysis of soil samples from the 2006 BRC investigation. Methods used in the other investigations are included in Appendix B, and each of the DVSRs (Appendix C). Each of the identified USEPA methods are considered the most appropriate method for the respective constituent class, and each was submitted as part of the DVSRs approved by NDEP.

For the analytical data, the most recent associated reference method utilized in Borrow Area investigations is provided in the following guidelines:

- *Contract Laboratory Program Statement of Work for Chlorinated Dibenzo-p-Dioxin and Chlorinated Dibenzofuran: Multi-media, Multi-concentration* (USEPA 2005a);
- *Contract Laboratory Program Statement of Work for Organic Analysis* (USEPA 2003b~~2003a~~);
- *Contract Laboratory Program Statement of Work for Organic Analysis* (USEPA 2004a);
- *Contract Laboratory Program Statement of Work for Inorganic Analysis* (USEPA 2004b);

- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), Third Edition* (USEPA 2005b);
- *Procedures Manual of the Environmental Measurements Laboratory, HASL-300* (DOE 1997); and
- *Modified Elutriator Method for the Determination of Asbestos in Soils and Bulk Material* (Berman and Kolk 2000).

Laboratory reporting limits were based on those outlined in the reference method and the sampling and analysis plan. In accordance with respective laboratory standard operating procedures (SOPs), the analytical processes included performing instrument calibration, laboratory method blanks, and other verification standards used to ensure quality control during the analyses of collected samples. Laboratory reporting limits were used in the risk assessment unless detection limits were modified due to blank contamination.

~~Laboratory reporting limits were based on those outlined in the reference method and the sampling and analysis plan. In accordance with respective laboratory SOPs, the analytical processes included performing instrument calibration, laboratory method blanks, and other verification standards used to ensure quality control during the analyses of collected samples.~~

The range of detection limits achieved in field samples was compared to USEPA Region 9 industrial Preliminary Remediation Goals (PRGs) (USEPA 2004c). A number of chemicals had non-detectable results with detection limits above industrial PRGs: 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)~~, arsenic~~, benzo(a)pyrene, dibenzo(a,h)anthracene, cobalt-60, lead-210, uranium-235, 3,3'-~~-~~dichlorobenzidine, bis(2-chloroethyl) ether, hexachlorobenzene, N-nitrosodimethylamine, N-nitrosodi-n-propylamine, 1,2,3-trichloropropane, 1,2-dibromoethane, and trichloroethylene.

The detection limits exceeded PRGs by a factor(s) of 3.8 for 2,3,7,8-TCDD~~tetrachlorodibenzo-p-dioxin, 3.1 to 3.3 for arsenic~~, 1.6 to 2.4 for benzo(a)pyrene, 1.6 to 2.4 for dibenzo(a,h)anthracene, 1.1 to 2.2 for cobalt-60, 1.1 to 32.7 for lead-210, 1.4 for uranium-235, 1.01 to 1.4 for 3,3'-dichlorobenzidine, 1.04 to 1.9 for bis(2-chloroethyl) ether, 1.02 for hexachlorobenzene, 9.8 to 14.8 for N-nitrosodimethylamine, 1.3 to 4.5 for N-nitrosodi-n-propylamine, 1.6 for 1,2,3-trichloropropane, 1.6 for 1,2-~~-~~dibromoethane, and 1.1 for trichloroethylene. A single dioxin sample contained elevated reporting limits for 2,3,7,8-TCDD. As discussed below, dioxins/furans were retained as COPCs due to this detection limit issue.~~The~~

~~PRG is greater than half the detection limit for the majority of the non-detect results for most of these chemicals: 2,3,7,8-tetrachlorodibenzo-p-dioxin (97%), benzo(a)pyrene (90%), dibenzo(a,h)anthracene (90%), cobalt-60 (97%), uranium-235 (100%), 3,3'-dichlorobenzidine (100%), bis(2-chloroethyl) ether (100%), hexachlorobenzene (100%), N-nitrosodi-n-propylamine (100%), 1,2,3-trichloropropane (100%), 1,2-dibromoethane (100%), and trichloroethylene (100%). For arsenic, samples with detection limits above PRGs are well within the range of detected concentrations, and as described below arsenic is retained for quantification in the risk assessment and therefore the slightly elevated detection limits are incorporated into the calculation of exposure point concentrations.~~ For lead-210, the frequency and range of detected concentrations are very similar between the site and background~~, as was considered comparable in statistical comparisons with background~~. For N-nitrosodimethylamine and N-nitrosodi-n-propylamine, all of the detection limits are above the PRG value. This may lead to the potential for concentrations to be present at levels that exceed *de minimus* risk metrics. However, the detection limits for all other nitroso-amine type compounds are sufficiently low to detect concentrations of interest should nitroso-amine compounds have been present at the site, none have been detected, and there is no site history to suggest the compounds may have been utilized at the property. The available lines of evidence suggest that although the detection limits for N-nitrosodimethylamine and N-nitrosodi-n-propylamine are elevated, this should have minimal impact on the outcome of the risk assessment. Therefore, the detection limits are considered adequate for risk assessment purposes.

For asbestos, there is no regulatory limit to compare the detection limits of chrysotile and amphibole fibers for this method. For asbestos, the appropriate measure of adequate characterization is not a detection limit, but the analytical sensitivity. There was a single detection of short ~~were no detections of long~~ amphibole fibers. The short amphibole fibers are not ~~; however, the detection limits were~~ used to calculate risks. However, based on the presence of amphibole at the site, risks due to amphibole fibers were calculated using the analytical sensitivity for the appropriate receptors. The analytical sensitivity is perhaps not low enough in regards to the amphibole fibers. No long fibers were detected; however, upper bound risks were greater than 10^{-6}.

3.1.6 Criterion V – Data Review

The data review portion of the data usability process focuses primarily of the quality of the analytical data received from the laboratory. All Site data that are used in the risk assessment must be evaluated on the basis of completeness, precision (based on duplicates), and accuracy

(based on laboratory spikes). In addition, the laboratory results data are reviewed for blank contamination. DVSRs were prepared for each data collection effort. The results of ERM's~~MWH's~~ data review for these issues are presented below.~~:~~

3.1.6.1 Laboratory QA/QC – Precision, Accuracy and Method Performance

Although certain laboratory limits, such as percent recovery (PR) and relative percent difference (RPD) between sample and duplicate, were exceeded for certain compounds or analyses, as identified by the laboratory (and confirmed during ERM's~~MWH's~~ review of the data), there does not appear to be a wide-spread effect on the quality of the analytical results. ~~Furthermore, based on a review of the laboratory narratives (provided in the laboratory reports in each of the DVSRs), the laboratories do not believe that the observed exceedances of laboratory criteria represent a concern.~~ Additional discussion of specific exceedances, with respect to precision and accuracy, is summarized~~provided~~ below under Criterion VI (sections 3.1.7.1 and 3.1.7.2) with more detail provided in tabular form in Appendix D, Attachment D-2).

3.1.6.2 Field Duplicates

Seven field duplicate samples were collected and analyzed for perchlorate, organochlorine pesticides, VOCs, metals, and SVOCs at locations EB-3 (at 15 feet bgs), EB-8 (at 25 feet bgs), PEB-13 (at 0.5 feet bgs), and PEB-17 (at 25 feet bgs) and for perchlorate, radionuclides, dioxin/furans, PAHs, pH, herbicides, organophosphorus and organochlorine pesticides, PCBs, VOCs, metals, and SVOCs at BP-03 (at 0 feet bgs), BP-06 (at 0 feet bgs), and BP-09 (at 0 feet bgs). In addition, a field duplicate was collected at BEC-01 for asbestos. Also for asbestos, there are two samples (BP-08-0A and BP-02-0A) which were run twice due to difficulty in identifying fibers. These samples are not field duplicates but are presented for informational purposes. One sample identified a short amphibole fiber which provides a reason for calculating risks due to potential amphibole exposure even though no long fibers were detected. The field duplicates were reviewed to provide an indication of the precision of the field sampling procedures. It is expected that the concentration of a given chemical in a field duplicate and the original sample should be similar given that the samples are collected in the same location, in the same manner, and at the same time. Nonetheless, some variation is expected, and the relative difference (measured as the RPD) between the samples is likely to be greater than for laboratory duplicates. ERM~~MWH~~ reviewed the analytical data for the chemicals detected in the field duplicate pairs. The RPD~~relative percent difference~~ between the sample concentrations was calculated for those chemicals that were detected in both samples. All RPD's were below 50 percent except for the following: delta-BHC at location EB-8 with an RPD of 144%; barium at location EB-3 with an

RPD of 57.1%; lead at location PEB-13 with an RPD of 71.5%; chromium at location PEB-17 with an RPD of 57%; 2,3,7,8-tetrachlorodibenzofuran and sodium at location BP-06 with RPDs of 138% and 84%, respectively; and phosphorus (as P) and ronnel at location BP-09 with RPD's of 55% and 93%, respectively. These results were qualified as estimated. For asbestos, the primary sample BEC-01 was qualified due to blank contamination. The duplicate sample was used in the risk assessment. Data which resulted in qualification are provided in detail in Appendix D, Attachment D-2~~While there are differences that are rather large, they do not appear to be consistent with a widespread issue with the data~~.

3.1.6.3 Data Validation

Soil sample data were subject to data validation. DVSRs for each of the investigations used in this risk assessment have been submitted and approved (Appendix C). The analytical data were validated according to the internal procedures using the principles of USEPA National Functional Guidelines (USEPA 1999, 2001b, 2002b~~2002a~~, 2004d) and were designed to ensure completeness and adequacy of the dataset. Any analytical errors and/or limitations in the data have been addressed and an explanation for data qualification provided in the respective data tables.

For some analytical results, 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 USEPA guidelines (USEPA 1999, 2001b, 2002b~~2002a~~, 2004d). Data validation flags indicate when results were considered non-detect (U), estimated (J), or rejected (R). Sample results were rejected based on findings of serious deficiencies in the ability to properly collect or analyze the sample and meet QC criteria. Only rejected data were considered unusable for decision-making purposes and rejected analytical results were not used in the risk assessment. Sample results qualified as estimated were affected by special circumstances and are likely to be quantitatively biased to some degree; estimated analytical results were used in the risk assessment. Data qualified as non-detect represents an analyte or compound that was not detected above the sample quantitative limit and such data were used in the risk assessment. These data usability decisions follow the guidelines provided in the *Guidance for Data Usability in Risk Assessment (Parts A and B;)* ~~(~~USEPA 1992b,c). The details of the data evaluation for the background dataset are provided by Environ (2003) and BRC/TIMET (2007, currently in review by the NDEP). ~~).~~

3.1.7 Criterion VI – Data Quality Indicators

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 the risk assessment. The DQIs include precision, accuracy, representativeness, comparability, and completeness (PARCC). The project Quality Assurance Project Plan (QAPP; BRC and MWH 2006b) 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, Organics and Inorganics and Dioxin/Furans* (USEPA 1999, 2001b, 2002b~~2002a~~, 2004d).

3.1.7.1 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 laboratory limits for precision, as measured by the RPD between laboratory control sample (LCS) analyses, are the laboratory control limits based on historical data calculated as specified in the analytical methods. If these limits are not met, the laboratory will follow the actions specified in the analytical method and the laboratory's SOPs.

Precision of a set of analyses is evaluated by determining the RPDs for matrix spike and matrix spike duplicate (MS/MSD) samples for organics and duplicate samples for inorganics. Precision is calculated using the following equation, where Xl and X2 are duplicate measurements:

$$RPD(\%) = \left[\frac{X_1 - X_2}{\left(\frac{X_1 + X_2}{2} \right)} \right] \times 100$$

As discussed above, the precision of the data was evaluated using several laboratory QA/QC procedures. Based on ERM's~~MWH's~~ review of the results of these procedures, there do not appear to be any wide-spread data usability issues associated with precision. In several instances, however, the calculated RPDs were outside the laboratory QC limits for individual chemicals as discussed below.

Matrix spike/matrix spike duplicates - Except as noted below, laboratory MS/MSD analyses were performed and RPDs were calculated for all analyses. MS/MSD results were not provided for the eight samples associated with the 2000 Borrow Area investigation (GES 2000). The metals results

~~RPDs calculated by the laboratory~~ were rejected from~~generally within~~ the 2000 Borrow Area investigation, since no QC data were available. The organic data were deemed usable based on the availability of surrogate data.

~~laboratory's acceptance criteria; however,~~ RPD exceedances occurred in at least one preparation batch for the following analytes: 2,4,5-T, 2,4,5-TP, 2,4-D, ~~aluminum,~~ dicamba, dichlorodifluoromethane, dichlorprop, dinitrobutyl phenol~~alcohol~~, phosphorus (as P), 2,4-dinitrophenol, endosulfan II, endosulfan sulfate, methoxychlor, ethanol, 1,2,3,4,7,8,9-heptachlorodibenzofuran, 4,4'-DDE, endrin aldehyde, and titanium. Sample specific results are presented in tabular form in Appendix D, Attachment D-2.~~MS/MSD analyses alone cannot be used to evaluate the precision and accuracy of individual samples, and the presence of RPD exceedances in individual samples does not necessarily indicate a lack of precision or accuracy.~~ Based on both the laboratory and ERM~~laboratory's and MWH~~ review there does not appear to be any significant data usability issues resulting from the MS/MSD results.

Laboratory control samples (LCS) - Laboratory LCS/LCSD analyses were performed and RPDs were calculated by the laboratory in all sample lots except as noted below. LCS results were not provided with the 2000 Borrow Area investigation (GES 2000). The metals results were rejected from the 2000 Borrow Area investigation, since no QC data were available. The organic data were deemed usable based on the availability of surrogate data.

~~RPDs calculated by the laboratory were generally within the laboratory's acceptance criteria; however,~~ RPD exceedances occurred in at least one preparation batch for the following analytes: 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,2,3~~,4,7,8,9-heptachlorodibenzofuran, 1,2,3~~-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-~~-~~dibromo-3-chloropropane, 1,2-dichloroethane, 1,3-dichloropropane, 1,4-dichlorobenzene, 2,2-dichloropropane, 2-nitropropane, acetone, ~~aldrin,~~

~~benzo(a)anthracene, benzo(g,h,i)perylene, benzo(k)fluoranthene,~~ benzoic acid, bromomethane, CFC-11, CFC-12, freon-113, chloroethane, chloromethane, cis-1,3-dichloropropylene, ~~dibenzo(a,h)anthracene,~~ ethylbenzene, ~~indeno(1,2,3-c,d)pyrene,~~ methyl ethyl ketone, methyl isobutyl ketone, methyl-n-butyl ketone, MTBE, naphthalene, trans-1,3-dichloropropylene, tribromomethane, vinyl acetate, and vinyl chloride. Results for benzoic acid in the nine associated samples were rejected due to low recoveries of the spike compound and not due to the RPD issue. Sample specific results are presented in tabular form in Appendix D, Attachment D-2.~~LCS/LCSD analyses alone cannot be used to evaluate the precision and accuracy of individual samples, and the presence of RPD exceedances in individual samples does not necessarily indicate a lack of precision or accuracy.~~ Based on both the laboratory and ERM~~laboratory's and MWH~~ review there does not appear to be any significant data usability issues resulting from the LCS/LCSD results.

3.1.7.2 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:

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

The results of ERM's~~MWH's~~ analysis of accuracy are presented below:

Holding times and sample temperature - 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. The following samples had qualified results for a number of VOCs: EB-1-20-20.5, EB-1-35-35.5, EB-2-30-30.5, EB-2-35-35.5, EB-3-

5-5.5, EB-3-10-10.5, EB-3-20-20.5, EB-3-30-30.5, EB-3-35-35.5, EB-7-5-5.5, EB-7-20-20.5, EB-7-30-30.5, and EB-7-35-35.5. A number of samples were also qualified for organophosphorus pesticides: EB-8-25, EB-8-26, EB-8-35, EB-7-25, EB-7-35, PEB-11-25, PEB-11-35, EB-3-25, EB-3-35, PEB-13-25, PEB-13-35, PEB-17-25, PEB-17-26, PEB-17-35, PEB-18-25, PEB-18-35, PEB-9-25, and PEB-9-35. One sample (BP-01-02-22-06) was qualified SVOCs, and three samples (BP-02-02-23-06, BP-03-02-27-06, and BP-07-40-41.5-A) had removed data for organochlorine pesticides and SVOCs, and was rejected for hexavalent chromium ~~VI~~ results due to not meeting recommended holding times. The VOCs and organophosphorus pesticides were qualified as estimated and associated risk estimates may be biased low. However, there are many other samples for both analyses that were not compromised by missed holding times.

Twenty-eight sample IDs also received VOC, SVOC, PCB, and pesticide data qualifiers due to sample temperature.

Laboratory control samples - LCS evaluation reports were included with all analyses of metals, dioxin/furans, VOCs, SVOCs, PCBs, PAHs, and organochlorine pesticides except for eight samples analyzed for VOCs, SVOCs and metals associated with the GES 2000 Borrow Area investigation. Percent recoveries were reported outside the laboratory~~laboratory's~~ recovery limits for 1,1-dichloropropene, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-butanone, 2-chloroethyl vinyl ether, 2-chlorotoluene, 2-hexanone, 4-chlorotoluene, 4-methyl-2-pentanone, acetone, benzene, benzoic acid, bromobenzene, bromomethane, carbon disulfide, CFC-12, chlorobenzene, cymene, dibutyl phthalate, dichlorofluoromethane, endrin aldehyde, iodomethane, isopropyl benzene, m,p-xylene, methoxychlor, methylene chloride, naphthalene, n-propylbenzene, o-xylene, radium-226, tert-butylbenzene, toluene, trichloroethene, trichlorofluoromethane, tungsten, vinyl acetate~~radionuclides, metals, organochlorine pesticides, SVOCs, PAHs, VOCs~~, and vinyl chloride.~~chlorinated herbicides.~~ Associated results were qualified. Twenty-five results for 2-butanone, 18 for 2-chloroethylvinyl ether, 19 for 2-hexanone, 13 for 4-methyl-2-pentanone, 35 for benzoic acid, and six results for vinyl acetate were rejected for use due to low or 0 percent recovery. All other results were qualified as estimated and are acceptable for use. Most results were biased low; however, some detections for 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 2-chloroethyl vinyl ether, 2-hexanone, acetone, methylene chloride, naphthalene, and radium-226 were biased high and may represent a high bias to the risk estimates. Except as noted, no LCS evaluations were flagged by the laboratory due to percent recovery outside of the

laboratory's acceptance criteria. ERM~~MWH~~, therefore, believes that LCS evaluations meet the requirement of accuracy.

Matrix spike recovery - Matrix spike evaluation reports were included in all sample lots for analyses of metals, radionuclide, dioxin/furans, VOCs, SVOCs, PCBs, PAHs, and organochlorine pesticides except for eight samples analyzed for VOCs, SVOCs and metals associated with the 2000 GES Borrow Area investigation. Matrix spike percent recovery was outside of the laboratory's recovery limits for the following SDGs:

F6B240341 (metals, cyanide, dioxins and PAHs),

F6B240362 (metals, cyanide and perchlorate)

F6B240403 (metals, perchlorate)

F6B280340(metals, perchlorate, organochlorine pesticides)

L0306194 (metals, organochlorine pesticides, VOCs, SVOCs)

L0306231 (metals, organochlorine pesticides, VOCs, SVOCs)

L0306232 (metals)

L0306230 (metals, SVOCs)

L0306252 (metals, organochlorine pesticides, VOCs, SVOCs)

L0306289 (metals, VOCs, SVOCs)

L0306250 (metals)

L0306300 (metals, organochlorine pesticides, VOCs)

L0306291 (metals, organochlorine pesticides)

L0304003 (SVOCs)

L0304004 (organochlorine pesticides, SVOCs)

L0304005 (SVOCs)

The following list contains the analytes impacted (qualified) by the variances in the matrix spike recoveries:

1,2,4-trichlorobenzene, 2-hexanone, 2,3,7,8-tetrachlorodibenzofuran, 4,4'-DDE, acenaphthylene, aluminum, antimony, barium, calcium, chromium (total), copper, cyanide (total), dichlorodifluoromethane, dieldrin, endosulfan I, endrin aldehyde, heptachlor, iron, ~~manganese,~~ magnesium, nickel, niobium, octachlorodibenzodioxin, perchlorate, phosphorus (as P), silicon, strontium, thallium, titanium, tungsten, vanadium, vinyl acetate, zinc, and zirconium.

Most of the spike recoveries that were outside control limits are slightly outside the control limits and only represent a minor potential to underestimate risks. As such these results were considered for use in the risk assessment. Only the matrix spike results for total cyanide, 4,4'-DDE, endosulfan I, endrin aldehyde, ~~and~~ heptachlor, and tungsten show the potential for a significant underestimation of a soil concentration at locations BP-01 (cyanide), BP-02 (cyanide), BP-03 (cyanide), BP-04 (cyanide), PEB-11-0.5 (tungsten), PEB-11-35 (tungsten), EB-3-0.5 (tungsten), EB-3-15 (tungsten), EB-3-25 (tungsten) and BP-09-0-1A (4,4'-DDT, endosulfan I, endrin, and heptachlor). ~~(pesticides).~~ However, the inability to recover measurable levels of these constituents is likely due to matrix interferences and correcting for initial soil concentrations of the samples. The associated results were rejected and not used in the risk assessment. The remainder of the data were qualified as estimated and the majority of the qualified data are for metals. They are mostly biased low due to low recoveries and may represent an underestimation of risks. However, since the qualified data do not represent all of the data for a single analyte, they are not expected to have a large impact on risk estimates. With the exception of those analyses noted, no MS/MSD evaluations were flagged by the laboratory due to percent recovery outside of the laboratory's acceptance criteria. ERM~~MWH~~, therefore, believes that MS/MSD evaluations meet the requirements of the accuracy parameter.

Surrogate recovery - Surrogate spike recovery is used to evaluate the accuracy of reported measurements. A surrogate standard is a distinct chemical that behaves similarly to the target chemical and is purposely added to the sample prior to cleanup and extraction. The surrogate spike recovery is used to assess recovery of the target chemical from the sample matrix. A known amount of a surrogate standard is added to the sample prior to cleanup. The amount of the surrogate detected in the analysis is compared to the amount added and the percent recovery's determined. Accuracy is calculated as follows:

$$\%R = \left[\frac{X - T}{K}\right] \times 100$$

where:

R = recovery
X = analytical result of spike sample
T = analytical result of the un-spiked aliquot
K = known addition of the spiked compound

Surrogate spike recoveries were listed for all organochlorine and organophosphorus pesticides, PCBs, PAHs, SVOCs, and VOCs. Surrogate recoveries fell below the laboratory's acceptance criteria for the following samples and parameters: BP-01-0-1-A (organophosphorus pesticides), BP-02-30-31.5-A (VOCs), BP-07-10-11.5A (organophosphorus pesticides), EB-8-5.0-5.5 (organochlorine pesticides), EB-2-20-20.5 (VOCs), and EB-3-30-30.5 (organochlorine pesticides). Surrogate recoveries exceeded the laboratory's acceptance criteria for the following samples and parameters: BP-01-30-31.5-A (VOCs), BP-02-40-41.5-A (VOCs), BP-03-20-21.5-A (VOCs), BP-03-30-31.5-A (VOCs), BP-04-30-31.5-A (VOCs), BP-05-40-41.5-A (VOCs), BP-06-40-41.5-A (VOCs), BP-07-40-41.5-A (VOCs), BP-08-20-21.5-A (VOCs), BP-08-30-31.5-A (VOCs), BP-08-40-41.5-A (VOCs), BP-09-0-1-A (organochlorine pesticides), BP-09-10-11.5-A (organochlorine and organophosphorus pesticides), BP-09-20-21.5-A (organochlorine pesticides and VOCs), BP-09-30-31.5-A (organochlorine and organophosphorus pesticides and VOCs), BP-09-40-41.5-A (VOCs), BP-10-30-31.5-A (VOCs), BP-10-40-41.5-A (VOCs), and PEB-11-35 (organochlorine pesticides). No data were rejected due to low surrogate recoveries. The majority of the data were biased high due to high recoveries and may represent an overestimation of risks. Sample specific results are discussed in tabular form in Appendix D, Attachment D-2. With the exception of those analyses noted, no surrogate/spike recoveries were flagged by the laboratory due to recoveries outside of the laboratory's acceptance criteria. ~~MWH believes that surrogate spike recovery evaluations meet the requirements of the accuracy parameter.~~

Blanks - Accuracy is also evaluated by comparing results for the analysis of blank samples to results for investigative samples. 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. Contaminant concentrations in blanks should be less than detection or reporting limits. The following are analytes that were detected in blanks that were within five times detections in field samples, which resulted in field sample results being considered non-detects or estimated detections with a high bias.

2003 BRC Analytes		
Vinyl acetate	Chromium	Dibutyl phthalate
Asbestos		
2006 BRC Analytes		
Arsenic	Boron	Dichloromethane
Mercury	Molybdenum	Niobium
Phosphorus	Radium 226	Radium 228
Silicon	Thallium	Tungsten
Vanadium	Zinc	

3.1.7.3 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 2002b). 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 were selected randomly in order to adequately assess the exposure areas. The various site characterization efforts discussed in Section 2.4 (Parsons 2000, GES 2000, GES 2003a,b, Aeolus 2003b, 2006 soil investigation by BRC) were developed to allow collection of samples that are representative of the media to which the receptors may be exposed. The samples were analyzed for a broad spectrum of analyses across the site. Samples were delivered to the laboratory in coolers with ice to minimize the loss of analytes. At times the samples were received outside the recommended temperature range or were analyzed beyond the holding time. Sample specific results are discussed in tabular form in Appendix D, Attachment D-2.

3.1.7.4 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 Borrow Area is 99 percent. Blank contamination resulted in the qualification of a few of the data, based on application of the protocol described in RAGS (USEPA 1989) which led to treatment of some of the measurements as non-detects. Not all of

the analytical data collected were used in the risk assessment. Besides the rejected data, some samples were reanalyzed and the best or least qualified result was selected.

3.1.7.5 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 listed in Table 2; 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. Only when precision and accuracy are known can datasets be compared with confidence.

Comparability is a concern within the context of this risk assessment because the data used were collected during several site characterization programs over several years. The only results included in the risk assessment that may be from different methods is for metals. The analyses USEPA 6010B and 6020 were used. The main difference between the analyses is that the USEPA 6020 method uses a mass spectrometer to identify the metals which allows it to achieve lower detection limits for some metals, but both methods use inductively coupled plasma. There is no anticipated problem in combining these results. All of the other analyses for each analyte and medium were conducted by the same laboratory and method. There are a few compounds (*e.g.*, naphthalene) which are included in multiple analyses with different reporting limits. Naphthalene is included in the VOC (SW8260B) analysis which has relatively low reporting limits, but it is also included in the SVOC (SW8270C) analysis which has much higher reporting limits. In this case, the VOC result was selected unless the VOC result was rejected. For radium-226, the analysis was performed by two methods. Many results were qualified due to blank contamination in one method; consequently, the result from the other method was used in the risk assessment. Otherwise, detection limits were comparable between different site characterization programs as well as between the background dataset and the site dataset. ~~The data review presented earlier in this section did not identify any reasons to qualify the comparability of the data within this dataset.~~

3.1.8 Data Adequacy

The concept of data adequacy incorporates: (1) an analytical program that seeks to quantify all relevant Site chemicals that have the potential to affect risk calculations, and (2) a spatial density of sampling points that provides confidence that the Site has been sufficiently characterized. The

risk assessment analytical program for the Site represents a broad suite of analyses that cover all chemicals that might be conceivably expected to be present at elevated levels at the Site as a result of historical operations on the Site or adjacent to the Site. An evaluation of the adequacy of the sampling for use in risk assessment is presented in Appendix D, Attachment D-3.~~C.~~ The evaluation includes results from two unrelated analyses. The first qualitatively evaluates whether the sample collection appears to be adequately representative in relation to the CSM. The second addresses data quality using traditional classical statistics-based process. The focus of the evaluation was on four chemicals that are likely to be important in the risk assessment; arsenic, radium-226, beta-BHC, and dioxins/furans.

3.1.8.1 Conceptual Site Model

Statistical analysis is only one aspect to evaluating sample size adequacy. It is also important to make sure that the data are fully representative of the fate and transport, exposure pathways, and receptor scenarios being evaluated for decision making. At the Borrow Area the investigations have focused on possible contamination in surface and subsurface soils. The samples were analyzed for chemicals that are likely to be important in the risk assessment. The sample locations are reasonably spread out throughout the Site and include surface and multiple subsurface depths at most of the locations.

Background comparisons have also been performed. Although it is concluded that radium-226 site concentrations are statistically greater than background, the differences do not visually appear large. ~~Qualitatively, sample sizes could be considered adequate for radium-226 given the similarity to background concentrations. Furthermore, hot spots do not seem to be evident based on the data, and were not considered likely.~~ Under these circumstances, the sampling scheme seems appropriate.

~~In addition, hot spots do not seem to be prevalent at the Site based on the data, and were not expected based on historical land use.~~ In general as the data do not show indications of ~~hot spots or~~ outliers, the sampling scheme seems appropriate.

3.1.8.2 Traditional Data Quality Assessment Approach

The sample size calculations presented in Appendix D, Attachment D-3~~C~~ use a formula that accommodates data that are not normally distributed. This test is based on comparing an average concentration to a threshold (*i.e.*, risk-based screening level [RBSL]) that is analyte specific. The target RBSLs were calculated using the risk assessment inputs in this risk assessment for

construction workers, maintenance workers, and trespassers.~~indoor commercial workers.~~ These RBSLs are presented in the project QAPP (BRC and MWH 2006b). The RBSLs were based on a target hazard index (HI) of 1.0 or a target cancer risk level of 10^{-6}. The minimum RBSL for worker receptors was selected for the evaluation, which was the maintenance worker due to greater exposure time. For some radionuclides the site mean concentration exceeded an RBSL based on the target cancer risk level of 10^{-6}. For these chemicals an RBSL was calculated using a 10^{-5} or 10^{-4} target cancer risk level.

The methodology evaluates the number of samples needed to determine with sufficient statistical power the attainment of site concentrations relative to a target soil concentrations given a desired level of confidence, target soil concentrations, specified tolerable difference from the target soil concentrations, and site data standard deviations. Site standard deviations are calculated using site data in Appendix D, Attachment D-3.~~C.~~ A matrix table was created with estimated sample size needs for a range of confidence levels. The level of confidence range included 0.15, 0.20 and 0.25 false negative error (β) and 0.05, 0.10, and 0.15 false positive error (α). The tolerable difference from the RBSL ranged from 10 percent to 30 percent. A drawback of this analysis is that the acceptable alpha and beta error as well the desired tolerable difference from the RBSL have not been previously established nor selected. Results could change based on selection of different acceptable error rates and tolerable differences.

For arsenic, beta-BHC, and dioxins/furans sample sizes were adequate for a wide range of threshold concentrations. For radium-226, sample size was adequate for the RBSL at the 10^{-4} target risk level. It should be noted that sample size adequacy could change if alternate tolerable differences were used. However, since the existing site means are much higher than the maximum current tolerable difference of 30 percent, much higher tolerable differences would likely have to be selected as alternate criteria to result in a different outcome from the current tests. For example, at the lowest RBSL where sample adequacy was observed the site means for arsenic, beta-BHC, dioxins/furans, and radium-226 were 85%, 99%, 90%, and 30% ~~percent~~ lower than the RBSL, respectively.

~~As mentioned, there are some theoretical issues with the *a posteriori* computation of samples sizes. A probabilistic approach to assessing the sample size can be executed wherein a distributional model of the mean concentration of each chemical of interest is constructed, distributions of mean concentrations estimated, and then the probability that the mean concentration exceeds a threshold concentration (RBSL) evaluated. This procedure was not undertaken for this assessment.~~

Overall, the results of the evaluation indicates that there are an adequate number samples collected for each chemical for use in this risk assessment.

4.0 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 data quality objectives and developing exposure scenarios.

The risk assessment evaluates current and potential future land-use conditions. Currently, the Site is undeveloped. Current receptors that may use the property include on-site construction workers involved in the excavation of borrow area material, and current/future on-site trespassers. The CSM also considers other future land-uses. For example, the CSM includes the planned use of borrow area material. All potential transfer pathways were included in the CSM. The human health CSM ~~for the Site~~ is presented in Figure 4.

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

The following release mechanisms were not evaluated in this evaluation:

- Storm/surface water runoff into surface water and sediments
- Vapor emission and transport into indoor air
- Uptake by plants

Although these release mechanisms are identified here, no quantitative modeling is presented in this Chapter. Instead, those primary release mechanisms identified for particular receptors are presented in this Chapter, and are quantitatively evaluated in Chapter 6. The potential for downward vertical migration in the vadose zone is evaluated in Chapter 9.

4.1 IMPACTED ENVIRONMENTAL MEDIA

Environmental media at the Site consist of three categories: soil, groundwater 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.

As shown~~indicated~~ in Figure~~Section~~ 2~~,.1 above, review of site history~~ the two areas ~~that constitute the Borrow Area~~ are bisected by the known contaminated area of the previous Western Ditch, which will not be used as the source of any of the borrow materials. Even though there is no evidence of disposal of any waste materials in the proposed Borrow Area, because the area, in general, lies in the midst of other waste disposal areas, it is possible that some surface contamination ~~has occurred~~ due to water run-off and~~,~~ airborne deposition may have occurred. Historically, there have been drainage channels in the Borrow Area created by~~,~~ storm water runoff from adjoining CAMU and plant areas. It is possible that the ~~, and the possibility that~~ soil in the Borrow Area has been impacted by runoff from neighboring sites.

4.2 MIGRATION PATHWAYS

~~4.2 INTER-MEDIA TRANSFERS~~

Exposure to Borrow Area soils chemicals may be direct, or indirect following migration pathways.~~inter-media transfers.~~ These pathways~~transfers~~ can be primary or secondary and impacted soil is the initial source. For example, upward migration of chemicals entrained on dust particles from impacted soil into ambient air thereby reaching a point of human inhalation represents a primary transfer.

These migration pathways~~inter-media transfers~~ represent the potential ~~migration pathways~~ that ~~may transport~~ one or more chemicals may be transported to an area away from the Borrow Area soil where a human receptor could be exposed. Discussions of each of the identified potential migration~~transfer~~ pathways are presented below. Figure 4 presents a conceptualized diagram of the migration pathways~~inter-media transfers~~ and fate and transport modeling for the Borrow Area soil.

Four initial migration~~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 outdoor air. The second primary migration~~transfer~~ pathway is via fugitive dust emissions into ambient air. The third primary migration~~transfer~~

pathway is downward migration of chemicals from soil to groundwater. This pathway is evaluated in Chapter 9. Finally, chemicals in soil can migrate~~be transferred~~ to plants grown in Borrow Area soil via uptake through the roots. The plant uptake pathway is typically evaluated for residential receptors; however, as discussed in Section 4.3 below, because the Borrow Area soil will not be used as fill material for residential development, this pathway was not evaluated in the HHRA.

While the constraints for borrow soil placement excludes the use as fill for residential development, the soil could be used for commercial development where the volatiles could potentially migrate from soil into indoor air of commercial buildings. These exposures are expected to be negligible compared to the risks associated with the pathways considered in this risk assessment as discussed in the Uncertainty Analysis (Chapter 7).

4.3 POTENTIAL HUMAN EXPOSURE SCENARIOS

The following section summarizes Borrow Area soil exposures and the potential human exposure scenarios. 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, soil);
- A point of potential human contact with the medium; and
- A route of exposure (*e.g.*, inhalation, ingestion, dermal contact).

The Borrow Area soil is proposed for use as fill material for various construction projects. Any such project will involve limited or no post-construction exposures to the Borrow Area soil. The constraints placed on the use of Borrow Area soil as fill material are: (1) the materials will be used in non-residential areas; (2) the placement of soils will be such that there are limited~~no~~ exposure pathways for receptors; (3) a minimum soil column height will be maintained between where these soils are placed and the local groundwater such that impacts to groundwater demonstrated via the leaching evaluation are negligible; (4) to the extent possible, these materials will be placed in significant quantities (approximately 50,000 yards) at each location (DBS&A 2006a). An additional constraint on the use of Borrow Area soil as fill material is that it will not be placed in environmentally sensitive areas.[3] Therefore, the following presents the primary

[3] These areas may include wetlands, National and State parks, critical habitats for endangered or threatened species, wilderness and natural resource areas, marine sanctuaries and estuarine reserves, conservation areas, preserves,

exposure pathways for each of the potential receptors to Borrow Area soil. These populations and complete/potentially complete exposure pathways for each of the receptors were evaluated in the HHRA.

4.3.1 Identification of Exposure Pathways and Receptors

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 one hour a day are less than those associated with exposure to the same chemicals at the same concentrations for two hours a day. An exposure pathway is a description of the ways in which a person could be exposed to chemicals. Potential health impacts from chemicals in a medium can occur via one or more exposure pathways. Exposure pathways for each of the receptors evaluated in this risk assessment are presented in Figure 4, and summarized below.

- Future Construction Workers~~workers~~ (on-site soil/off-site fill material)
  - incidental soil ingestion*
  - external exposure from soil†
  - dermal contact with soil
  - outdoor inhalation of dust*‡
  - outdoor inhalation of VOCs from soil

- Current/Future Trespassers (on-site soil)
  - incidental soil ingestion*
  - external exposure from soil†
  - dermal contact with soil
  - outdoor inhalation of dust*‡
  - outdoor inhalation of VOCs from soil

wildlife areas, wildlife refuges, wild and scenic rivers, recreational areas, national forests, Federal and State lands that are research national areas, heritage program areas, land trust areas, and historical and archaeological sites and parks. These areas may also include unique habitats such as aquaculture sites and agricultural surface water intakes, bird nesting areas, critical biological resource areas, designated migratory routes, designated seasonal habitats, State designated Natural Areas, State designated areas for protection or maintenance of aquatic life, and particular areas, relatively small in size, important to maintenance of unique biotic communities.

- Future Outdoor Maintenance Workers~~maintenance workers~~ (off-site fill material)
  - incidental soil ingestion*
  - external exposure from soil†
  - dermal contact with soil
  - outdoor inhalation of dust*‡
  - outdoor inhalation of VOCs from soil

*Includes radionuclide exposures.
†Only radionuclide exposures.
‡Includes asbestos exposures; evaluated separately.

As indicated above and in Figure 4, future outdoor off-site maintenance workers, future on-site/off-site construction workers, and current/future on-site trespassers could be exposed to chemicals in soil through skin contact, inhalation of VOCs in outdoor air, inhalation of chemicals adsorbed to fugitive dust, or incidental ingestion of soil when soiled hands or objects are placed in or near the mouth. For radionuclides, external radiation is also a potential soil-related exposure pathway for all receptors. For asbestos, inhalation of fugitive dust is considered the only potential soil-related exposure pathway for all receptors. Risks to potential nearby, off-site receptors that may be impacted during excavation and placement activities are addressed qualitatively in the Uncertainty Analysis (Chapter 7) based on the risk characterization for the on-site receptors.

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, in order to ensure that a risk assessment focuses on those substances that contribute the greatest to the overall risk (USEPA 1989); two procedures were used to eliminate the COPCs for quantitative evaluation in the risk assessment:

- identification of chemicals with detected levels which are at or less than background concentrations (where applicable), and
- identification of chemicals that are infrequently detected at the Site.

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 Chapter indicate that such elimination is possible. The procedure for evaluating COPCs relative to background conditions is presented below.

5.1 EVALUATION OF DETECTIONS RELATIVE TO BACKGROUND CONDITIONS

USEPA (1989, 2002c,d~~2002b,c~~) guidance allows for the elimination of chemicals from further quantitative evaluation if detected levels are not elevated above naturally occurring levels. Typically for purposes of selecting COPCs for the risk assessment, COPCs are chemicals that are elevated above naturally occurring levels based on statistical comparison. For the purpose of selecting COPCs for the risk assessment, appropriate statistical methods were applied for the background comparison. When the results of the statistical analyses indicate that a particular chemical is within background levels, then the chemical was not quantitatively evaluated in the risk assessment. That is, a chemical was selected as a COPC based on background conditions if it was determined to be above background levels in any individual background comparison test. With the application of this conservative approach, a chemical was excluded as a COPC only if it was determined to be at or below background levels in all statistical comparison tests. Chemicals that would have been eliminated as COPCs utilizing a weight of evidence approach (rather than exceedance of a single test metric) are identified in the Uncertainty Analysis (Chapter 7). Additionally, chemicals eliminated as COPCs are addressed qualitatively in the Uncertainty Analysis (USEPA 2002c~~2002b~~).

Background concentrations of metals and radionuclides considered representative of the Site soils were evaluated. A comparison of site-related soil concentrations to background levels was conducted using the existing, provisional soils background dataset presented in the ~~draft~~ *Background Shallow Soil Summary Report, BMI Complex and Common Area Vicinity* (BRC/TIMET 2007~~2006~~, currently in review by the NDEP~~revision~~), which includes both the Environ (2003) dataset and the BRC/TIMET dataset collected in 2005. A single site-related dataset was used for the background comparisons containing all depths; no stratification of data was performed. These comparisons were performed using the Quantile test, Slippage test, *t*-Test and the Wilcoxon rank sum test with Gehan modification. The Quantile test, Slippage test, and Wilcoxon Rank Sum test are non-parametric. That is, the tests are distribution free, thus an assumption of whether the data are normally or lognormally distributed is not necessary. The computer statistical software program Guided Interactive Statistical Decision Tools (GISdT®; ~~®~~ (~~N~~eptune and Company 2007~~2006~~), was used to perform all statistical comparisons, with a decision error of alpha = 0.025. ~~An alpha = 0.025 is adequate to identify differences between the two datasets since multiple statistical tests are proposed (Black 2006).~~

The Wilcoxon Rank Sum test performs a test for a difference between two population measures of center. This is a non-parametric method that relies on the relative rankings of data values and the measure of center is quantified by the sum of the ranks in both Site and background data. Knowledge of the precise form of the population distributions is not necessary. The Wilcoxon Rank Sum test has less power than the two-sample t-test when the data are in fact normally distributed; however the assumptions are not as restrictive. The GISdT® version of the Wilcoxon Rank Sum test uses the Mantel approach which is equivalent to using the Gehan ranking system.

The Quantile test addresses tail effects which are not addressed in the Wilcoxon rank-sum test. The Quantile test looks for differences in the right tails (upper-end of the dataset) rather than central tendency like the Wilcoxon rank-sum test. The Quantile test was performed using a defined quantile = 0.80.

The Slippage test evaluates whether there are an unreasonable number of site data points that exceed the maximum background value.

Typically an alpha = 0.05 is used to evaluate a statistically significant result. Since several correlated tests were conducted, a lower alpha was selected. As more tests are performed, it becomes more likely that a statistically significant result will be obtained purely by chance. Given the use of the multiple statistical tests, an alpha = 0.025 was selected as a reasonable significance level for the COPC selection. ~~Any chemical that resulted in a p value less than 0.025~~

~~in one of the four tests was retained as a COPC.~~ Additionally, these tests are set up with one-sided hypotheses.

Consequently, not only are differences between the two samples able to be detected, a directional determination can be made as well (*i.e.*~~*g.*~~, Site is greater than background). Normal QQ~~Aluminum, antimony, barium, cobalt, copper, iron, lead, manganese, silicon, thallium, and zinc are metals in Borrow Area soils that are at or below provisional background levels. Actinium-228, bismuth-212, bismuth-214, polonium-212, potassium-40, radium-228, thallium-208, thorium-232, thorium-234, and uranium-235 are radionuclides in Borrow Area soils that are at or below provisional background levels. All other metals and radionuclides are at levels above provisional background levels, or do not have available background data. Cumulative probability~~ plots and side-by-side box-and-whisker plots were also prepared to evaluate whether the Site data and background data are representative of a single population. These plots were qualitatively~~not~~ used in the selection of COPCs~~, but are presented for qualitative purposes only~~. These plots give a visual indication of the similarities between the Site and background datasets. Table 3 presents the background comparison results for the Site. The comparison statistics, summary statistics, and box-and-whisker and normal QQ~~cumulative probability~~ plots are included in Appendix E~~D~~.

5.2 FURTHER SELECTION OF COPCS

From the list of COPCs identified in Section 5.1, further selection of COPCs was performed by:

- Including chemicals positively identified in at least one sample, including: (1) chemicals with no qualifiers attached (excluding non-detect results with unusually high detection limits, if warranted), and (2) chemicals with qualifiers attached that indicate known identities but estimated concentrations (*e.g.*, J-qualified data); and

- Including chemicals detected at levels significantly elevated above levels of the same chemicals detected in associated blank samples (this protocol includes an analyte if it is known to be Site-related and its concentration is greater than five times the maximum amount detected in any blank; if the chemical is a common laboratory contaminant [as defined by USEPA 1989], it is included only if its concentration is greater than 10 times the maximum amount detected in any blank).

In further deriving the list of COPCs, the following criteria established by USEPA (1989) were also considered:

Concentration and Toxicity – Aspects of concentration and toxicity must be considered prior to eliminating a chemical as a COPC. For example, weight-of-evidence for human toxicity is considered in conjunction with site exposure concentrations. Thus, Class A carcinogens (*e.g.*, benzene) were retained as COPCs.

Furthermore, consistent with Agency for Toxic Substances and Disease Registry (ATSDR) guidance (De Rosa *et al*. 1997), if the maximum dioxins/furans toxic equivalency (TEQ) concentration does not exceed the ATSDR screening value of 50 parts per trillion (ppt), dioxins/furans will generally not be retained as COPCs. This screening value is consistent with a recent review of the scientific evidence for the risks posed by dioxins (Paustenbach *et al*. 2006). The maximum TCDD TEQs~~TCCD Equivalents~~ for all samples with detections were less than the screening level of 50 ppt. However, the reporting limit for 2,3,7,8-TCDD in sample BP-09 was 61 pg/g (ppt). Due to this elevated reporting limit, a TCDD TEQ concentration of 31.8 pg/g was calculated. This means that the TCDD TEQ for this sample lies somewhere between 0.35 pg/g (based on detected congeners only) and approximately 63 pg/g (based on full reporting limits for the non-detected congeners), a value which exceeds the ATSDR screening target level of 50 pg/g. Therefore, dioxins/furans (as TCDD TEQ) are retained as COPCs~~TCDD equivalents are therefore not retained as COPCs but are discussed qualitatively in the Uncertainty Analysis (Chapter 7)~~.

Availability of Toxicity Criteria – Some chemicals have not been assigned toxicity criteria by USEPA. Although included as COPCs, these chemicals were not quantitatively ~~quantitative~~ evaluated in the risk assessment. These chemicals include organic tentatively identified compounds (TICs) (cyclic octaatomic sulfur, o,~~O,~~o'-diethyl s-methyl thiophos, diethyl phosphorodithioic acid, phosphorothioic acid s-[2-[(1, S-methyl methanethiosulphonate), and several organic compounds (O,O,O-triethyl phosphorothioate, p-chlorothiophenol), and metals (calcium, magnesium, niobium, potassium, sodium, tungsten, zirconium). Because of the inconclusive nature of TICs as potentially 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. The exclusion of these COPCs from quantitative analysis is addressed qualitatively in the Uncertainty Analysis (Chapter 7).

Frequency of Detection – Another criterion that may warrant COPC reduction is the frequency of detection. In general, chemicals exhibiting a low frequency of detection will 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 (USEPA 2007a~~2006a~~), may be considered for elimination. PBT chemicals are toxic, persist in the environment and bioaccumulate in food chains and, thus, pose risks to human health and ecosystems. Prior to eliminating a COPC based on the frequency of detection criteria, (1) any elevated detection limits are addressed, and (2) data distributions within the Site are considered. Results of the selection of COPCs, including the rationale for excluding chemicals as COPCs are presented in Table 4.

6.0 HUMAN HEALTH RISK ASSESSMENT

This Chapter presents the human health risk assessment of all COPCs identified in Chapter 5 for all receptors of concern via all complete pathways. The methods used in the risk assessment follow standard USEPA guidance. 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:

- USEPA. 1992a. *Guidelines for Exposure Assessment.*
- USEPA. 1991a. *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual. Supplemental Guidance.*
- USEPA. 1996. *Soil Screening Guidance*.
- USEPA. 1997a. Exposure Factors Handbook.
- USEPA. 2000. *Soil Screening Guidance for Radionuclides.*
- USEPA. 2002a.~~2002d.~~ *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.*
- USEPA. 2003a. *Technical Support Document for a Protocol to Assess Asbestos-Related Risk. Final Draft.*

The risk assessment is a deterministic risk assessment; meaning that, single values based on generally 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 each area.

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 media of concern. The second step is fate and transport modeling to predict concentrations that may be present when direct measurements are not available. The third 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 hazard indices are calculated.

6.1 DETERMINATION OF EXPOSURE POINT CONCENTRATIONS

A representative exposure concentration is a COPC-specific and media-specific concentration value. In the 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.

6.1.1 Soil Exposure Point Concentrations

The HHRA incorporates representative exposure concentration estimates (*e.g.*, 95 percent upper confidence limit [UCL] on the arithmetic mean [USEPA 1992c, 2002e]) that specifically relate to potential site-specific human exposure conditions. For the 95 percent UCL concentration approach, the 95 percent UCL was computed in order to represent the area-wide exposure point concentrations. The UCL incorporates the uncertainty of the estimate of the mean and is the value that, with repeated sets of samples, will be greater than the true mean 95 percent of the time. Based on USEPA (1989) guidance and NDEP requests, 95 percent UCL were calculated using three options for ~~,~~ non-detects; (1) use of the detection limit directly, (2) use ~~for COPCs were assigned a value~~ of one-half the detection limit, and (3) a random number between zero and the detection limit for each non-detect. For radionuclide uncensored data, the actual reported value was used. For samples with field duplicates, the primary sample was used, unless rejected, in which case the duplicate sample was used if not rejected. Data identified in the data usability evaluation as unusable due to elevated reporting limits were not used in the calculation of representative exposure concentrations. The formulas for calculating the 95 percent UCL COPC concentration (as the representative exposure concentration) are presented in USEPA (1992c, 2002e).

The~~Although the Work Plan stated that the~~ 95 percent UCL statistical calculations were ~~would be~~ performed using the computer statistical software program GISdT® (Neptune and Company 2007). Because 95 percent UCLs were calculated using three options for non-detects, three different sets of 95 percent UCL statistical calculations were performed for each COPC resulting in three estimates of a normal 95 percent UCL for normally distributed data and nine estimates of a bootstrap 95 percent UCL for non-normally distributed data. For normally distributed data the maximum of the three normal 95 percent UCLs was selected. For non-normal data the maximum of the nine bootstrap 95 percent UCLs was selected. If the selected 95 percent UCL did not exceed the maximum value (including detects and detection limits) it was selected as the

exposure point concentration, otherwise the maximum value was used as the exposure point concentration~~2006), these calculations were not completed using GISdT®, rather, USEPA's ProUCL (version 3.00.02) was utilized. Although GISdT® calculates and presents a number of suitable UCL values, the program provides no recommendations which value is most appropriate. As ProUCL provides consistent recommendations based upon published decision criteria, the ProUCL program was utilized for UCL calculations~~.

The 95 percent UCL of the arithmetic mean concentration is used as the average concentration, because it is not possible to know the true mean. The 95 percent UCL, therefore, accounts for uncertainties due to limited sampling data. An estimate of average concentration is used because: carcinogenic and chronic non-carcinogenic toxicity criteria are based on lifetime average exposures; and, average concentration is most representative of the concentration that would be contacted at a site, over time (USEPA 1992c).

Representative exposure concentrations for soil are typically based on the potential exposure depth for each of the receptors. However, given that the HHRA purpose was to assess exposures to soil following excavation and use as off-site fill material, the 95 percent UCL was generated for all data collected within the excavation extent and depth. This 95 percent UCL is used for all potentially exposed receptors. The 95 percent UCL for each COPC is presented in Table 5. For indirect exposures, this concentration was used in fate and transport modeling. See Section 6.3.4 for a discussion on exposure point concentrations for asbestos. An analysis of the representativeness of the 95 percent UCL is provided below.

6.1.1.1 Representativeness of the 95 Percent~~percent~~ UCL

For the purposes of this risk assessment, the 95 percent UCL on the arithmetic mean were calculated for each COPC for both site and background data using the computer statistical~~USEPA ProUCL~~ software program GISdT® (Neptune and Company 2007~~(USEPA 2004e~~) and were used to estimate risks to human health if they did not exceed the maximum ~~detected~~ value.~~-~~ The 95 percent UCL on the mean is intended to estimate the average exposure across a defined area.~~-~~ Maximum ~~detected~~ values are sometimes used when 95 percent UCLs of the mean) are difficult to estimate, and when the UCLs are greater than the maximum ~~detected~~ value. They are also sometimes used to provide a greater degree of protection for human health, however, this does not follow guidance (*e.g.*, RAGS), and can result in action being taken at a site when such action is unnecessary.

In order to demonstrate that the 95 percent UCLs used in the risk assessment are representative and realistic, six chemicals were reviewed.~~selected for the calculation of confidence intervals.~~ The primary risk drivers arsenic, lead-210, and radium-226 as well as three chemicals with relatively high contributions to the total risk, hexachlorobenzene, alpha-BHC and beta-BHC were selected.~~ Silver was also selected because the maximum was used to estimate risks and the detection frequency was greater than five percent.~~ The table below shows the summary statistics for the six~~95% confidence intervals for the five~~ chemicals. Risks for all six chemicals were calculated using the 95 percent UCL. The 95 percent UCL for all compounds is greater than the mean as expected. The 95 percent UCLs and the means are greater than the maximum detection for lead-210 and hexachlorobenzene.~~ The 95% confidence intervals are based on the assumption that the data is normally distributed, however, this is only true for radium-226. For all chemicals, the 95 percent UCL is within or exceeds the range of the 95% confidence interval. For hexachlorobenzene, the maximum detected value was selected for use in the risk assessment because the 95 percent UCL exceeded the maximum. The maximum detected value does not fall within the range of the 95% confidence interval, however, there was only a single detection of hexachlorobenzene at the Borrow Area and the confidence interval is based on 99 percent non-detect values.~~ Hexachlorobenzene was only detected in one sample and was selected as a COPC because it is a PBT compound.

~~Comparatively, risk estimates for silver are based on the maximum detected value. The detection frequency for silver is 50 percent. The 95 percent UCL is double the upper range of the confidence interval, however, the maximum detected value falls within the range of the 95% confidence interval.~~ Based on the results in the table below, it is demonstrated that the exposure point concentrations used in the risk assessment are representative of the dataset because the 95 percent UCLs are greater than the mean; however, they are relatively close to the mean. Because there are large sample sizes it is expected that the 95 percent UCL and the means should be close. For the analytes presented below, no 95 percent UCLs are more than two times the mean concentration.

Analyte	Sample Size	Max Detect	Mean	Std. Dev.	95% UCL	EPC Basis	EPC
Arsenic	80	25	7.0	5.3	8.2	Bootstrap using DL	95% UCL
Lead-210	49	2.3	8.0	10	11	Bootstrap using DL	95% UCL
Radium-226	49	4.5	2.0	0.7	2.2	Bootstrap using DL	95% UCL
Hexachlorobenzene	81	0.072	0.43	0.17	0.46	Bootstrap using DL	95% UCL

alpha-BHC	102	0.073	0.0073	0.011	0.0097	Bootstrap using DL	95% UCL
beta-BHC	102	0.46	0.02	0.058	0.036	Random DL	95% UCL

DL = detection limit
UCL = upper confidence
EPC = exposure point concentration.

6.1.2 *Air Exposure Point Concentrations*

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 typically a time-dependent reduction of chemical concentrations in water, soil, and air.

The fate and transport modeling conducted for the Site took into account chemical-specific physical parameters and migration pathways discussed in Section 4.2. All modeling input parameters, calculations and results are presented in Appendix F.

Analyte	Sample Size	Max	Mean	Std. Dev.	95% CI	Range		95% UCL	Distribution	EPC
Arsenic	88	25	6.5	5.2	1.1	5.4	7.6	8.9	NP	95% UCL
Silver	88	0.70	1.6	6.3	1.3	0.31	2.9	5.8	NP	Max
Radium-226	49	4.5	1.9	0.79	0.22	1.7	2.1	2.1	NORMAL	95% UCL
Hexachlorobenzene	81	0.072	0.21	0.083	0.018	0.20	0.23	0.23	NP	Max
alpha-BHC	102	0.073	0.0065	0.013	0.0025	0.0041	0.0090	0.014	NP	95% UCL
beta-BHC	102	0.46	0.021	0.059	0.011	0.010	0.032	0.057	NP	95% UCL

NP = Non-parametric.
EPC = exposure point concentration.

6.1.3 *Outdoor Air*

Exposure to COPCs bound to dust particles was evaluated using the USEPA's Particulate Emission Factor (PEF) approach (2002a2002d). The USEPA guidance for dust generated by construction activities (USEPA 2002a2002d) was used for assessing construction worker

exposures. For exposures to VOCs in outdoor air, the USEPA volatilization factor approach was used (USEPA 2002a~~2002d~~). Input soil concentrations for these models were the exposure point concentrations identified above.

~~6.2 FATE AND TRANSPORT MODELING~~

~~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 fate and transport modeling conducted for the Site took into account chemical-specific physical parameters and inter-media transfers discussed in Section 4.2. All modeling input parameters, calculations and results are presented in Appendix E.~~

6.1.4 Outdoor Air Modeling for Volatiles

Ambient air concentrations due to subsurface volatilization were estimated using the USEPA volatilization factor approach (USEPA 2002a~~2002d~~). This model combines information about the behavior of a chemical in the environment with site and atmospheric parameters to determine a volatilization factor of a chemical at the soil surface following upward migration from soil. The resultant volatilization factor was multiplied by the dispersion factor for volatiles (Q/C_{vol} for Las Vegas; from USEPA 2002a~~2002d~~; see Table 1) for use in the outdoor air exposure pathway. Exposure point concentrations for outdoor air are presented in Table 6.

6.1.5 Fugitive Dust Generation, Dispersion, and Deposition

COPCs adsorbed to soil particles can potentially become airborne, resulting in possible exposure of receptors and/or migration and off-site deposition and accumulation in soil. Long-term exposure to COPCs bound to dust particles were evaluated using the USEPA's PEF approach (USEPA 2002a~~2002d~~). 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 2002a~~2002d~~]) values in this equation were for Las Vegas, Nevada (Appendix D of USEPA 2002a~~2002d~~; see Table 1). The USEPA guidance for dust generated by construction activities (USEPA 2002a~~2002d~~) was used for short-term construction worker exposures. The construction worker modeling uses default model assumptions, except for soil moisture and silt content, for which site-specific data are available.

6.1.6 Asbestos Exposure Point Concentrations

The exposure point concentrations for asbestos were based on the pooled analytical sensitivity of the dataset. The pooled analytical sensitivity was 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 2003a). 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 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 where the mean equals the number of structures detected. In EXCEL, the following equation may be employed to calculate this value:

$$95\%\ \text{UCL of Poisson Distribution } (10^6 \text{ s/gPM10}) = \text{CHIINV}(1-\alpha, 2\times(\text{Long fiber count}+1)/2)$$

This value is then multiplied by the pooled analytical sensitivity to estimate the upper bound concentration. The intent of the risk assessment methodology was to predict the risk associated with airborne asbestos.

In order to quantify the airborne asbestos concentration, the estimated dust levels or PEFs used in other areas of the risk assessment were used:

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

6.2 EXPOSURE ASSESSMENT

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 and the chemical concentrations identified in Section 6.1.

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 7 through 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 were default factors developed by USEPA's Superfund program. Default values were modified to reflect site-specific conditions, where possible. The site-specific factors were derived to reflect average or reasonable maximum exposure conditions, based on Site data. This is the case for current/future on-site trespasser exposure frequency and time. In these instances, professional judgment was used to select appropriate exposure factors. For the current/future on-site trespasser exposure frequency and time, it is assumed that a current/future on-site trespasser could access the Site for 50 days per year (or one day per week) and spend four hours on the Site per visit. The exposure parameters used in the risk assessment were those defined in the Work Plan (MWH 2006).

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 average daily dose (ADD) of COPCs that may be taken in by the exposed individuals. Later, in the risk characterization step of the assessment, the ADDs 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 ADD of the COPCs via each of the complete exposure pathways is based on USEPA (1989, 1992a) 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:

$$ADD \ or \ LADD \ (mg/kg - day) = \frac{C \times IR \times EF \times ED \times (BIO or AF)}{AT \times BW}$$

where:

C	=	COPC concentration (*e.g.*, ~~milligrams per kilogram [~~mg/kg~~]~~, milligrams per cubic meter [mg/m^3])
IR	=	intake rate; the amount of the transport medium contacted per unit time (*e.g.*, mg/day, m^3/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
AF/BIO	=	absorption fraction (percent) / relative bioavailability (unitless)
AT	=	averaging time; the time over which the exposure is averaged (days)
BW	=	body weight (kilograms)

With the exception of arsenic, the relative oral bioavailability (BIO) of all COPCs was assumed to be 100 percent. For arsenic, based on scientific literature recommendations on arsenic bioavailability (Roberts *et al*. 2001; Ruby *et al*. 1999; USEPA 2001c), an arsenic oral bioavailability of 30 percent was used. The actual oral bioavailability of arsenic (as well as other metals at the Site) is likely to be lower than this value. Chemical-specific dermal absorption values from USEPA guidance were used in the risk assessment.

6.2.3 Radionuclides

Risks associated with radionuclides were evaluated separately from chemicals. Recently available USEPA risk assessment methodologies for radionuclides were used (USEPA 2000). There are several important differences between evaluating risks pertinent to radionuclides and those pertinent to chemicals. These differences include:

- Results are presented as activities (*e.g.*,~~Concentrations are based on units of activity (*e.g.*,~~ pCi/g) instead of units of mass (*e.g.*, mg) in soil;

- Only the carcinogenic effects of radionuclides due to ionizing radiation are considered. A radionuclide may also have a chemical toxicity (*e.g.*, uranium or lead). These risks are addressed separately by using the concentration of mass of chemical in soil, rather than activity; and

- CSFs are based on the total theoretical age-averaged ILCR~~incremental lifetime cancer risk~~ per intake of the radionuclide, or per unit external radiation exposure to gamma-emitting radionuclides. An adult only soil ingestion CSF is available and was used for all receptors. Except for external CSFs, which are presented as risk/year per pCi/g soil, CSFs for radionuclides are not expressed as a function of body weight or time as are CSFs for chemicals.

Exposure equations and parameter values used were the standard deterministic risk assessment exposure parameters based on typical USEPA (2000, 2007b~~2006b~~) default values. The exposure equations were modified to include radionuclide decay as used in USEPA's radionuclide PRG equations (USEPA 2007b~~2006b~~). Default parameter values are presented in Tables 7 through 9. These factors were also used in the calculation of a site-specific background radionuclide risk level.

6.2.4 Asbestos

Although final guidance is unavailable at this time, USEPA recommends that site-specific risk assessments be performed for asbestos. Risks associated with asbestos in soil were evaluated using the most recent draft methodology proposed by USEPA (2003a~~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). Exposure pathways, equations, and parameters used are those presented in USEPA (2003a~~2003b~~). Adjustments for exposure duration and exposure intensity, consistent with the methodology, were made for each of the receptor populations, based on the respective exposure parameters presented in Tables 7 through~~and~~ 9.

The calculation of risks to asbestos are presented in Appendix G. ~~F. The exposure point concentration was based on the pooled analytical sensitivity of the dataset. The pooled analytical sensitivity was 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. The pooled analytical sensitivity is the best estimate of asbestos. The upper bound of the asbestos concentration was also evaluated. It is calculated as the 95 percent UCL on the mean of the assumed underlying Poisson distribution used to model the number of structures found. The intent of the risk assessment methodology was to predict the amount of airborne asbestos which can be inhaled by a receptor. In order to quantify the airborne asbestos concentration, the estimated dust levels or PEFs used in other areas of the risk assessment were used.~~

For assessing asbestos risks, Table 8-2 (Based on Optimum Risk Coefficients) of USEPA (2003a~~2003b~~) was used. Table 8-2 presents best estimate risks estimates based upon 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 were selected for use 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 (2003a), because the asbestos risks to male and female smokers/non-smokers are different, population~~Population~~ averaged risks were evaluated based on Equation 8-1.~~Eqn. 8-1 of USEPA (2003b).~~ This equation (presented in Section 6.3.5 below) considers male smokers, male non-~~smokes, female smokers, and female non-~~smokers, female smokers, and female non-smokers, and is based upon the assumption that 21.4% of the general population smokes (USEPA 2003a). The population averaged risks accounts for the weighted risks to both the smoking and non-smoking populations collectively. In addition, because both chrysotile and amphibole have been detected at the site and in the general area (for example, from the City of Henderson wastewater reclamation facility [WRF] sampling), both could be expected to occur at the Site. Therefore, both amphibole and chrysotile fibers were conservatively evaluated in the HHRA, regardless as to whether either was detected (as calculated using the 95 percent UCL on the mean of the assumed underlying Poisson distribution).

~~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). 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).~~

~~The Modified Elutriator Method incorporates collection of samples that are re-suspended and then forced through an airway and filter. Asbestos structures are isolated and concentrated of 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. These are precisely the dimensions required to combine such measurements with published dust emission and dispersion models to convert them to asbestos emission and dispersion estimates. Thus, because published dust emission and dispersion models can be used to address many of the exposure pathways of interest in this study, these 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 (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 2007c~~2006c~~) and the Health Effects Assessment Summary Tables (HEAST; USEPA 1997b). CSFs are chemical-specific, experimentally-derived potency values used to calculate the risk of cancer resulting from exposure to carcinogenic chemicals. A higher value implies a more potent carcinogen. Reference doses (RfDs) are experimentally derived "no-effect" values used to quantify the extent of adverse non-cancer health effects from exposure to chemicals. Here, a lower RfD implies a more potent toxicant. These criteria are generally developed by USEPA risk assessment work groups and listed in USEPA risk assessment guidance documents and databases. The following hierarchy for selecting toxicity criteria was used (from USEPA 2003c):

1. IRIS
2. USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs)
3. National Center for Environmental Assessment (NCEA, or other current USEPA sources)
4. HEAST

5. Cal/EPA Office of Environmental Health Hazards Assessment (OEHHA) Toxicity Criteria Database

6. USEPA Criteria Documents (*e.g.*, drinking water criteria documents, drinking water Health Advisory summaries, ambient water quality criteria documents, and air quality criteria documents)

7. ATSDR toxicological profiles

8. USEPA's Environmental Criteria and Assessment Office (ECAO)

9. Peer-reviewed scientific literature

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~~2004f~~). USEPA stated 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, the oral-gastrointestinal absorption efficiencies are greater than 50 percent, with two exceptions. One exception is cadmium, which has a reported oral absorption of 2.5 percent (USEPA 2004e~~2004f~~). This value was utilized to adjust the oral reference dose for dermal exposures.

The other exception is arsenic, where an oral absorption value of less than 30 percent was used. This value is based on oral bioavailability studies of monkeys administered arsenic in a soil matrix (Roberts *et al*. 2001; cited in USEPA 2001c). The arsenic oral RfD and CSF are based on a human drinking water study, which also includes some contribution of arsenic in food (USEPA 2007c~~2006c~~). The matrix differences between the critical study (drinking water/food) versus the oral bioavailability studies contribute to the uncertainty in the risk/hazard estimates. However, it is generally assumed that oral absorption from water is essentially complete (100 percent). In addition, Wester *et al*. (1993) demonstrated that there is no statistical difference in the dermal absorption from water and soil in monkeys (USEPA 2001c). Therefore, the USEPA indicated adjustment of the oral toxicity criteria to generate dermal criteria was unnecessary. Thus, oral toxicity values were also used for assessing dermal exposures.

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 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, 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 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. 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, 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. An understanding of the uncertainties associated with RfDs is important in evaluating the significance of the hazard indices calculated in the risk characterization portion of the risk assessment. When available sub-chronic RfDs were used to evaluate construction worker exposures. The COPCs in this assessment with USEPA-established oral/dermal and inhalation RfDs are presented in Table 10.

6.3.3 Carcinogenic Effects

USEPA develops CSFs 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 are typically derived from the upper 95th percentile confidence limit of the slope, and thus the actual risks are unlikely to be higher than those predicted using the CSF, and may be considerably lower. The

COPCs in this assessment with USEPA-established oral/dermal and inhalation CSFs are presented in Table 11.

6.3.4 Radionuclides

Radionuclides toxicity criteria were obtained from the USEPA's *Preliminary Remediation Goals for Radionuclides* (USEPA 2007b~~2006b~~). For some radionuclides, two different toxicity criteria were available from this table: one for the specific radionuclide only and one for the radionuclide and associated short-lived radioactive decay products (*i.e.*, those decay products with radioactive half-lives less than or equal to six months). To be conservative, the toxicity criteria that include radioactive decay products were used. If the decay product is out of equilibrium with its parent, the daughter's toxicity is evaluated separately. The radionuclide CSFs are presented in Table 12.

6.3.5 Asbestos

For assessing asbestos risks, toxicity criteria were obtained from Table 8-2 (Based on Optimum Risk Coefficients) of USEPA (2003a~~2003b~~). Population averaged risks were evaluated based on Equation~~Eqn.~~ 8-1 of USEPA (2003a).

$$URF = 0.5 \times ((0.786 \times (NSM + NSF)) + ((0.214 \times (SM + SF)) \times 0.00001/0.00010$$

where:

URF = Population Averaged Unit Risk Factor $[s/cm^3]^{-1}$;*.g.*, mg/kg, milligrams per cubic meter $[mg/m^3]$)
NSM = risk for male non-smokers
NSF = risk for~~2003b). This equation considers male smokers,~~ male non-smokers
SM = risk for male smokers
SF = risk for~~smokes,~~ female smokers
0.00001/0.00010 = factor to convert risk from risk per 100,000 to risk per 1,000,000

As stated above and in USEPA (2003a), Equation 8-1 above is derived based on the assumption that 21.4% of the general population smokes (and subsequently 78.6% are non-smokers). The equation above creates a population averaged risk by weighting individual male~~,~~ and female smoker and non-smoker risks by the percent of each assumed present in the potentially exposed populations.~~smokers.~~ The resulting unit risk factors (structures/cubic centimeter) are presented in Appendix G.~~F.~~

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 as the incremental probability of an individual developing cancer over a lifetime as a result of a chemical exposure. Carcinogenic risks were evaluated by multiplying the estimated average exposure rate (*i.e.*, LADD calculated in the exposure assessment) by the chemical's CSF. 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 will result 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. According to USEPA (1989), this approach is appropriate for theoretical upper-bound ~~incremental lifetime cancer risks (~~ILCRs~~)~~ of less than 1×10^{-2}. The following equations were used to calculate COPC-specific risks and total risks:

$$Risk = LADD \times CSF$$

where:

LADD = lifetime average daily dose (mg/kg-d)
CSF = cancer slope factor $(mg/kg\text{-}d)^{-1}$

and

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

It is assumed that cancer risks from various exposure routes are additive. Thus, the result of the assessment is a high-end estimate of the total carcinogenic risk. High-end carcinogenic risk estimates were compared to the USEPA acceptable risk range of 1 in 10,000 (10^{-4}) and 1 in 1 million (10^{-6}) and NDEP's acceptable level of 10^{-6}. If the estimated 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 1×10^{-5} (1 E-5) represents 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.

The equation used to calculate asbestos risks, which were evaluated separately, was:

$$Risk = Estimated\ Airborne\ Concentration\ (s/cm^3) \times Adjusted\ URF\ (s/cm^3)^{-1}$$

6.4.2 Methods for Assessing Non-Cancer Health Effects

Non-cancer adverse health effects were 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 (*i.e.*, the RfDs).

ADDs and RfDs were compared by dividing the ADD by the RfD to obtain the ADD:RfD ratio, as follows:

$$Hazard\ Quotient = \frac{ADD}{RfD}$$

where:

ADD = average daily dose (mg/kg-d)
RfD = reference dose (mg/kg-d)

The ADD-to-RfD ratio is known as a hazard quotient (HQ). If a person's average exposure is less than the RfD (*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, 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 the 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.

6.4.3 Risk Assessment Results

The calculation of chemical theoretical upper-bound ILCRs and non-cancer health effects are presented by receptor in Tables 13 through 15. Radionuclide risk calculations are presented by receptor in Tables 16 through 18. Asbestos risk calculations are presented in Table 19 and Appendix G.~~F.~~ These tables present the theoretical upper-bound cancer risk estimates~~ILCRs~~ and non-cancer health effects calculations for all receptors. All calculation spreadsheets for this risk assessment are included in Appendix B, hardcopy tables for asbestos and background risks are presented in Appendices G and H, respectively. The results are summarized in Chapter 8.

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 ~~relative degree of~~ uncertainty associated with a risk estimate. In this Chapter, a qualitative discussion of the uncertainties associated with the risk assessment for the Site is presented.

Risk assessments are not intended to estimate actual risks to a receptor associated with exposure to chemicals in the environment. In fact, estimating actual risks is impossible because of the variability in the exposed or potentially exposed populations. 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 multitude of conservative assumptions used in risk assessments guard against 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 risk assessment can be grouped into four main categories that correspond to these steps:

- Uncertainties in environmental sampling and analysis
- Uncertainties in fate and transport modeling
- Uncertainties in assumptions concerning exposure scenarios
- Uncertainties in toxicity data and dose-response extrapolations

~~It is possible to quantify the uncertainty in a risk assessment through the use of Monte Carlo simulations in the risk calculations. Risk assessments with quantitative uncertainty analyses are called "probabilistic evaluations." Instead of calculating risks using point estimates, which are often upper-bound values, for each parameter, as was done at the facility, a probability distribution function representing a range of data is used. A computer model performs the risk calculations up to 10,000 times, and each iteration incorporates a different combination of data from the various probability distribution functions. The result is a distribution of risks instead of a single value. In general, theoretical risks calculated in probabilistic risk assessments are lower and more realistic than those calculated in deterministic evaluations, and because the result is a distribution and not a point estimate, there is a level of certainty associated with the calculated risks. A quantitative uncertainty analysis was not performed for this Site.~~ The uncertainties associated with the risk assessment for the Site are summarized below and in Table 20.

7.1 ENVIRONMENTAL SAMPLING AND ANALYSIS

The risk assessment for the Site was based on the sampling results obtained from several investigations conducted by GES (2000 2003a,b), MWH and Aeolus (2003b), and the 2006 MWH and BRC investigation. Errors in sampling results can arise from the field sampling, laboratory analyses, and data analyses. Errors in laboratory analysis procedures are possible, although the impacts of these sorts of errors on the risk estimates are likely to be low. The environmental sampling at the Site is one source of uncertainty in the evaluation. However, the number of sampling locations and events is large and widespread, and sampling was performed using approved procedures; therefore, the sampling and analysis data is sufficient to characterize the impacts and the associated potential risks.

7.1.1 Sampled Media

Because the objective of this risk assessment is to determine whether Borrow Area material would pose a potential risk to current and future receptors during its excavation and placement in support of future commercial development projects, sampling at the Site consisted of soil sampling only. Air, soil vapor, and groundwater samples were not collected because these media would not be relevant to assessing risks from borrow area material excavation and placement. Therefore, given that the only anticipated exposures are from soils, and sufficient samples have been collected for the purposes of characterizing chemical concentrations within the Borrow Area, the risk assessment is considered adequate for assessing Site-related risks.

Only validated data are included in the HHRA, therefore, several sample locations collected during the Parsons 2000 investigation that are located within the current definition of the Borrow Area boundary are not included in the HHRA dataset because these data were not subjected to data validation. All of the detected concentrations of COPCs associated with these samples are consistent with concentrations from other datasets included in the HHRA with the exception of beta-BHC. Although the concentrations associated with beta-BHC for these two samples are the largest detected in the Borrow Area (1.9 and 2.4 mg/kg), estimation of a 95 percent UCL associated with addition of these concentrations (0.25 mg/kg) would not result in risks that would alter the overall estimated risk for the Borrow Area soils. Therefore, exclusion of these two locations is considered unlikely to affect the outcome of the HHRA.

7.1.2 Analyte Quantification

A number of samples (as discussed in Section 3.1~~2~~.7.2) had qualified results for a number of VOCs, and three removed or rejected samples for organochlorine pesticides and hexavalent chromium due to holding time, and numerous samples were qualified due to sample receipt temperature. For organochlorine pesticides and hexavalent chromium, the remaining number of samples is large and considered sufficient for estimating risks associated with the Borrow Area soils. The qualified data may potentially yield reduced risk estimates for VOCs. However, arsenic is the largest contributor to the chemical risk estimates ~~are predominated by arsenic~~, which make~~s~~ up more than~~over~~ 90 percent of the total ILCR. The conservative nature of the exposure point concentrations for air (volatilization factor discussed below), the low contribution to total risk from VOCs compared to other compounds, and the large number of samples available for SVOCs and pesticides is suggestive that the data are ~~is~~ sufficient for risk assessment purposes.

Most of the spike recoveries that were outside control limits are slightly outside the control limits and only represent a minor potential to underestimate risks for 1,2,4-trichlorobenzene, 2-hexanone, 2,3,7,8-tetrachlorodibenzofuran, 4,4'-DDE, acenaphthylene, aluminum, antimony, barium, calcium, chromium (total), copper, cyanide (total), dichlorodifluoromethane, dieldrin, endosulfan ~~endosulfan~~ I, endrin aldehyde, heptachlor, iron, manganese, magnesium, nickel, niobium, octachlorodibenzodioxin, perchlorate, phosphorus (as P), silicon, strontium, thallium, titanium, tungsten, vanadium, vinyl acetate, zinc, and zirconium.

As such these results were considered for use in the risk assessment. Only the matrix spike results for total cyanide, 4,4'-DDE, endosulfan I, endrin aldehyde, and heptachlor show the potential for a significant underestimation of a soil concentration at locations BP-01 (cyanide), BP-02 (cyanide), BP-03 (cyanide), BP-04 (cyanide), and BP-09 (pesticides). However, the inability to recover measurable levels of these constituents is likely due to matrix interferences and correcting for initial soil concentrations of the samples.

7.1.3 Detection Limits

In some instances, analytical detection limits were above typical risk assessment screening levels (*e.g.*, USEPA Region 9 PRGs) for some chemicals not evaluated in the risk assessment because the chemical was not-detected in any of the investigation samples. This data gap presents an uncertainty of whether these chemicals are present at levels above acceptable risk levels. However, these instances are relatively few, and given the limited exposures expected, ~~although~~

this may possibly cause some underestimation of risk. Overall, the risk assessment overestimates~~performed for the COPCs is adequate for assessing~~ Borrow Area material-related risks.

Long asbestos~~Asbestos~~ amphibole fibers were not detected but were assessed at the analytical detection limit. A single short amphibole fiber was detected. However, short fibers are not used to quantitate asbestos risks. Zero long structures detected yields a 95 percent UCL of the Poisson distribution of three. Based on this, the assumption that amphibole fibers were present in non-detect samples resulted in risk estimates that exceed the risk goal of 1×10^{-6}. However, given that amphibole has been detected at the site and in the general area, this assumption is not unreasonable.

7.1.4 Exposure Point Concentrations

The exposure point concentrations used in the risk assessment are intended to overestimate mean concentrations. The 95 percent UCLs were calculated using three options for non-detects; use of the detection limit directly, use of one-half the detection limit, and a random number between zero and the detection limit for each non-detect. Because 95 percent UCLs were calculated using three options for non-detects three different sets of 95 percent UCL statistical calculations were performed for each COPC resulting in three estimates of a normal 95 percent UCL for normally distributed data and nine estimates of a bootstrap 95 percent UCL for non-normally distributed data. For normally distributed data the maximum of the three normal 95 percent UCLs was selected. For non-normal data the maximum of the nine bootstrap 95 percent UCLs was selected. If the selected 95 percent UCL did not exceed the maximum value (including detects and detection limits) it was selected as the exposure point concentration, otherwise the maximum value was used as an exposure point concentration. Use of the maximum non-detect result adds a significant source of uncertainty. For example, the maximum detected concentration for hexacholobenzene is 0.072 mg/kg. However due to elevated detection limits, the maximum detection limit is 1.1 mg/kg, the 95 percent UCL and exposure point concentration for hexachlorobenzene is 0.46 mg/kg. Thus because of the elevated detection limits for hexachlorobenzene, the exposure point concentration is over six times greater than the maximum detected concentration.

7.2 FATE AND TRANSPORT MODELING

Where possible, measured data were used in the risk assessment. However, fate and transport modeling was necessary in order to quantify estimated risks associated with media for which measured data were not available (*i.e.*, air). When available, site-specific data were used in the modeling. Where site-specific data were unavailable, input parameters were selected such that modeling concentrations were conservatively estimated.

7.2.1 Volatilization Factors

Volatilization factors were calculated based upon USEPA volatilization factor approach (USEPA 2002a~~2002d~~). The same volatilization factors were used for all exposed receptor scenarios. The construction worker volatilization factors ~~for the construction worker~~ were not adjusted to account for soil intrusion activities. Soil intrusion associated with construction activities could results in increased volatilization from the subsurface to outdoor. However, the volatilization factors used are conservative and are not likely to underestimate exposures.

7.2.2 Particulate Emission Factors

Particulate emission factors were calculated based upon USEPA particulate emissions factor approaches for both the wind erosion fugitive dust generation as well as construction activities fugitive dust generation (USEPA 2002a). The wind erosion fugitive dust particulate emissions factors were used for the maintenance worker and trespasser receptors. The construction activities fugitive dust particulate emissions factors were used for the construction worker receptors.

7.3 HUMAN HEALTH RISK ASSESSMENT

Below is a discussion of the uncertainties inherent in each step of the risk assessment process.

7.3.1 Exposure Assessment

In this report, the exposure assessment is based on a number of assumptions with varying degrees of uncertainty (USEPA 1992a). Uncertainties can arise from the types of exposures examined, the points of potential human exposure, the concentrations of COPCs at the points of human exposure, and the intake assumptions. These factors and the ways in which they contribute to the risk estimation are discussed below.

7.3.1.1 Types of Exposures Examined

The selection of exposure pathways is a process, often based on professional judgment, which attempts to identify the most probable potentially harmful exposure scenarios. 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 evaluation, potential risks were estimated for current/future on-site trespassers and various worker exposure scenarios. Risks to potential receptors were estimated for a number of different exposure pathways (*e.g.*, inhalation of volatiles). While other exposure routes could exist for a particular receptor, these exposures are expected to be lower than the risks associated with the pathways considered.

An exposure route that was not quantitatively evaluated is the inhalation of volatiles in indoor air due to volatilization and upward migration from soil. While the constraints for borrow soil placement excludes the use as fill for residential development, the soil could be used for commercial development where the volatiles could potentially migrate from soil into commercial buildings. These exposures are expected to be negligible compared to the risks associated with the pathways considered in this risk assessment for the following reasons:

- Volatile COPCs were infrequently detected at low levels in soils, ranging from 6 to 33 percent detection frequencies.
- The potential indoor pathway is based on the future use of the Borrow Area soil as fill. The physical processing of the soil during excavation is expected to significantly further reduce the concentrations of volatile COPCs in the Borrow Area soil. Under this scenario the soil will be excavated, handled, and transported to placement areas as fill or foundational materials.

7.3.1.2 Points of Human Exposure

Another source of uncertainty in the exposure assessment is the assumption made regarding the locations where individuals could be exposed to impacted media. Because the intended use of the excavated material is only for commercial development and precludes use in residential developments or placement in environmentally sensitive areas, the assessment of current/future on-site trespasser and worker related exposures is considered sufficient~~appropriate~~.

Other potential receptors may be exposed to COPCs in the Borrow Area soils during the excavation and placement activities and could include commercial workers and visitors to

properties adjacent to the excavation and placement areas. However, the receptors assessed are those anticipated to engage in activities with the highest exposure potential because the quantified exposures include direct contact with the Borrow Area soils over a prolonged period of time (future off-site maintenance worker) and exposure to conservative estimates of dust generated during the excavation and placement activities (future on-site/off-site construction workers). Therefore, it may be concluded that if the risk and hazard estimates for the receptors with the greatest anticipated exposures are within acceptable limits, then those associated with lesser exposures (pathways, duration) should also be within or below these acceptable limits.

~~Although a weight of evidence approach to COPC selection was described in the Work Plan (MWH 2006), if a chemical failed a single background comparison test it was included as a COPC. Chemicals included as COPCs under this procedure were antimony, mercury, selenium, and silver. Because these COPCs were included only due to exceeding a single test of four background comparisons completed, risks for Borrow Area soils are likely overestimated as a result.~~

7.3.1.3 Intake Assumptions Used

The risks calculated depend largely on the assumptions used to calculate the rate of COPC intake. For this assessment, reasonable maximum exposures were used. In the absence of a value for a particular exposure parameter, professional judgment based on Site conditions was used. The uncertainties associated with the parameters used in this risk assessment are described below.

Individuals can come into contact with chemicals via a number of different exposure routes. For the reasonable maximum exposure scenarios, standard default rates were used for these exposures. These represent upper-bound values and provide reasonable maximum activity assumptions. The use of these standard default and upper-end values makes it likely that the risk is not underestimated, and may in fact be overestimated.

The amount of COPCs the body absorbs may be different from the amount of a COPC contacted. In this assessment, absorption of ingested and inhaled COPCs is conservatively assumed to be 100 percent (except for arsenic oral bioavailability). Actual chemical and site-specific values are likely less than this default value.

Standard default values developed by USEPA are used for reasonable maximum exposures frequency and exposure duration for restaurant patrons and workers. These estimates are conservative values, and the possibility that they underestimate the risk is low.

7.3.2 Toxicological Data and Dose Response Extrapolations

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. USEPA assigns each carcinogen a designation of A through E, dependent upon the strength of the scientific evidence for carcinogenicity. In the establishment of the non-carcinogenic criteria, conservative multipliers, known as uncertainty and modifying factors, are used.

7.3.2.1 COPCs Lacking Toxicological Data

Toxicity criteria have not been established for some of the chemicals identified as COPCs for the risk assessment. Although included as COPCs, these chemicals were not quantitative evaluated in the risk assessment. These chemicals include organic TICs (cyclic octaatomic sulfur, o,~~O,~~o'-diethyl s-methyl thiophos, diethyl phosphorodithioic acid, phosphorothioic acid s-[2-[(1, S-methyl methanethiosulphonate), several organic compounds (O,O,O-triethyl phosphorothioate, p-chlorothiophenol), and metals (calcium, magnesium, niobium, potassium, sodium, tungsten, zirconium). Because of the inconclusive nature of TICs as potentially 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.

7.3.2.2 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 and CSFs, which results in the likelihood that the risk is overstated.

Typically, animals are administered high doses (*e.g.*, maximum tolerated dose) of a chemical in a standard diet or in air. Humans may be exposed to much lower doses in a highly variable diet,

which may affect the toxicity of the chemical. In these studies, animals, usually 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 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.

Dermal toxicity criteria are not available from the USEPA. Typically, a simple route-to-route (oral-to-dermal) extrapolation is assumed such that the available oral toxicity criteria (RfD and CSF) are used to quantify potential systemic effects associated with dermal exposure. However, as noted in USEPA's RAGS Part E (USEPA 2004e~~2004f~~), there is uncertainty associated with this approach because the oral toxicity criteria are based on an administered dose and not an absorbed dose. In general, USEPA (2004e~~2004f~~) recommends an adjustment to the oral toxicity criteria to convert an administered dose into an absorbed dose. The adjustment accounts for the absorption efficiency of the chemical in the "critical study" that is the basis of the oral toxicity criterion. If the oral absorption in the critical study is 100 percent, then the absorbed dose is equivalent to the administered dose and no adjustment is necessary. If the oral absorption of a chemical in the critical study is poor (less than 50 percent), then the absorbed dose is much smaller than the administered dose. In this situation, an adjustment to the oral toxicity criteria is recommended.

Arsenic and cadmium are the only COPCs evaluated in this risk assessment that have ~~where an~~ oral absorption values of less than 50 percent ~~was used~~. For cadmium, a gastrointestinal absorption value of 2.5 percent is published by USEPA (2004e~~2004f~~), and was used to create an adjusted RfD used for dermal exposures. This gastrointestinal absorption value is employed only to adjust the results of study utilized to develop the oral RfD for cadmium in order to produce a dermal RfD, as per USEPA guidance (USEPA 2004e). The gastrointestinal absorption value was not utilized to adjust oral intakes of cadmium in soils for this risk assessment (*i.e.*, an oral absorption value of 100 percent was used for cadmium)

A value of 30 percent was used for arsenic and it is based on oral bioavailability studies of monkeys administered arsenic in a soil matrix (Roberts *et al*. 2001; cited in USEPA 2001c). The arsenic oral RfD and CSF are based on a human drinking water study, which also includes some contribution of arsenic in food (USEPA 2007c~~2006c~~). The matrix differences between the critical study (drinking water/food) versus the oral bioavailability studies contribute to the uncertainty in the risk characterization. However, it is generally assumed that oral absorption

from water is essentially complete (100 percent). Therefore, no adjustment to the oral toxicity criteria is necessary (USEPA 2004e~~2004f~~). In addition, Wester *et al*. (1993) has demonstrated that there is no statistical difference in the dermal absorption from water and soil in monkeys (USEPA 2001c). Thus, the magnitude of arsenic absorption is considered equivalent and no adjustment to the oral toxicity criteria is necessary for dermal exposures. Therefore, the uncertainty associated with the dermal risks/hazards presented in this risk assessment is considered low and are not likely underestimated.

7.3.2.3 Non-Carcinogenic Toxicity Criteria

In the establishment of the non-carcinogenic criteria, conservative multipliers, 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 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 insure the protection of sensitive individuals.

7.3.2.4 Sub-Chronic Non-Carcinogenic Toxicity Criteria

Future on-site/off-site construction~~Construction~~ worker exposures are evaluated for an exposure duration of one-year, which is more representative of a sub-chronic exposure rather than a chronic exposure. As such, where available, sub-chronic RfD were used to characterize non-cancer effects for the future on-site/off-site 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 future on-site/off-site construction worker.

7.3.2.5 Carcinogenic Toxicity Criteria

Uncertainty due to extrapolation of toxicological data for potential carcinogens tested in animals to human data is more prominent for potentially carcinogenic chemicals than non-carcinogenic ones. USEPA uses the LMS model to extrapolate the toxicological data. The LMS assumes that there is no threshold for carcinogenic substances; that is, exposure to even one molecule 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 the effect occurs via a threshold mechanism or not. An animal bioassay 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, 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, which assumes that there is no threshold of response. The dose-response curve generated by the model is known as the maximum likelihood estimate (MLE). 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 federal government, including USEPA itself, has acknowledged the limitations of the high-to-low dose extrapolation models, particularly the LMS (USEPA 1991b). 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: (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 MLE. The inherent conservatism at low doses is due in part to the fact that the LMS 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 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) 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.

7.3.2.6 Uncertainties with the Asbestos Risk Assessment

For the risk assessment, asbestos concentrations were presented two ways, as a best estimate and upper bound. The best estimate utilized the actual measurement results for asbestos fibers at the Borrow area multiplied by the analytical sensitivity, whereas the upper bound estimate is based upon the 95 percent UCL of the Poisson distribution. This is considered particularly conservative in the case of amphibole fibers, because there were no detections of amphibole fibers, but the risks calculated based on the 95 percent UCL of the Poisson distribution which resulted in assumption of three fibers being present.

Two sets of URFs were presented by USEPA (2003a), the optimum risk coefficients (Table 8-2) and conservative risk coefficients (Table 8-3). The values in Table 8-2 (optimum) were selected for use because they are the authors' best estimates of fiber potency and risk based upon the available data, whereas the conservative values in Table 8-3 are overestimates incorporating additional health protective assumptions by presenting values based upon only the most conservative (highest response), and best "behaved" data. While the use of the optimum risk coefficients is considered to produce the best risk estimates for decision making because they take into account a number of appropriate studies, greater risks could be estimated using the conservative URFs and needs to be acknowledged. Furthermore, both sets of URFs are based on only a limited number of focused studies, and some of the data sets included acting purportedly in a "not well behaved" fashion (*i.e.*, non-monotonic). While the URFs are robust in that they separate the potency effects based on fiber types and size, cancer type (mesothelioma and lung cancer) and receptor-specific traits (gender and smoking behavior), further study may reveal additional data that would change the interpretations of the complete data set to perhaps produce more or less conservative risk estimates.

Additionally, it should be noted that unlike URFs for chemical cancer risk estimation (that is, ILCRs), the risks generated by the asbestos URFs are not directly comparable because they are not a risk of contracting cancer, but rather an estimate of additional deaths from lung cancer or mesothelioma per 100,000 persons (or 1,000,000 persons as modified for use the HHRA) from constant lifetime exposure. Asbestos risks estimated herein are therefore an estimate of increased mortality rate rather than an increased risk of morbidity.

Lastly, the URFs as presented in USEPA (2003a) are estimated increase in mortality resulting from a lifetime of exposure, these URFs are modified and applied to less than lifetime exposure estimates in the HHRA which may overestimate calculated risks.

7.3.3 Combinations of Sources of Uncertainty

Uncertainties from different sources are compounded in the risk assessment. 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 will all be expressed in the result. Therefore, by combining all upper-bound numbers, the uncertainty is compounded~~, and the resulting risk estimate is above the 90th or 95th percentile, perhaps even greater than the 99th percentile~~.

8.0 SUMMARY OF RISK ASSESSMENT RESULTS

This risk assessment has evaluated potential risks to human health associated with chemicals detected in soil at the Borrow Area located within the BRC proposed CAMU in Clark County, Nevada. In this Chapter, the risks presented as the HI and ILCR are provided for all receptors assessed (as described in Section 6.5). Background risks are presented separately in Appendix H.~~F.~~

These 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 calculation of theoretical upper-bound ILCRs and HIs are presented by receptor in Tables 13 through 15. Radionuclide ILCRs are presented by receptor in Tables 16 through 18. Asbestos estimated deaths from lung cancer or mesothelioma~~ILCRs~~ are presented by receptor in Table 19. A summary of the results of this assessment are presented in Table 21. The following summarizes the results for each of the receptors evaluated in this risk assessment.

8.1 FUTURE ON-SITE/OFF-SITE CONSTRUCTION WORKER

The HI for the future on-site/off-site construction worker at the Site is 0.3~~2~~, which is below the target HI 1.0. The theoretical upper-bound ILCR for the future on-site/off-site construction worker at the Site is 7~~9~~ $\times 10^{-7}$ for chemical exposures. This ILCR is below the risk goal of 1×10^{-6} and the USEPA acceptable risk range (10^{-6} to 10^{-4}). The theoretical upper-bound ILCR for radionuclide exposures for the future on-site/off-site construction worker at the Site is 6~~7~~ $\times 10^{-6}$. This ILCR is above the risk goal of 1×10^{-6}, but is consistent with the radionuclide background soil cancer risk of 2~~5~~ $\times 10^{-6}$ and within the USEPA acceptable risk range (10^{-6} to 10^{-4}).

The estimated risks for death from lung cancer or mesothelioma~~ILCRs~~ for the best estimate and upper bound concentrations of asbestos range from 5×10^{-8} to 1×10^{-7} for chrysotile fibers, and from zero to 6×10^{-6} for amphibole fibers. It should be noted that zero risks are associated with long amphibole structures. Only a single short amphibole structure has been detected at the Site.~~Amphibole structures have not been detected at the Site, but have been detected in the general area.~~ The upper bound estimated risk for death from lung cancer or mesothelioma~~ILCR~~ is associated with the UCL of the Poisson distribution which assumes the mean amphibole concentration is equal to three long amphibole structures per cubic centimeter.~~may be present at the Site.~~ These risk estimates for deaths from lung cancer or mesothelioma~~ILCRs~~ range from above to below the risk goal of 1×10^{-6} and below or within the USEPA acceptable risk range

(10^{-6} to 10^{-4}). However, the high-end ~~cancer~~ risk estimate for deaths from lung cancer or mesothelioma of 6×10^{-6} is an overly conservative value for the following reasons:

- 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; and
- The values from Tables 8-2 of USEPA (2003a~~2003b~~) should only be used for structures longer than 10 µm and thinner than 0.4 µm; and are recommended only for constant lifetime~~low-level~~ exposures, not short term exposures such as construction activities.

These results indicate that exposures to COPCs in soil at the Site should not result in adverse health effects to future construction workers.

8.2 FUTURE OFF-SITE MAINTENANCE (OUTDOOR) WORKER

The HI for the future off-site maintenance worker at the whole Site is 0.08~~03~~, which is below the target HI 1.0. The theoretical upper-bound ILCR for the future off-site maintenance worker is 3~~2~~ $\times 10^{-6}$. This ILCR is above the risk goal of 1×10^{-6} and within the USEPA acceptable risk range (10^{-6} to 10^{-4}). The theoretical upper-bound ILCR for radionuclide exposures for the future off-site maintenance worker is 1~~9~~ $\times 10^{-4}$~~^{5}~~. This ILCR is above the risk goal of 1×10^{-6}, but is consistent with the radionuclide background soil cancer risk of 5×10^{-5} and within the USEPA acceptable risk range (10^{-6} to 10^{-4}).

The estimated risks for death from lung cancer or mesothelioma~~ILCRs~~ for the best estimate and upper bound concentrations of asbestos range from 8×10^{-10} to 2×10^{-9} for chrysotile fibers, and from zero to 9×10^{-8} for amphibole fibers. It should be noted that zero risks are associated with long amphibole structures. Only a single short amphibole~~Amphibole~~ structures has ~~have not~~ been detected at the Site~~, but have been detected in the general area~~. The upper bound estimated risk for death from lung cancer or mesothelioma ~~ILCR~~ is associated with the 95 percent UCL of the Poisson distribution which assumes the mean amphibole concentration is equal to three long amphibole structures per cubic centimeter.~~may be present at the Site.~~ These risk estimates for deaths from lung cancer or mesothelioma~~ILCRs~~ are below the risk goal of 1×10^{-6} and below the USEPA acceptable risk range (10^{-6} to 10^{-4}). As described above for the future on-site/off-site construction worker, the high-end cancer risk estimate is an overly conservative value.

These results indicate that exposures to COPCs in soil at the Site should not result in adverse health effects to future off-site maintenance workers.

8.3 CURRENT/FUTURE ON-SITE TRESPASSER

The HI for the current/future on-site trespasser is 0.02~~01~~, which is below the target HI 1.0. The theoretical upper-bound ILCR for the current/future on-site trespasser is 2×10^{-7} for chemical exposures. This ILCR is below the risk goal of 1×10^{-6} and below the USEPA acceptable risk range (10^{-6} to 10^{-4}). The theoretical upper-bound ILCR~~ILCRs~~ for radionuclide exposures for the current/future on-site trespasser is 3×10^{-6}. This ILCR is above the risk goal of 1×10^{-6}, but is consistent with the radionuclide background soil cancer risk of 1~~2~~ $\times 10^{-6}$ and within the USEPA acceptable risk range (10^{-6} to 10^{-4}).

The estimated risks for death from lung cancer or mesothelioma~~ILCRs~~ for the best estimate and upper bound concentrations of asbestos range from 2×10^{-11} to 6×10^{-11} for chrysotile fibers, and from zero to 2×10^{-9} for amphibole fibers. It should be noted that zero risks are associated with long amphibole structures. Only a single short amphibole structure has been detected at the Site.~~Amphibole structures have not been detected at the Site, but have been detected in the general area.~~ The upper bound estimated risk for death from lung cancer or mesothelioma~~ILCR~~ is associated with the 95 percent UCL of the Poisson distribution which assumes the mean amphibole concentration is equal to three long amphibole structures per cubic centimeter.~~may be present at the Site.~~ These risk estimates for deaths from lung cancer or mesothelioma~~ILCRs~~ are below the risk goal of 1×10^{-6} and below the USEPA acceptable risk range (10^{-6} to 10^{-4}). As described above for both the future off-site maintenance and future on-site/off-site construction workers, the high-end cancer risk estimate is an overly conservative value.

These results indicate that exposures to COPCs in soil at the Site should not result in adverse health effects to current/future on-site trespassers.

9.0 POTENTIAL IMPACTS TO GROUNDWATER

This Chapter presents the evaluation of the potential impacts to groundwater considering the use of Borrow Area soil as off-site fill material. This evaluation has been conducted using the VLEACH vertical migration model and site-specific ~~soil~~ analytical results of soil samples collected from the Borrow Area. The VLEACH modeling was conducted for all COPCs identified in the HHRA. The evaluation was conducted using the USEPA VLEACH model as distributed by Waterloo Hydrogeologic, Inc. in the model software package WHI UnSat Suite Plus 2.2.0.2.

9.1 MODEL APPROACH AND INPUT PARAMETERS

VLEACH was run separately for each of the distinctly different soil layers (that is, Borrow Area fill material and underlying native soil). In order to evaluate heterogeneous soil layers using VLEACH, multiple iterations of VLEACH were performed, where the output of one run (Borrow Area fill material) was used as the input into another run (underlying native soil). For each VLEACH run the user is allowed to input an initial recharge water concentration that comes in the top of the soil layer. At the end of a run, VLEACH provides the concentration in the bottom soil layer and the recharge (or soil moisture) leaving the bottom of the soil layers. Hence from the first VLEACH run for the upper Borrow Area fill material, the output of soil moisture concentration at the bottom of this soil layer was then used as the input concentration of recharge for the VLEACH evaluation of the subsequent native soil layer below. Likewise the estimated contaminant soil concentration at the bottom of the Borrow Area fill material was used as the initial soil concentration for the upper cell of the underlying native soil VLEACH run. Although the use of the model in this fashion is not explicitly mentioned in the VLEACH manual (Model Version 2.2a, USEPA 1997c), staff at the USEPA Robert S. Kerr Environmental Research Laboratory, Center for Subsurface Modeling Support in Ada, Oklahoma have indicated that this is an appropriate use of the model to account for heterogeneous soil layers.[4]

VLEACH model input values are presented in Appendix I.~~C.~~ The intent of this evaluation is to predict impacts to groundwater considering the use of Borrow Area soils as off-site fill material. The evaluation was conducted with the following conservative input parameters:

[4] Personal communications between Ken Kiefer (MWH) and Robert Earle (USEPA), September 27, 2006.

- depth to groundwater was assumed to be 25 feet bgs, the shallowest depth to groundwater for any of the placement sites (see Section 2.3.5~~4~~);

- fill material is assumed to be placed at a thickness of 20 feet above the native soil. A thicker fill material depth results in more conservative model estimates. It is not considered likely that fill material greater than this thickness would be placed at any one location;

- an infiltration rate of 4 inches per year (equivalent to 100 percent ~~%~~ of local rainfall, Table I~~G~~-1);

- The exposure point~~95 percent UCL~~ concentrations for each of the COPCs (see Table 5) were used as input concentrations for the fill material soil. Native soils at each placement site were assumed to be unimpacted for modeling purposes; and

- USEPA Soil Screening Guidance default chemical properties were used (Table I~~G~~-2).

The VLEACH model is based on several assumptions that typically result in conservative evaluations of migration potential. These assumptions include:

- The model simulates one-directional flow only;

- liquid phase dispersion is neglected. Hence, the migration of the chemical will be simulated as a plug. This assumption causes higher dissolved concentrations and lower travel time predictions than would occur in reality and;

- instantaneous equilibrium between phases is assumed within each cell.~~-~~ After the mass is exchanged between the cells, the total mass in each cell is recalculated and re-equilibrated between the different phases and applied to the full depth of each cell. Thus assuming that some portion of the mass transferred into the top of one cell instantaneously reaches the bottom of the cell.

In addition to the concentrations of soil COPCs, which are the representative exposure point~~95 percent UCL~~ concentrations used in the HHRA, VLEACH requires the following soil input parameters: bulk density; effective porosity, moisture content, and organic carbon content.

Soils present in the Borrow Area will be separated into Type II and sand fractions. ~~-~~Each of these materials will then be used in industrial/commercial situations subject to certain other conditions discussed previously (Section 4.3).~~-~~ It is expected that the Type II material will be compacted to approximately 85 to 95 percent ~~%~~ compaction during use.~~-~~ Sand will not be compacted.

Site-specific input parameters for the four soil parameters listed above were obtained by collecting samples from existing stockpiles of Type II and sand that were processed from Borrow Area soil during 2004. ~~–~~These piles were created when certain of the Borrow Area soil from roughly surface to six feet deep or so were processed.

It should be noted that the entire Borrow Area is part of a uniform geological alluvial fan whose characteristic is homogeneous except for presence of occasional calcified materials (caliche) which will be separated during screening operations. ~~–~~Upon separation, the Type II and reject sand materials are themselves homogeneous since the Type II materials have to meet certain size distribution specifications.~~–~~ In other words, once separated, the Type II and sand materials exhibit homogeneous characteristics irrespective of the condition in which the Borrow Area soil are present.~~–~~ The size of the piles of these materials should also not affect their homogeneity. Also, with the exception of organic carbon content, the three other parameters required for VLEACH (namely bulk density, porosity and moisture content) depend more on the compaction (for bulk density and porosity) and exposure to water (for moisture) of these materials, rather than the source of these materials. Regarding organic carbon content, while that can vary with depth of materials excavated, it should be noted that there is scarce vegetation in the Borrow Area and it is not expected that organic carbon will vary significantly for Borrow Area soil with depth.

Composite samples were collected from the Type II and sand piles using the methodology discussed in ASTM D 75-03 for sampling soil stockpiles and analyzed for the various parameters as discussed above. In addition, to these samples, soil parameter data were collected for seven of the eight potential placement sites. Site-specific soil properties for both the fill materials and placement site soils are provided in Appendix I~~G~~ (Table I~~G~~-3). The laboratory results for each of these samples are also provided in Appendix I, Attachment I-2~~G~~.

9.2 RESULTS

VLEACH results are the maximum pore water concentrations in the vadose zone at the groundwater interface and do not take into account groundwater mixing.~~–~~ The VLEACH outputs provided electronically in Appendix I contain~~on Appendix B contains~~ the results of the evaluation for each of the COPCs. VLEACH modeling was performed for four of the seven sites for with soil properties were available. The three~~four~~ sites selected were determined to be the sites with the worst-case modeling results through a sensitivity analysis assessing all seven sites (Table I-7~~G-4~~). VLEACH outputs are provided in Appendix I, Attachment I-1. A summary of the VLEACH model results are presented in Table 22.~~Appendix B.~~ VLEACH model results

indicate that none of the COPCs should adversely impact groundwater quality above maximum contaminant levels (MCLs) within the next thirty years. The model does indicate that the modeled concentrations of iron and methylene chloride may exceed USEPA residential tap water PRGs within thirty years. However, the concentrations of iron in the site soils evaluated were comparable to background levels. In addition, the potential migration to groundwater pathway is based on the future use of the Borrow Area soil as fill. This physical processing of the soil is expected to significantly reduce the concentrations of volatile COPCs, such as methylene chloride, in the Borrow Area soil. Under this scenario the soil will be mass-graded, crushed, potentially segregated into Type II aggregate and reject sand prior to being transported and placed as construction fill material. Therefore, the potential impacts of methylene chloride predicted by the model are unlikely.

9.3 DISCUSSION

The VLEACH results represent very conservative evaluation of the potential migration of COPCs in Borrow Area fill material to groundwater. Using conservative assumptions, for example 100 percent rainfall infiltration rate and no groundwater dilution, the results indicate minimal potential to significantly impact groundwater. The conservativeness of the evaluation results in estimates that will likely over estimate potential impacts.

As indicated in the VLEACH manual (USEPA 1997c) contaminant organic carbon partition coefficient (based on USEPA values); infiltration rate; and the fraction organic carbon in soil (obtained from field measurements). have the most influence on the model results. Use of site-specific values for these parameters, where available, should add to the applicability of the modeling for the site. Also, according to the VLEACH manual (Figure 8-14), soil porosity is not a sensitive parameter with regards to groundwater impact prediction. Although the range site specific porosity (24% to 37%) is outside the range of porosity (35% to 45%) included in the sensitivity analysis presented in the VLEACH manual, the use of site-specific values of porosity should add to the applicability of the VLEACH modeling for the site. In order to evaluate the impact that the rainfall infiltration rate has on the model results, a sensitivity analysis was performed by varying the infiltration rate from 2 to 6 inches per year. This sensitivity analysis range is inclusive of the infiltration rate evaluated for the site (4 inches per year). In addition, the mass balance for the model was checked to confirm that the timestep and number of cells used provided a stable solution.

~~Also, according to the VLEACH manual (Figure 8-14), soil porosity is not a sensitive parameter with regards to groundwater impact prediction. For this evaluation, site-specific values of porosity were used in the VLEACH modeling.~~

A number of limitations exist for the VLEACH model. These include:

- Data gaps/uncertainties
- Omission of certain chemical and physical processes
- Lack of an appropriate model validation opportunity

Data gaps or uncertain input values that may exist for the site include:

- Accurate site-specific infiltration parameter measurements incorporated in the model
- Limited~~Inadequate and/or inconsistent~~ field sampling data (*e.g.*, the future model scenario is for Borrow Area soil being placed as fill and the modeling is based on soil samples collected from in place Borrow Area soil prior to excavation and placement)
- Site-specific chemical data (*e.g.*, degradation rates)

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 is not taken into account in the model (*e.g.*, COPC mobility may decrease or increase in the presence of other solvent-related COPC components). Every effort has been made to obtain results that provide reasonable estimates of actual site conditions. Uncertain input values were selected based on available scientific information to err on the conservative side.

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TABLES

TABLE 1
DATA USABILITY WORKSHEET
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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Activity	Comment
Field Sampling	
Discuss sampling problems and field conditions that affect data usability.	No field conditions resulted in poor sample recovery.
Are samples representative of receptor exposure for this medium (e.g. sample depth, grab vs composite, filtered vs unfiltered, low flow, etc.)?	Soil samples were all discrete samples, except for those collected for asbestos. Soil samples were representative of receptor exposures and analyzed for a broad spectrum of analyses.
Were samples appropriately documented and can they be correlated to a specific geographic location?	All samples reported by the laboratory were documented on the chain-of-custodies and were correlated to a specific geographic location.
Assess the effect of field QC results on data usability.	Field equipment blank and soil duplicate samples were collected during all field sampling activities as specified in the QAPP. The qualifications resulting from QC sample results which exceeded the acceptable range specified in the QAPP are specified in Attachment D-2.
Summarize the effect of field sampling issues on the risk assessment, if applicable.	For soils there were few field sampling issues that affected the data quality for risk assessment purposes. There were some samples that were qualified due to sample temperature at the time of receipt exceeding the control limit.
Analytical Techniques	
Were the analytical methods appropriate for quantitative risk assessment?	Yes the analytical techniques used for soils analysis were appropriate for risk assessment purposes. Analytical techniques for soils followed USEPA and DOE-based guidelines.
Were detection limits adequate?	Yes, in general the soils analyses met the detection limits required for risk assessment purposes. Some soil data had variable reporting limits. Specific results which exceeded the industrial PRGs are discussed in Attachment D-2. However, dioxin/furans were retained as COPCs due to an elevated detection limit which resulted in the TEQ for that sample exceeding the ATSDR screening target level.
Summarize the effect of analytical technique issues on the risk assessment, if applicable.	There were no issues raised which were particular to the analytical techniques used. Analytical techniques for soils followed USEPA and DOE-based guidelines.

TABLE 1
DATA USABILITY WORKSHEET
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Activity	Comment
Data Quality Indicators	
Precision - How were duplicates handled?	For soils, true duplicates cannot be collected, so replicate samples are considered as duplicates. The duplicate samples were compared for consistency (RPD was calculated) and the result from the primary sample for that location was used in the risk assessment unless the primary result was rejected and the duplicate was not.
Accuracy - How were duplicate samples handled?	Duplicate samples were compared for consistency (RPD was calculated) and the primary sample result was used in the risk assessment for that location unless the primary result was rejected and the duplicate was not. See the data usability tables in Attachment D-2 for data qualified due to field duplicate inconsistencies.
Representativeness - Indicate any problems associated with data representativeness (e.g., trip blank or rinsate blank contamination, chain of custody problems, etc.).	Chain of custody forms were checked by QC staff and laboratory was informed of any problems within 1 to 2 days of sample collection. Based on the procedures used, the soil data was representative of site conditions.
Completeness - Indicate any problems associated with data completeness (e.g., incorrect sample analysis, incomplete sample records, problems with field procedures, etc.).	There were no problems identified.
Comparability - Indicate any problems associated with data comparability.	USEPA methods/DOE based methods were utilized throughout the project. BRC has collected the data over a number of years. A couple of laboratories were used however for the most part the methods used were the same from laboratory to laboratory. For PAHs, data is used from methods EPA 8270 and EPA 8310. For background data was also collected over a number of years. Statistical tests have been performed to compare the datasets which are from different geological ranges and investigations. The use of this data is not expected to impact the quality of the risk assessment.
Were the DQOs specified in the QAPP satisfied?	Yes, DQIs for soils (equipment rinseate blanks, split sample results) were adequate for use in the risk assessment.
Summarize the effect of DQO issues on the risk assessment, if applicable.	For soils, PARCC criteria for soils met DQOs and resulted in usable data for the risk assessment.

TABLE 1
DATA USABILITY WORKSHEET
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Activity	Comment
Data Validation and Interpretation	
What are the data validation requirements?	For soils data, all laboratory reports were provided as a CLP equivalent package. The detailed data validation procedures are consistent with the USEPA National Functional Guidelines for Data Validation. The data were reviewed for a subset of the USEPA National Functional Guideline parameters including holding times, accuracy, precision and other performance parameters specified in the QAPP.
What method or guidance was used to validate the data?	The USEPA National Functional Guidelines for Data Validation were used to derive data validations SOPs in the QAPP.
Was the data validation method consistent with guidance? Discuss any discrepancies.	Yes, data validation methods were consistent with the guidance as described in the QAPP.
Were all data qualifiers defined? Discuss those which were not.	Yes, all definitions of all data qualifiers are presented in the laboratory reports.
Which qualifiers represent usable data?	All data collected and validated by BRC are usable as qualified unless they are rejected with an R symbol. Rejected data have not been used in the risk assessment
Which qualifiers represent unusable data?	Data qualified as "R" (rejected) represents unusable data.
How are tentatively identified compounds handled?	TICs were evaluated in the risk assessment
Summarize the effect of data validation and interpretation issues on the risk assessment, if applicable.	Valid data were sufficient to perform the risk assessment. All data collected and validated by BRC are usable for the risk assessment as qualified unless they were rejected. For a sample by sample review of data usability, see the data usability summary tables in Attachment D-2.
Additional notes:	

Note: The purpose of this Worksheet is to succinctly summarize the data usability analysis and conclusions. Reference specific pages in the risk assessment text to further expand on the information presented here.

TABLE 2
2006 BORROW AREA INVESTIGATION PROJECT LIST OF ANALYTES
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical Group	Analytical Method	CAS Number	Compound List
Ions	**EPA 314.0**	14797-73-0	Perchlorate
Polychlorinated Dibenzodioxins/ Dibenzofurans	**EPA 8290**	39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran
		3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin
		67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran
		35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin
		55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran
		70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran
		39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin
		57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran
		57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin
		72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran
		19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin
		57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran
		40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin
		60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran
		57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran
		51207-31-9	2,3,7,8-Tetrachlorodibenzofuran
		1746-01-6	2,3,7,8-Tetrachlororodibenzo-p-dioxin
Asbestos	**ISO 10312 TEM**	1332-21-4	Asbestos
General Chemistry Parameters	**EPA 9010/9014**	57-12-5	Cyanide (Total)
	EPA 9045C	pH	pH in soil
Metals	**EPA 6020/6010B**	7429-90-5	Aluminum
		7440-36-0	Antimony
		7440-38-2	Arsenic
		7440-39-3	Barium
		7440-41-7	Beryllium
		7440-42-8	Boron
		7440-43-9	Cadmium
		7440-70-2	Calcium
		7440-47-3	Chromium
		7440-48-4	Cobalt
		7440-50-8	Copper
		7439-89-6	Iron
		7439-92-1	Lead
		1313-13-9	Lithium
		7439-95-4	Magnesium
		7439-96-5	Manganese
		7439-98-7	Molybdenum
		7440-02-0	Nickel
		7440-03-1	Niobium
		7440-05-3	Palladium
		7723-14-0	Phosphorus
		7440-06-4	Platinum
		7440-09-7	Potassium
		7782-49-2	Selenium
		7440-21-3	Silicon
		7440-22-4	Silver
		7440-23-5	Sodium

TABLE 2
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Chemical Group	Analytical Method	CAS Number	Compound List
Metals (continued)	**EPA 6020/6010B**	7440-24-6	Strontium
		7704-34-9	Sulfur
		7440-28-0	Thallium
		7440-31-5	Tin
		7440-32-6	Titanium
		7440-33-7	Tungsten
		7440-61-1	Uranium
		7440-62-2	Vanadium
		7440-66-6	Zinc
		7440-67-7	Zirconium
	EPA 7196A[1]	18540-29-9	Chromium (VI)
	EPA 7470/7471A	7439-97-6	Mercury
Organophosphorous Pesticides	**EPA 8141A**	264-27-19	Azinphos-ethyl
		86-50-0	Azinphos-methyl
		786-19-6	Carbophenothion
		2921-88-2	Chlorpyrifos
		56-72-4	Coumaphos
		298-03-3	Demeton-O
		126-75-0	Demeton-S
		333-41-5	Diazinon
		62-73-7	Dichlorvos
		60-51-5	Dimethoate
		298-04-4	Disulfoton
		2104-64-5	EPN
		13194-48-4	Ethoprop
		56-38-2	Ethyl parathion
		52-85-7	Fampphur
		55-38-9	Fenthion
		121-75-5	Malathion
		953-17-3	Methyl carbophenothion
		298-00-0	Methyl parathion
		7786-34-7	Mevinphos
		300-76-5	Naled
		297-97-2	O,O,O-Triethyl phosphorothioate (TEPP)
		298-02-2	Phorate
		732-11-6	Phosmet
		299-84-3	Ronnel
		22248-79-9	Stirophos (Tetrachlorovinphos)
		3689-24-5	Sulfotep
Chlorinated Herbicides	**EPA 8151A**	93-76-5	2,4,5-T
		93-72-1	2,4,5-TP (Silvex)
		94-75-7	2,4-D
		94-82-6	2,4-DB
		75-99-0	Dalapon
		1918-00-9	Dicamba

TABLE 2
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Chemical Group	Analytical Method	CAS Number	Compound List
Chlorinated Herbicides (continued)	**EPA 8151A**	120-36-5	Dichloroprop
		88-85-7	Dinoseb
		94-74-6	MCPA
		93-65-2	MCPP
Organochlorine Pesticides	**EPA 8081A**	53-19-0	2,4-DDD
		3424-82-6	2,4-DDE
		72-54-8	4,4-DDD
		72-55-9	4,4-DDE
		50-29-3	4,4-DDT
		309-00-2	Aldrin
		319-84-6	alpha-BHC
		5103-71-9	alpha-Chlordane
		319-85-7	beta-BHC
		57-74-9	Chlordane
		319-86-8	delta-BHC
		60-57-1	Dieldrin
		959-98-8	Endosulfan I
		33213-65-9	Endosulfan II
		1031-07-8	Endosulfan sulfate
		72-20-8	Endrin
		7421-93-4	Endrin aldehyde
		53494-70-5	Endrin ketone
		58-89-9	gamma-BHC (Lindane)
		5103-74-2	gamma-Chlordane
		76-44-8	Heptachlor
		1024-57-3	Heptachlor epoxide
		72-43-5	Methoxychlor
		8001-35-2	Toxaphene
Polychlorinated Biphenyls	**EPA 8082**	12674-11-2	Aroclor 1016
		11104-28-2	Aroclor 1221
		11141-16-5	Aroclor 1232
		53469-21-9	Aroclor 1242
		12672-29-6	Aroclor 1248
		11097-69-1	Aroclor 1254
		11096-82-5	Aroclor 1260
Polynuclear Aromatic Hydrocarbons	**EPA 8310[2]**	83-32-9	Acenaphthene
		208-96-8	Acenaphthylene
		120-12-7	Anthracene
		56-55-3	Benzo(a)anthracene
		50-32-8	Benzo(a)pyrene
		205-99-2	Benzo(b)fluoranthene
		191-24-2	Benzo(g,h,i)perylene
		207-08-9	Benzo(k)fluoranthene
		218-01-9	Chrysene
		53-70-3	Dibenzo(a,h)anthracene
		193-39-5	Indeno(1,2,3-cd)pyrene
		85-01-8	Phenanthrene
		129-00-0	Pyrene

TABLE 2
2006 BORROW AREA INVESTIGATION PROJECT LIST OF ANALYTES
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Chemical Group	Analytical Method	CAS Number	Compound List
Radiochemicals	**EPA 901.1/ HASL GA-01-R**	14331-83-0	Actinium-228
		14913-49-6	Bismuth-212
		14733-03-0	Bismuth-214
		13981-50-5	Cobalt-57
		10198-40-0	Cobalt-60
		14255-04-0	Lead-210
		015816-77-0	Lead-211
		15092-94-1	Lead-212
		15067-28-4	Lead-214
		13966-00-2	Potassium-40
		14913-50-9	Thallium-208
		15623-47-9	Thorium-227
		15065-10-8	Thorium-234 (from U-235)
	EPA 903.0	13982-63-3	Radium-226
	EPA 904.0	15262-20-1	Radium-228
	Quantitate from Parent or Daughter Radionuclide	14952-40-0	Actinium-227 (from Th-227)
		14331-79-4	Bismuth-210 (from Pb-210)
		15229-37-5	Bismuth-211 (from Pb-211)
		13981-52-7	Polonium-210 (from Pb-210)
		13981-52-7	Polonium-212 (from Bi-212)
		15735-67-8	Polonium-214 (from Bi-214)
		15756-58-8	Polonium-216 (from Pb-212)
		15422-74-9	Polonium-218 (from Pb-214)
		15100-28-4	Protactinium-234 (from Th-234)
		15623-45-7	Radium-223 (from Th-227)
		13233-32-4	Radium-224 (from Pb-212)
		14133-67-6	Thallium-207 (from Pb-211)
		14932-40-2	Thorium-231 (from U-235)
		7440-29-1	Thorium-232
		14274-82-9	Thorium-228
		14269-63-7	Thorium-230
		13966-29-5	Uranium-233/234
		15117-96-1	Uranium 235/236
		7440-61-1	Uranium-238(from Th-234)
Semivolatile Organic Compounds	**EPA 8270C[2]**	95-94-3	1,2,4,5-Tetrachlorobenzene
		122-66-7	1,2-Diphenylhydrazine
		123-91-1	1,4-Dioxane
		3457-46-3	2,2'-Dichlorobenzil
		95-95-4	2,4,5-Trichlorophenol
		88-06-2	2,4,6-Trichlorophenol
		120-83-2	2,4-Dichlorophenol
		105-67-9	2,4-Dimethylphenol
		51-28-5	2,4-Dinitrophenol
		121-14-2	2,4-Dinitrotoluene
		606-20-2	2,6-Dinitrotoluene
		91-58-7	2-Chloronaphthalene
		95-57-8	2-Chlorophenol
		91-57-6	2-Methylnaphthalene

TABLE 2
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Chemical Group	Analytical Method	CAS Number	Compound List
Semivolatile Organic Compounds (continued)	**EPA 8270C[3]**	88-74-4	2-Nitroaniline
		88-75-5	2-Nitrophenol
		91-94-1	3,3-Dichlorobenzidine
		99-09-2	3-Nitroaniline
		3457-46-3	4,4'-Dichlorobenzil (as 2,2'-dichlorobenzil)
		101-55-3	4-Bromophenyl phenyl ether
		59-50-7	4-Chloro-3-methylphenol
		7005-72-3	4-Chlorophenyl phenyl ether
		123-09-1	4-Chlorothioanisole
		106-54-7	4-Chlorothiophenol
		100-01-6	4-Nitroaniline
		100-02-7	4-Nitrophenol
		83-32-9	Acenaphthene
		208-96-8	Acenaphthylene
		98-86-2	Acetophenone
		62-53-3	Aniline
		120-12-7	Anthracene
		103-33-3	Azobenzene
		56-55-3	Benzo(a)anthracene
		50-32-8	Benzo(a)pyrene
		205-99-2	Benzo(b)fluoranthene
		191-24-2	Benzo(g,h,i)perylene
		207-08-9	Benzo(k)fluoranthene
		65-85-0	Benzoic acid
		100-51-6	Benzyl alcohol
		111-91-1	bis(2-Chloroethoxy)methane
		54-28-1	bis(2-Chloroethyl) ether
		108-60-1	bis(2-Chloroisopropyl) ether
		117-81-7	bis(2-Ethylhexyl) phthalate
		111-44-4	bis(Chloromethyl) ether
		80-07-9	bis(p-Chlorophenyl) sulfone
		1142-19-4	bis(p-Chlorophenyl)disulfide
		85-68-7	Butylbenzyl phthalate
		86-74-8	Carbazole
		218-01-9	Chrysene
		53-70-3	Dibenzo(a,h)anthracene
		132-64-9	Dibenzofuran
		542-88-1	Dichloromethyl ether
		84-66-2	Diethyl phthalate
		131-11-3	Dimethyl phthalate
		84-74-2	Di-n-butyl phthalate
		117-84-0	Di-n-octyl phthalate
		882-33-7	Diphenyl disulfide
		139-66-2	Diphenyl sulfide
		127-63-9	Diphenyl sulfone
		206-44-0	Fluoranthene
		86-73-7	Fluorene
		118-74-1	Hexachlorobenzene

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Chemical Group	Analytical Method	CAS Number	Compound List
Semivolatile Organic Compounds (continued)	**EPA 8270C[3]**	87-68-3	Hexachlorobutadiene
		77-47-4	Hexachlorocyclopentadiene
		67-72-1	Hexachloroethane
		118-29-6	Hydroxymethyl phthalimide
		193-39-5	Indeno(1,2,3-cd)pyrene
		78-59-1	Isophorone
		106-44-5	m,p-Cresol
		91-20-3	Naphthalene
		98-95-3	Nitrobenzene
		621-64-7	N-nitrosodi-n-propylamine
		86-30-6	N-nitrosodiphenylamine
		95-48-7	o-Cresol
		29082-74-4	Octachlorostyrene
		106-47-8	p-Chloroaniline (4-Chloroaniline)
		106-54-7	p-Chlorobenzenethiol
		608-93-5	Pentachlorobenzene
		87-86-5	Pentachlorophenol
		85-01-8	Phenanthrene
		108-95-2	Phenol
		129-00-0	Pyrene
		110-86-1	Pyridine
		108-98-5	Thiophenol
			Tentatively Identified Compounds (TICs)
Volatile Organic Compounds	**EPA 8260B**	630-20-6	1,1,1,2-Tetrachloroethane
		71-55-6	1,1,1-Trichloroethane
		79-34-5	1,1,2,2-Tetrachloroethane
		79-00-5	1,1,2-Trichloroethane
		75-34-3	1,1-Dichloroethane
		75-35-4	1,1-Dichloroethene
		563-58-6	1,1-Dichloropropene
		87-61-6	1,2,3-Trichlorobenzene
		96-18-4	1,2,3-Trichloropropane
		120-82-1	1,2,4-Trichlorobenzene
		95-63-6	1,2,4-Trimethylbenzene
		95-50-1	1,2-Dichlorobenzene
		107-06-2	1,2-Dichloroethane
		540-59-0	1,2-Dichloroethene
		78-87-5	1,2-Dichloropropane
		108-70-3	1,3,5-Trichlorobenzene
		108-67-8	1,3,5-Trimethylbenzene
		541-73-1	1,3-Dichlorobenzene
		542-75-6	1,3-Dichloropropene
		142-28-9	1,3-Dichloropropane
		106-46-7	1,4-Dichlorobenzene
		594-20-7	2,2-Dichloropropane
		95-49-8	2-Chlorotoluene
		591-78-6	2-Hexanone
		79-46-9	2-Nitropropane

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Chemical Group	Analytical Method	CAS Number	Compound List
Volatile Organic Compounds (continued)	**EPA 8260B**	108-90-7	4-Chlorobenzene
		106-43-4	4-Chlorotoluene
		108-10-1	4-Methyl-2-pentanone (MIBK)
		67-64-1	Acetone
		75-05-8	Acetonitrile
		71-43-2	Benzene
		108-86-1	Bromobenzene
		75-27-4	Bromodichloromethane
		75-25-2	Bromoform
		74-83-9	Bromomethane
		75-15-0	Carbon disulfide
		56-23-5	Carbon tetrachloride
		108-90-7	Chlorobenzene
		74-97-5	Chlorobromomethane
		124-48-1	Chlorodibromomethane
		75-00-3	Chloroethane
		67-66-3	Chloroform
		74-87-3	Chloromethane
		156-59-2	cis-1,2-Dichloroethene
		10061-01-5	cis-1,3-Dichloropropene
		99-87-6	Cymene (Isopropyltoluene)
		73506-94-2	Dibromochloroethane
		124-48-1	Dibromochloromethane
		96-12-8	Dibromochloropropane
		74-95-3	Dibromomethane
		25321-22-6	Dichlorobenzene
		75-09-2	Dichloromethane (Methylene chloride)
		624-92-0	Dimethyldisulfide
		64-17-5	Ethanol
		100-41-4	Ethylbenzene
		75-69-4	Freon-11(Trichlorofluoromethane)
		76-13-1	Freon-113(1,1,2-trichloro-1,2,2-trifluoroethane)
		75-71-8	Freon-12(Dichlorodifluoromethane)
		142-82-5	Heptane
		31394-54-4	Isoheptane
		98-82-8	Isopropylbenzene
		mp-XYL	m,p-Xylene
		78-93-3	Methyl ethyl ketone (2-Butanone)
		74-88-4	Methyl iodide
		1634-04-4	MTBE (Methyl tert-butyl ether)
		104-51-8	n-Butyl benzene
		103-65-1	n-Propylbenzene
		124-19-6	Nonanal
		95-47-6	o-Xylene
		135-98-8	sec-Butylbenzene
		100-42-5	Styrene
		98-06-6	tert-Butyl benzene
		127-18-4	Tetrachloroethene

TABLE 2
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Chemical Group	Analytical Method	CAS Number	Compound List
Volatile Organic Compounds (continued)	**EPA 8260B**	108-88-3	Toluene
		156-60-5	trans-1,2-Dichloroethene
		10061-02-6	trans-1,3-Dichloropropene
		71-55-6	Trichloroethane
		79-01-6	Trichloroethene
		108-05-4	Vinyl acetate
		75-01-4	Vinyl chloride
		1330-20-7	Xylenes (total)
			Tentatively Identified Compounds (TICs)

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 Methods 8260B and 8270C.
[1] = Hexavalent chromium analyses used an alkaline digestion procedure for extracting hexavalent chromium prior to analysis.
[2] = For SVOCs, Method 8270C is the primary analytical method, but for risk assessment purposes results from Method 8310 will be used.
[3] = Method 3540 for extraction and Method 3640 for cleanup are to be used as appropriate.

TABLE 3
BACKGROUND COMPARISON SUMMARY
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	Background										Site									
Chemical	No. of Detects	Total Samples	% Detects	Minimum Detect	Maximum Detect	1st Quantile	Median	Mean	3rd Quantile	Standard Deviation	No. of Detects	Total Samples	% Detects	Minimum Detect	Maximum Detect	1st Quantile	Median	Mean	3rd Quantile	Standard Deviation
Aluminum	120	120	100%	3740	15300	6708	8420	8899	11200	2653	80	80	100%	3580	17600	5500	6550	7519	8525	3111
Antimony	49	120	41%	0.12	0.5	0.16	0.16	0.18	0.20	0.09	44	80	55%	0.07	0.34	0.15	0.24	0.34	0.25	0.61
Arsenic	120	120	100%	2.1	7.2	3.3	3.9	4.1	4.9	1.1	80	80	100%	1.9	25	3.5	5.2	7.0	7.7	5.3
Barium	120	120	100%	73	836	145	190	223	233	126	80	80	100%	40	927	118	140	162	172	104
Beryllium	120	120	100%	0.16	0.9	0.44	0.54	0.56	0.69	0.16	65	80	81%	0.27	1.1	0.33	0.44	0.48	0.58	0.21
Boron	34	104	33%	5.2	11.6	1.7	2.1	3.6	5.8	2.6	19	48	40%	6.7	32	2.9	5.3	9.2	13	8.7
Cadmium	16	120	13%	0.052	0.2	0.065	0.065	0.070	0.065	0.017	48	80	60%	0.03	0.32	0.07	0.13	0.15	0.25	0.09
Calcium	104	104	100%	8160	82800	17530	23650	28130	35230	14860	48	48	100%	3170	692000	26230	38700	71440	50100	117600
Chromium (Total)	120	120	100%	2.6	17	7.0	8.8	8.9	10.8	2.9	79	80	99%	2.8	110	6.9	9.1	12	13	13
Cobalt	120	120	100%	3.7	16	6.4	8.3	8.2	9.7	2.5	80	80	100%	2.3	11	4.5	5.4	5.7	6.5	1.7
Copper	120	120	100%	7.8	31	14	17	17	20	4.2	80	80	100%	7.4	25	11	13	14	15	3.7
Iron	120	120	100%	5410	19700	10480	13050	12810	15100	3263	80	80	100%	4700	23300	8495	10250	11480	13300	4050
Lead	120	120	100%	3	35	6.4	7.8	9.4	10.6	5.1	80	80	100%	3.4	19	5.7	7.4	7.7	8.7	2.9
Lithium	104	104	100%	7.5	27	11	13	14	16	4.3	46	48	96%	7.9	62	12	16	21	29	13
Magnesium	120	120	100%	4580	17500	6970	9425	9505	11700	3046	80	80	100%	4110	36500	5723	7200	9217	9315	6458
Manganese	120	120	100%	151	1090	344	419	425	496	135	80	80	100%	68	763	130	186	217	277	120
Mercury	93	120	78%	0.0084	0.1	0.009	0.015	0.018	0.022	0.015	24	80	30%	0.0071	0.040	0.010	0.010	0.017	0.020	0.016
Molybdenum	120	120	100%	0.17	2.0	0.38	0.48	0.55	0.62	0.28	76	80	95%	0.33	5.9	0.6	0.66	0.86	1.0	0.76
Nickel	120	120	100%	7.8	30	11	15	15	18	4.2	80	80	100%	5.0	72	10	18	28	45	20
Niobium	0	104	0%	NA	NA	1	1	1	1	0	14	48	29%	0.40	2.0	1.3	1.3	2.6	2.3	3.8
Palladium	104	104	100%	0.14	1.5	0.29	0.40	0.46	0.55	0.24	48	48	100%	0.14	1.6	0.34	0.47	0.57	0.79	0.31
Platinum	5	104	5%	0.045	0.1	0.022	0.022	0.024	0.022	0.011	2	48	4%	0.01	0.020	0.05	0.05	0.11	0.10	0.15
Potassium	104	104	100%	625	3890	1233	1535	1730	2058	733	48	48	100%	1260	7300	1843	2625	2789	3470	1190

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Chemical	Background										Site									
	No. of Detects	Total Samples	% Detects	Minimum Detect	Maximum Detect	1st Quantile	Median	Mean	3rd Quantile	Standard Deviation	No. of Detects	Total Samples	% Detects	Minimum Detect	Maximum Detect	1st Quantile	Median	Mean	3rd Quantile	Standard Deviation
Selenium	52	120	43%	0.1	0.6	0.079	0.079	0.17	0.27	0.13	4	80	5%	0.12	0.64	0.25	0.26	0.45	0.45	0.60
Silicon	104	104	100%	335	4150	563	720	981	1068	780	39	48	81%	56	278	72	105	122	165	64
Silver	16	120	13%	0.019	0.1	0.13	0.13	0.12	0.13	0.03	44	80	55%	0.05	0.70	0.08	0.17	1.7	0.25	6.6
Sodium	104	104	100%	111	1320	210	452	486	685	286	48	48	100%	167	3770	516	1015	1238	1575	846
Strontium	104	104	100%	69	808	135	186	223	258	132	48	48	100%	69	678	165	214	265	347	144
Thallium	42	120	35%	0.1	1.8	0.21	0.27	0.50	0.49	0.48	1	80	1%	1.6	1.6	0.11	0.23	0.25	0.25	0.28
Tin	103	104	99%	0.2	0.8	0.40	0.49	0.48	0.55	0.13	48	48	100%	0.22	1.1	0.39	0.51	0.55	0.68	0.20
Titanium	120	120	100%	200	1010	393	504	510	618	171	80	80	100%	271	1200	416	641	622	776	219
Tungsten	0	104	0%	NA	NA	0	1	1	1	0	19	76	25%	0.56	2.6	0.25	0.29	0.63	0.69	0.69
Uranium	103	103	100%	0.43	2.7	0.82	0.94	1.0	1.10	0.31	48	48	100%	0.54	4.6	0.86	1.2	1.5	1.9	0.89
Vanadium	120	120	100%	14.6	59	26	36	35	43	11	80	80	100%	14	78	26	31	36	43	14
Zinc	120	120	100%	15.4	121	29	37	37	43	13	79	80	99%	10	59	20	28	29	35	10
Zirconium	104	104	100%	60.1	179	112	125	126	145	27	48	48	100%	65	497	158	192	227	300	89
Actinium-228	120	120	100%	1.11	3.4	1.5	1.8	1.8	2.0	0.38	43	49	88%	1.1	3.0	1.7	1.9	1.8	2.1	0.5
Bismuth-210	1	104	1%	2.2	2.2	0.20	0.60	0.61	0.90	0.58	12	12	100%	0.10	1.5	0.6	0.80	0.83	1.1	0.44
Bismuth-212	68	120	57%	0.71	1.8	0.77	1.0	1.0	1.2	0.34	5	49	10%	1.1	1.4	1.1	1.5	1.5	1.7	0.38
Bismuth-214	120	120	100%	0.52	1.6	0.80	0.93	0.95	1.1	0.21	22	49	45%	0.94	1.8	0.37	0.45	0.76	1.2	0.46
Lead-210	2	120	2%	1.9	2.2	0.30	0.67	0.72	1.1	0.64	3	49	6%	1.5	2.3	1.5	4.7	8.0	7.3	10.3
Lead-212	120	120	100%	0.94	2.1	1.3	1.5	1.5	1.7	0.26	49	49	100%	0.73	2.9	1.6	1.8	1.8	2.0	0.37
Lead-214	120	120	100%	0.61	1.7	0.8	0.9	1.0	1.1	0.22	49	49	100%	0.71	2.6	1.2	1.3	1.4	1.5	0.31
Polonium-210	1	104	1%	2.2	2.2	0.20	0.60	0.61	0.90	0.58	12	12	100%	0.10	1.5	0.6	0.80	0.83	1.1	0.44
Polonium-212	64	104	62%	0.46	1.2	0.50	0.61	0.65	0.78	0.22	12	12	100%	0.38	0.91	0.5	0.66	0.65	0.74	0.16
Polonium-214	104	104	100%	0.52	1.6	0.81	0.93	1.0	1.1	0.21	12	12	100%	0.94	1.6	1.2	1.2	1.3	1.4	0.19

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	Background										Site									
Chemical	No. of Detects	Total Samples	% Detects	Minimum Detect	Maximum Detect	1st Quantile	Median	Mean	3rd Quantile	Standard Deviation	No. of Detects	Total Samples	% Detects	Minimum Detect	Maximum Detect	1st Quantile	Median	Mean	3rd Quantile	Standard Deviation
Polonium-216	104	104	100%	1.08	2.1	1.3	1.6	1.5	1.7	0.25	12	12	100%	1.8	2.6	2.0	2.0	2.1	2.3	0.28
Polonium-218	96	104	92%	0.494	2.4	0.9	1.1	1.1	1.2	0.35	12	12	100%	1.7	3.0	1.8	2.3	2.2	2.5	0.41
Potassium-40	120	120	100%	17.8	35	23	25	25	27	3.3	49	49	100%	9.4	31	24	26	25	28	5.1
Protactinium-234	0	104	0%	NA	NA	NA	NA	NA	NA	NA	12	12	100%	1.2	1.7	1.4	1.5	1.5	1.5	0.14
Radium-224	104	104	100%	1.08	2.1	1.3	1.6	1.5	1.7	0.25	12	12	100%	3.3	8.7	3.6	4.1	4.4	4.5	1.5
Radium-226	96	104	92%	0.494	2.4	0.9	1.1	1.1	1.2	0.35	49	49	100%	0.93	4.5	1.5	1.9	2.0	2.4	0.70
Radium-228	68	84	81%	1.15	2.9	1.7	2.0	1.9	2.2	0.40	45	49	92%	0.78	3.3	1.8	2.0	2.1	2.4	0.59
Radon-220	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12	12	100%	1.79	2.64	NA	NA	NA	NA	NA
Radon-222	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12	12	100%	1.72	2.99	NA	NA	NA	NA	NA
Thallium-208	120	120	100%	0.33	0.7	0.48	0.54	0.54	0.60	0.09	49	49	100%	0.23	1.0	0.50	0.56	0.56	0.62	0.12
Thorium-228	120	120	100%	1.07	2.3	1.5	1.7	1.7	1.9	0.28	49	49	100%	0.55	2.6	1.49	1.75	1.71	1.96	0.43
Thorium-230	120	120	100%	0.66	3.0	1.0	1.2	1.2	1.4	0.38	49	49	100%	0.84	3.4	1.2	1.6	1.7	2.0	0.56
Thorium-232	120	120	100%	1.1	2.2	1.4	1.6	1.6	1.8	0.27	49	49	100%	0.55	2.64	1.4	1.5	1.5	1.8	0.37
Thorium-234	65	120	54%	1.11	2.5	0.75	1.3	1.2	1.6	0.63	13	49	27%	1.2	2.3	1.5	1.8	2.1	2.6	0.83
Uranium-234	61	120	51%	0.53	2.8	0.83	1.0	1.1	1.2	0.46	49	49	100%	0.56	3.7	1.1	1.5	1.6	2.0	0.61
Uranium-235	54	120	45%	0.037	0.21	0.043	0.059	0.066	0.089	0.038	33	49	67%	0.019	0.24	0.04	0.06	0.12	0.10	0.17
Uranium-238	120	120	100%	0.45	2.4	0.86	1.0	1.1	1.2	0.37	49	49	100%	0.58	2.7	1.0	1.4	1.4	1.6	0.47

Note: Summary and background comparison statistics were performed using one-half the detection limit for metals and using GISdT® (Neptune and Company 2007).
BOLD with Highlight indicates Site concentrations are greater than background.
WRS = Wilcoxon Rank Sum Test with the Gehan Modification
mg/kg - milligrams per kilogram
pCi/g - picoCuries per gram

TABLE 3
BACKGROUND COMPARISON SUMMARY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	T Test *p*	Quantile Test *p*	Slippage Test *p*	WRS Test *p*	Greater than Background?	Units	Basis
Aluminum	1.0 E+0	9.9 E-1	6.3 E-2	1.0 E+0	NO	mg/kg	Multiple tests
Antimony	8.4 E-2	NA	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests
Arsenic	4.3 E-6	8.3 E-8	7.8 E-11	9.2 E-5	YES	mg/kg	Multiple tests
Barium	1.0 E+0	1.0 E+0	4.0 E-1	1.0 E+0	NO	mg/kg	Multiple tests
Beryllium	9.9 E-1	9.0 E-1	2.4 E-2	1.0 E+0	YES	mg/kg	Slippage, Site Max > Background
Boron	3.6 E-5	NA	7.4 E-7	8.9 E-3	YES	mg/kg	Multiple tests
Cadmium	1.1 E-12	NA	8.0 E-2	4.0 E-2	YES	mg/kg	Proportion of detects higher for site vs background; marginal slippage and WRS results; t-test
Calcium	7.2 E-3	7.8 E-3	7.9 E-4	1.1 E-5	YES	mg/kg	Multiple tests
Chromium (Total)	1.2 E-2	1.8 E-2	3.6 E-6	6.6 E-2	YES	mg/kg	Multiple tests
Cobalt	1.0 E+0	1.0 E+0	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests
Copper	1.0 E+0	1.0 E+0	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests
Iron	9.9 E-1	7.0 E-1	1.6 E-1	1.0 E+0	NO	mg/kg	Multiple tests
Lead	1.0 E+0	9.6 E-1	1.0 E+0	9.9 E-1	NO	mg/kg	Multiple tests
Lithium	1.7 E-4	NA	7.0 E-8	1.6 E-3	YES	mg/kg	Multiple tests
Magnesium	6.4 E-1	8.2 E-1	1.4 E-3	1.0 E+0	YES	mg/kg	Slippage, Site Max 2x Background
Manganese	1.0 E+0	1.0 E+0	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests
Mercury	2.5 E-1	NA	1.0 E+0	1.0 E+0	NO	mg/kg	Slippage and WRS, Low detection frequency for t-test
Molybdenum	4.0 E-4	NA	6.1 E-2	7.2 E-9	YES	mg/kg	Multiple tests
Nickel	1.6 E-7	5.7 E-12	6.4 E-15	1.7 E-2	YES	mg/kg	Multiple tests
Niobium	5.5 E-4	NA	NA	5.8 E-4	YES	mg/kg	Low background detection frequency & higher detect proportion in site data; supported by results of multiple tests
Palladium	2.2 E-2	1.2 E-1	3.2 E-1	2.1 E-2	YES	mg/kg	Multiple tests
Platinum	9.8 E-5	NA	1.0 E+0	8.2 E-1	NO	mg/kg	Slippage and WRS, Low detection frequency for t-test
Potassium	1.8 E-7	3.4 E-6	2.3 E-4	1.6 E-9	YES	mg/kg	Multiple tests

TABLE 3
BACKGROUND COMPARISON SUMMARY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	T Test *p*	Quantile Test *p*	Slippage Test *p*	WRS Test *p*	Greater than Background?	Units	Basis
Selenium	6.8 E-5	NA	3.2 E-1	1.0 E+0	NO	mg/kg	Slippage and WRS, Low detection frequency for t-test
Silicon	1.0 E+0	1.0 E+0	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests
Silver	1.6 E-2	NA	8.6 E-5	1.3 E-5	YES	mg/kg	Multiple tests
Sodium	9.4 E-8	1.3 E-11	7.1 E-11	6.4 E-10	YES	mg/kg	Multiple tests
Strontium	4.4 E-2	2.3 E-1	1.0 E+0	1.8 E-2	NO	mg/kg	Slippage, Quantile, t-test and Site Max < Back Ground
Thallium	1.0 E+0	NA	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests; plots presented in Appendix D
Tin	1.1 E-2	1.3 E-5	2.7 E-3	5.3 E-2	YES	mg/kg	Multiple tests
Titanium	9.0 E-5	3.5 E-6	2.4 E-2	2.7 E-4	YES	mg/kg	Multiple tests
Tungsten	3.0 E-1	NA	NA	1.8 E-3	YES	mg/kg	Elevated DLs for site and background overlap sufficiently that statistical differences cannot be defined or defended; Higher proportion of detects in site vs background.
Uranium	2.0 E-4	7.7 E-7	2.8 E-3	1.1 E-3	YES	mg/kg	Multiple tests
Vanadium	4.1 E-1	1.8 E-1	9.5 E-3	7.4 E-1	YES	mg/kg	Slippage, Site Max > Background
Zinc	1.0 E+0	1.0 E+0	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests
Zirconium	2.2 E-10	5.4 E-13	1.1 E-15	5.1 E-16	YES	mg/kg	Multiple tests
Actinium-228	7.0 E-1	3.9 E-1	1.0 E+0	3.3 E-1	NO	mg/kg	Multiple tests
Bismuth-210	6.6 E-2	NA	1.0 E+0	2.1 E-18	YES	mg/kg	U-238 > background, if in equilibrium all U-238 decay products also > background
Bismuth-212	1.1 E-10	NA	1.0 E+0	9.0 E-1	NO	mg/kg	Slippage, WRS; Th-232, Ac-228< background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Bismuth-214	1.0 E+0	NA	2.9 E-1	9.9 E-1	YES	mg/kg	U-238 > background, if in equilibrium all U-238 decay products also > background
Lead-210	5.1 E-6	NA	1.1 E-1	1.2 E-2	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background
Lead-212	1.8 E-6	1.4 E-7	4.7 E-4	1.9 E-8	NO	mg/kg	Th-232, Ac-228< background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Lead-214	2.3 E-11	9.7 E-11	2.3 E-2	1.5 E-14	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background
Polonium-210	6.6 E-2	NA	1.0 E+0	2.1 E-18	YES	mg/kg	U-238 > background, if in equilibrium all U-238 decay products also > background
Polonium-212	5.0 E-1	NA	1.0 E+0	2.3 E-1	NO	mg/kg	Multiple tests
Polonium-214	7.1 E-5	1.5 E-3	1.0 E+0	2.9 E-5	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background

TABLE 3
BACKGROUND COMPARISON SUMMARY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	T Test *p*	Quantile Test *p*	Slippage Test *p*	WRS Test *p*	Greater than Background?	Units	Basis
Polonium-216	6.0 E-6	4.2 E-7	6.9 E-5	5.8 E-8	NO	mg/kg	Multiple tests; Th-232, Ac-228< background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Polonium-218	3.6 E-7	NA	6.9 E-5	3.2 E-8	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background
Potassium-40	7.9 E-1	2.4 E-1	1.0 E+0	1.5 E-1	NO	mg/kg	Multiple tests
Protactinium-234	3.9 E-14	NA	NA	4.9 E-27	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background
Radium-224	1.6 E-5	2.0 E-10	1.5 E-16	7.7 E-9	NO	mg/kg	Th-232, Ac-228 < background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Radium-226	3.7 E-12	NA	7.1 E-9	6.7 E-16	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background
Radium-228	9.1 E-3	NA	5.2 E-2	2.3 E-2	NO	mg/kg	Slippage; Th-232, Ac-228 < background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Radon-220	NA	NA	NA	NA	NO	mg/kg	Th-232, Ac-228< background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Radon-222	NA	NA	NA	NA	YES	mg/kg	U-238 > background, if in equilibrium all U-238 decay products also > background
Thallium-208	2.1 E-1	2.9 E-1	2.9 E-1	1.3 E-1	NO	mg/kg	Multiple tests; Th-232, Ac-228 < background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Thorium-228	3.8 E-1	2.0 E-1	6.5 E-3	3.0 E-1	NO	mg/kg	Multiple tests; Th-232, Ra-228< background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Thorium-230	3.1 E-6	4.3 E-5	8.3 E-2	1.3 E-7	YES	mg/kg	U-238 > background, if in equilibrium all U-238 decay products also > background
Thorium-232	9.4 E-1	7.1 E-1	2.9 E-1	9.2 E-1	NO	mg/kg	Multiple tests
Thorium-234	1.1 E-10	NA	1.0 E+0	4.6 E-1	YES	mg/kg	U-238 > background, if in equilibrium all U-238 decay products also > background
Uranium-234	1.6 E-6	NA	8.3 E-2	7.8 E-11	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background
Uranium-235	1.9 E-2	NA	2.6 E-1	5.8 E-1	NO	mg/kg	Multiple tests
Uranium-238	4.6 E-5	2.1 E-4	8.3 E-2	1.4 E-5	YES	mg/kg	Multiple tests

Note: Summary and background comparison statistics were performed using one-half the detection limit for metals and using GISdT® (Neptune and Company 2007).
BOLD with Highlight indicates Site concentrations are greater than background.
WRS = Wilcoxon Rank Sum Test with the Gehan Modification
mg/kg - milligrams per kilogram
pCi/g - picoCuries per gram

TABLE 4
CHEMICALS OF POTENTIAL CONCERN (COPC) SELECTION
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 10)

Chemical	Units	Number of Detects	Total Count	Det %	Minimum Detect	Maximum Detect	Greater than Background?	PBT[(1)] or Class A Carcinogen?	COPC?	Rationale
					Dioxins / Furans					
1,2,3,4,6,7,8-HpCDD	mg/kg	5	37	14%	0.0000056	0.000056	N/A	Yes	Yes	(1)(3)
1,2,3,4,6,7,8-HpCDF	mg/kg	9	37	24%	0.0000041	0.000073	N/A	Yes	Yes	(1)(3)
1,2,3,4,7,8,9-HpCDF	mg/kg	7	37	19%	0.0000027	0.000032	N/A	Yes	Yes	(1)(3)
1,2,3,4,7,8-HxCDD	mg/kg	0	37	0%	- -	- -	N/A	Yes	Yes	(1)(3)
1,2,3,4,7,8-HxCDF	mg/kg	9	37	24%	0.0000046	0.000044	N/A	Yes	Yes	(1)(3)
1,2,3,6,7,8-HxCDD	mg/kg	1	37	3%	0.0000042	0.0000042	N/A	Yes	Yes	(1)(3)
1,2,3,6,7,8-HxCDF	mg/kg	7	37	19%	0.000004	0.000024	N/A	Yes	Yes	(1)(3)
1,2,3,7,8,9-HxCDD	mg/kg	0	37	0%	- -	- -	N/A	Yes	Yes	(1)(3)
1,2,3,7,8,9-HxCDF	mg/kg	2	37	5%	0.000003	0.0000041	N/A	Yes	Yes	(1)(3)
1,2,3,7,8-PeCDD	mg/kg	0	37	0%	- -	- -	N/A	Yes	Yes	(1)(3)
1,2,3,7,8-PeCDF	mg/kg	7	37	19%	0.0000028	0.000023	N/A	Yes	Yes	(1)(3)
2,3,4,6,7,8-HxCDF	mg/kg	4	37	11%	0.0000038	0.0000061	N/A	Yes	Yes	(1)(3)
2,3,4,7,8-PeCDF	mg/kg	6	37	16%	0.0000032	0.000012	N/A	Yes	Yes	(1)(3)
2,3,7,8-TCDD	mg/kg	1	37	3%	0.00000083	0.00000083	N/A	Yes	Yes	(1)(3)
2,3,7,8-TCDF	mg/kg	10	37	27%	0.00000093	0.000025	N/A	Yes	Yes	(1)(3)
OCDD	mg/kg	8	37	22%	0.0000051	0.00026	N/A	Yes	Yes	(1)(3)
OCDF	mg/kg	9	37	24%	0.0000092	0.0003	N/A	Yes	Yes	(1)(3)
TCDD Equivalents	mg/kg	11	37	30%	0.00000047	0.000020	N/A	Yes	Yes	(11)(1)(10)
					Inorganics					
Aluminum	mg/kg	80	80	100%	3580	17600	NO	No	No	(6)
Antimony	mg/kg	44	80	55%	0.072	0.34	NO	No	No	(6)
Arsenic	mg/kg	80	80	100%	1.9	25.4	YES	Yes	Yes	(5)(9)
Asbestos	MF/g	3	22	14%	- -	- -	N/A	Yes	Yes	(5)
Barium	mg/kg	80	80	100%	40	927	NO	No	No	(6)
Beryllium	mg/kg	65	80	81%	0.27	1.1	YES	No	Yes	(5)(9)
Boron	mg/kg	19	48	40%	6.7	31.5	YES	No	Yes	(5)(9)
Cadmium	mg/kg	48	80	60%	0.034	0.32	YES	No	Yes	(12)
Calcium	mg/kg	48	48	100%	3170	692000	YES	No	Yes	(5)(9)
Chromium (Total)	mg/kg	79	80	99%	2.8	110	YES	No	Yes	(5)(9)
Cobalt	mg/kg	80	80	100%	2.3	10.9	NO	No	No	(6)
Copper	mg/kg	80	80	100%	7.4	24.9	NO	No	No	(6)
Hexavalent Chromium	mg/kg	0	79	0%	- -	- -	N/A	Yes	No	(2)
Iron	mg/kg	80	80	100%	4700	23300	NO	No	No	(6)
Lead	mg/kg	80	80	100%	3.4	18.5	NO	No	No	(6)

TABLE 4
CHEMICALS OF POTENTIAL CONCERN (COPC) SELECTION
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

Chemical	Units	Number of Detects	Total Count	Det %	Minimum Detect	Maximum Detect	Greater than Background?	PBT[(1)] or Class A Carcinogen?	COPC?	Rationale
Lithium	mg/kg	46	48	96%	7.9	61.8	YES	No	Yes	(5)(9)
Magnesium	mg/kg	80	80	100%	4110	36500	YES	No	Yes	(5)(9)
Manganese	mg/kg	80	80	100%	68	763	NO	No	No	(6)
Mercury	mg/kg	24	80	30%	0.0071	0.047	NO	Yes	No	(6)
Molybdenum	mg/kg	76	80	95%	0.33	5.9	YES	No	Yes	(5)(9)
Nickel	mg/kg	80	80	100%	5	72	YES	No	Yes	(5)(9)
Niobium	mg/kg	14	48	29%	0.4	2	YES	No	Yes	(13)
Palladium	mg/kg	48	48	100%	0.14	1.6	YES	No	Yes	(5)(9)
Perchlorate	mg/kg	56	88	64%	0.0478	46.1	N/A	No	Yes	(5)(9)
Phosphorus	mg/kg	48	48	100%	297	2340	N/A	No	Yes	(5)(9)
Platinum	mg/kg	2	48	4%	0.015	0.026	NO	No	No	(6)
Potassium	mg/kg	48	48	100%	1260	7300	YES	No	Yes	(5)(9)
Selenium	mg/kg	4	80	5%	0.12	0.64	NO	No	No	(6)
Silicon	mg/kg	39	48	81%	56.1	278	NO	No	No	(6)
Silver	mg/kg	44	80	55%	0.052	0.7	YES	No	Yes	(5)(9)
Sodium	mg/kg	48	48	100%	167	3770	YES	No	Yes	(5)(9)
Strontium	mg/kg	48	48	100%	68.9	678	NO	No	No	(6)
Thallium	mg/kg	1	80	1%	1.6	1.6	NO	No	No	(14)
Tin	mg/kg	48	48	100%	0.22	1.1	YES	No	Yes	(5)(9)
Titanium	mg/kg	80	80	100%	271	1200	YES	No	Yes	(5)(9)
Tungsten	mg/kg	19	76	25%	0.56	2.6	YES	No	Yes	(15)
Uranium	mg/kg	48	48	100%	0.54	4.6	YES	No	Yes	(5)(9)
Vanadium	mg/kg	80	80	100%	13.7	78.1	YES	No	Yes	(5)(9)
Zinc	mg/kg	79	80	99%	10.3	58.7	NO	No	No	(6)
Zirconium	mg/kg	48	48	100%	64.7	497	YES	No	Yes	(5)(9)
Organochlorine Pesticides										
2,4'-DDD	mg/kg	2	48	4%	0.0053	0.12	N/A	Yes	Yes	(7)
2,4'-DDE	mg/kg	6	48	13%	0.0031	0.022	N/A	Yes	Yes	(7)
4,4'-DDD	mg/kg	1	102	1%	0.0022	0.0022	N/A	Yes	Yes	(7)
4,4'-DDE	mg/kg	10	102	10%	0.0017	0.063	N/A	Yes	Yes	(7)
4,4'-DDT	mg/kg	13	102	13%	0.0018	0.062	N/A	Yes	Yes	(7)
Aldrin	mg/kg	0	102	0%	- -	- -	N/A	Yes	No	(2)
alpha-BHC	mg/kg	26	102	25%	0.0018	0.073	N/A	No	Yes	(5)
alpha-Chlordane	mg/kg	0	102	0%	- -	- -	N/A	Yes	No	(2)
beta-BHC	mg/kg	31	102	30%	0.0037	0.46	N/A	No	Yes	(5)

TABLE 4
CHEMICALS OF POTENTIAL CONCERN (COPC) SELECTION
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

Chemical	Units	Number of Detects	Total Count	Det %	Minimum Detect	Maximum Detect	Greater than Background?	PBT[(1)] or Class A Carcinogen?	COPC?	Rationale
Chlordane (technical)	mg/kg	0	102	0%	- -	- -	N/A	Yes	No	(2)
delta-BHC	mg/kg	22	102	22%	0.0046	0.1	N/A	No	Yes	(5)
Dieldrin	mg/kg	1	102	1%	0.015	0.015	N/A	Yes	Yes	(7)
Endosulfan I	mg/kg	0	102	0%	- -	- -	N/A	No	No	(2)
Endosulfan II	mg/kg	0	102	0%	- -	- -	N/A	No	No	(2)
Endosulfan sulfate	mg/kg	0	102	0%	- -	- -	N/A	No	No	(2)
Endrin	mg/kg	1	102	1%	0.0022	0.0022	N/A	No	No	(4)
Endrin aldehyde	mg/kg	0	102	0%	- -	- -	N/A	No	No	(2)
Endrin ketone	mg/kg	0	102	0%	- -	- -	N/A	No	No	(2)
gamma-BHC (Lindane)	mg/kg	16	102	16%	0.005	0.022	N/A	No	Yes	(5)
gamma-Chlordane	mg/kg	1	102	1%	0.011	0.011	N/A	Yes	Yes	(7)
Heptachlor	mg/kg	0	102	0%	- -	- -	N/A	No	No	(2)
Heptachlor epoxide	mg/kg	0	102	0%	- -	- -	N/A	No	No	(2)
Methoxychlor	mg/kg	4	102	4%	0.011	0.044	N/A	No	No	(4)
Toxaphene	mg/kg	0	102	0%	- -	- -	N/A	Yes	No	(2)
Herbicides										
2,2-Dichloropropionic acid	mg/kg	0	18	0%	- -	- -	N/A	No	No	(2)
2,4,5-T	mg/kg	0	18	0%	- -	- -	N/A	No	No	(2)
2,4,5-TP	mg/kg	2	18	11%	0.00113	0.00316	N/A	No	Yes	(5)
2,4-D	mg/kg	0	18	0%	- -	- -	N/A	No	No	(2)
4-(2,4-Dichlorophenoxy)butyric acid	mg/kg	0	18	0%	- -	- -	N/A	No	No	(2)
4-Amino-3,5,6-trichloropicolinic acid	mg/kg	0	8	0%	- -	- -	N/A	No	No	(2)
Dicamba	mg/kg	2	18	11%	0.00248	0.0028	N/A	No	Yes	(5)
Dichlorprop	mg/kg	1	18	6%	0.00162	0.00162	N/A	No	Yes	(5)
Dinitrobutyl phenol	mg/kg	0	18	0%	- -	- -	N/A	No	No	(2)
MCPA (2-Methyl-4-chlorophenoxyacetic	mg/kg	0	18	0%	- -	- -	N/A	No	No	(2)
MCPP	mg/kg	0	8	0%	- -	- -	N/A	No	No	(2)
Organic Acids										
Diethyl phosphorodithioic acid	mg/kg	4	4	100%	0.048	9.4	N/A	No	Yes	(5)
Organophosphorous Pesticides										
Azinphos-methyl	mg/kg	0	63	0%	- -	- -	N/A	No	No	(2)
Carbophenothion-methyl	mg/kg	1	37	3%	0.041	0.041	N/A	No	No	(4)
Demeton-S	mg/kg	1	53	2%	0.023	0.023	N/A	No	No	(4)
Dichlorvos	mg/kg	2	63	3%	0.54	2.9	N/A	No	No	(4)
Mevinphos	mg/kg	1	63	2%	0.052	0.052	N/A	No	No	(4)

TABLE 4
CHEMICALS OF POTENTIAL CONCERN (COPC) SELECTION
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	Units	Number of Detects	Total Count	Det %	Minimum Detect	Maximum Detect	Greater than Background?	PBT[(1)] or Class A Carcinogen?	COPC?	Rationale
O,O,O-Triethyl phosphorothioate	mg/kg	2	37	5%	0.014	0.037	N/A	No	Yes	(5)
Ronnel	mg/kg	1	63	2%	0.011	0.011	N/A	No	No	(4)
Polycyclic Aromatic Hydrocarbons										
Acenaphthene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Acenaphthylene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Anthracene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Benzo(a)anthracene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Benzo(a)pyrene	mg/kg	0	81	0%	- -	- -	N/A	Yes	No	(2)
Benzo(b)fluoranthene	mg/kg	0	73	0%	- -	- -	N/A	No	No	(2)
Benzo(g,h,i)perylene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Benzo(k)fluoranthene	mg/kg	0	73	0%	- -	- -	N/A	No	No	(2)
Chrysene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Dibenzo(a,h)anthracene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Fluoranthene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Indeno(1,2,3-cd)pyrene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Phenanthrene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Pyrene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Polychlorinated Biphenyls										
Aroclor 1016	mg/kg	0	37	0%	- -	- -	N/A	Yes	No	(2)
Aroclor 1221	mg/kg	0	37	0%	- -	- -	N/A	Yes	No	(2)
Aroclor 1232	mg/kg	0	37	0%	- -	- -	N/A	Yes	No	(2)
Aroclor 1242	mg/kg	0	37	0%	- -	- -	N/A	Yes	No	(2)
Aroclor 1248	mg/kg	0	37	0%	- -	- -	N/A	Yes	No	(2)
Aroclor 1254	mg/kg	1	37	3%	0.057	0.057	N/A	Yes	Yes	(7)
Aroclor 1260	mg/kg	0	37	0%	- -	- -	N/A	Yes	No	(2)
Radionuclides										
Actinium-227	pCi/g	0	0	0%	- -	- -	NO	Yes	No	(2)
Actinium-228	pCi/g	43	49	88%	1.1	2.95	NO	Yes	No	(6)(19)
Bismuth-210	pCi/g	12	12	100%	0.1	1.5	YES	Yes	Yes	(18)
Bismuth-211	pCi/g	0	0	0%	- -	- -	NO	Yes	No	(2)
Bismuth-212	pCi/g	5	49	10%	1.07	1.42	NO	Yes	No	(6)(19)
Bismuth-214	pCi/g	22	49	45%	0.94	1.75	YES	Yes	Yes	(18)
Cobalt-57	pCi/g	0	37	0%	- -	- -	NO	Yes	No	(2)
Cobalt-60	pCi/g	0	37	0%	- -	- -	NO	Yes	No	(2)
Lead-210	pCi/g	3	49	6%	1.5	2.31	YES	Yes	Yes	(18)
Lead-212	pCi/g	49	49	100%	0.727	2.85	NO	Yes	No	(6)(19)

TABLE 4
CHEMICALS OF POTENTIAL CONCERN (COPC) SELECTION
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

Chemical	Units	Number of Detects	Total Count	Det %	Minimum Detect	Maximum Detect	Greater than Background?	PBT[(1)] or Class A Carcinogen?	COPC?	Rationale
Lead-214	pCi/g	49	49	100%	0.708	2.6	YES	Yes	Yes	(18)
Polonium-210	pCi/g	12	12	100%	0.1	1.5	YES	Yes	Yes	(18)
Polonium-212	pCi/g	12	12	100%	0.38	0.91	NO	Yes	No	(6)(19)
Polonium-214	pCi/g	12	12	100%	0.94	1.58	YES	Yes	Yes	(18)
Polonium-216	pCi/g	12	12	100%	1.79	2.64	NO	Yes	No	(6)(19)
Polonium-218	pCi/g	12	12	100%	1.72	2.99	YES	Yes	Yes	(18)
Potassium-40	pCi/g	49	49	100%	9.44	30.8	NO	Yes	No	(6)
Protactinium-234	pCi/g	12	12	100%	1.19	1.7	YES	Yes	Yes	(18)
Radium-224	pCi/g	12	12	100%	3.3	8.7	NO	Yes	No	(6)(19)
Radium-226	pCi/g	49	49	100%	0.925	4.52	YES	Yes	Yes	(18)
Radium-228	pCi/g	45	49	92%	0.781	3.25	NO	Yes	No	(6)(19)
Radon-220	pCi/g	12	12	100%	1.79	2.64	NO	Yes	No	(6)(19)
Radon-222	pCi/g	12	12	100%	1.72	2.99	YES	Yes	Yes	(18)
Thallium-208	pCi/g	49	49	100%	0.234	1.02	NO	Yes	No	(6)(19)
Thorium-227	pCi/g	0	37	0%	- -	- -	NO	Yes	No	(2)
Thorium-228	pCi/g	49	49	100%	0.551	2.64	NO	Yes	No	(6)(19)
Thorium-230	pCi/g	49	49	100%	0.84	3.35	YES	Yes	Yes	(18)
Thorium-232	pCi/g	49	49	100%	0.549	2.64	NO	Yes	No	(6)(19)
Thorium-234	pCi/g	13	49	27%	1.19	2.3	YES	Yes	Yes	(16)(18)
Uranium-234	pCi/g	49	49	100%	0.557	3.69	YES	Yes	Yes	(18)
Uranium-235	pCi/g	33	49	67%	0.0192	0.24	NO	Yes	No	(6)(19)
Uranium-238	pCi/g	49	49	100%	0.575	2.73	YES	Yes	Yes	(9)
Semi-Volatile Organic Compounds										
1-Nonanal	mg/kg	1	21	5%	0.013	0.013	N/A	No	No	(4)
1,2,4,5-Tetrachlorobenzene	mg/kg	0	37	0%	- -	- -	N/A	No	No	(2)
2,4,5-Trichlorophenol	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
2,4,6-Trichlorophenol	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
2,4-Dichlorophenol	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
2,4-Dimethylphenol	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
2,4-Dinitrophenol	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
2,4-Dinitrotoluene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
2,6-Dinitrotoluene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
2-Chloronaphthalene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
2-Chlorophenol	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
2-Methylnaphthalene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)

TABLE 4
CHEMICALS OF POTENTIAL CONCERN (COPC) SELECTION
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Chemical	Units	Number of Detects	Total Count	Det %	Minimum Detect	Maximum Detect	Greater than Background?	PBT[(1)] or Class A Carcinogen?	COPC?	Rationale
2-Methylphenol	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
2-Nitroaniline	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
2-Nitrophenol	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
3,3'-Dichlorobenzidine	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
3-Methylphenol & 4-Methylphenol	mg/kg	0	37	0%	- -	- -	N/A	No	No	(2)
3-Nitroaniline	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
4-Bromophenyl phenyl ether	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
4-Chloro-3-methylphenol	mg/kg	0	37	0%	- -	- -	N/A	No	No	(2)
4-Chloroaniline	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
4-Chlorobenzenethiol	mg/kg	2	37	5%	0.3	1.5	N/A	No	Yes	(5)
4-Chlorophenyl phenyl ether	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
4-Chlorophenyl sulfone	mg/kg	0	37	0%	- -	- -	N/A	No	No	(2)
4-Nitroaniline	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
4-Nitrophenol	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Acetophenone	mg/kg	0	37	0%	- -	- -	N/A	No	No	(2)
Aniline	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Azobenzene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Benzenethiol	mg/kg	0	37	0%	- -	- -	N/A	No	No	(2)
Benzoic acid	mg/kg	5	49	10%	0.044	0.17	N/A	No	Yes	(5)
Benzyl alcohol	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
bis(2-Chloroethoxy)methane	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
bis(2-Chloroethyl) ether	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
bis(2-Chloroisopropyl) ether	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
bis(2-Ethylhexyl) phthalate	mg/kg	2	81	2%	0.036	0.046	N/A	No	No	(4)
Bis(p-chlorophenyl) disulfide	mg/kg	1	37	3%	26	26	N/A	No	No	(4)
Butyl benzyl phthalate	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Carbazole	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Cyclic octaatomic sulfur	mg/kg	3	3	100%	0.15	0.5	N/A	No	Yes	(5)
Dibenzofuran	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Diethyl phthalate	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Dimethyl phthalate	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Di-n-butyl phthalate	mg/kg	2	81	2%	0.064	2.3	N/A	No	No	(4)
Di-n-octyl phthalate	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Fluoranthene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Fluorene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)

TABLE 4
CHEMICALS OF POTENTIAL CONCERN (COPC) SELECTION
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	Units	Number of Detects	Total Count	Det %	Minimum Detect	Maximum Detect	Greater than Background?	PBT[(1)] or Class A Carcinogen?	COPC?	Rationale
Hexachlorobenzene	mg/kg	1	81	1%	0.072	0.072	N/A	Yes	Yes	(7)
Hexachlorobutadiene	mg/kg	0	101	0%	- -	- -	N/A	No	No	(2)
Hexachlorocyclopentadiene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Hexachloroethane	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Isophorone	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
N-(Hydroxymethyl)phthalimide	mg/kg	0	37	0%	- -	- -	N/A	No	No	(2)
Naphthalene	mg/kg	2	94	2%	0.03	0.034	N/A	No	No	(4)
N-hexadecanoic acid	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Nitrobenzene	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
N-Nitrosodi-n-propylamine	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
N-Nitrosodiphenylamine	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
O,o'-diethyl s-methyl thiophos	mg/kg	1	1	100%	0.61	0.61	N/A	No	Yes	(5)
Octachlorostyrene	mg/kg	0	37	0%	- -	- -	N/A	Yes	No	(2)
p-Chlorothiophenol	mg/kg	2	37	5%	0.3	1.5	N/A	Yes	Yes	(5)
Pentachlorobenzene	mg/kg	1	37	3%	0.088	0.088	N/A	No	No	(4)
Pentachlorophenol	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Phenol	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
Phenyl disulfide	mg/kg	0	37	0%	- -	- -	N/A	No	No	(2)
Phenyl sulfide	mg/kg	0	37	0%	- -	- -	N/A	No	No	(2)
Phenyl sulfone	mg/kg	0	37	0%	- -	- -	N/A	No	No	(2)
Phthalic acid	mg/kg	0	36	0%	- -	- -	N/A	No	No	(2)
Phosphorothioic acid, s-[2-[(1	mg/kg	1	1	100%	7.7	7.7	N/A	No	Yes	(5)
Pyridine	mg/kg	0	81	0%	- -	- -	N/A	No	No	(2)
S-methyl methanethiosulphonate	mg/kg	1	1	100%	0.74	0.74	N/A	No	Yes	(5)
Total Petroleum Hydrocarbons										
TPH (as Diesel)	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
TPH (as Motor Oil)	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Volatile Petroleum Hydrocarbons	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,1,1-Trichloroethane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,1,2,2-Tetrachloroethane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,1,2-Trichloro-1,2,2-trifluoroethane	mg/kg	0	21	0%	- -	- -	N/A	No	No	(2)
1,1,2-Trichloroethane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,1-Dichloroethane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,1-Dichloroethene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,1-Dichloropropene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,2,3-Trichlorobenzene	mg/kg	4	71	6%	0.0037	0.0058	N/A	No	Yes	(5)
1,2,3-Trichloropropane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,2,4-Trichlorobenzene	mg/kg	2	85	2%	0.0055	0.012	N/A	No	No	(4)

TABLE 4
CHEMICALS OF POTENTIAL CONCERN (COPC) SELECTION
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Chemical	Units	Number of Detects	Total Count	Det %	Minimum Detect	Maximum Detect	Greater than Background?	PBT[(1)] or Class A Carcinogen?	COPC?	Rationale
1,2,4-Trimethylbenzene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,2-Dibromo-3-chloropropane (DBCP)	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,2-Dichlorobenzene	mg/kg	0	85	0%	- -	- -	N/A	No	No	(2)
1,2-Dichloroethane	mg/kg	1	71	1%	0.0021	0.0021	N/A	No	No	(4)
1,2-Dichloropropane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,3,5-Trichlorobenzene	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
1,3,5-Trimethylbenzene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,3-Dichlorobenzene	mg/kg	0	85	0%	- -	- -	N/A	No	No	(2)
1,3-Dichloropropane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
1,4-Dichlorobenzene	mg/kg	0	85	0%	- -	- -	N/A	No	No	(2)
1-Hexanol, 2-ethyl-	mg/kg	0	0	0%	- -	- -	N/A	No	No	(5)
2-Chloroethyl vinyl ether	mg/kg	1	24	4%	0.0089	0.0089	N/A	No	No	(4)
2,2-Dichloropropane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
2-Butanone (MEK)	mg/kg	14	47	30%	0.004	0.06	N/A	No	Yes	(5)
2-Chlorotoluene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
2-Hexanone	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
2-Pentanone	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
3-Methylheptyl acetate	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
4-Chlorothioanisole	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
4-Chlorotoluene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
4-Isopropyltoluene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
4-Methyl-2-pentanone	mg/kg	1	58	2%	0.029	0.029	N/A	No	No	(4)
Acetic acid, 2-ethylhexyl este	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Acetone	mg/kg	24	73	33%	0.017	0.170	N/A	No	Yes	(5)
Acetonitrile	mg/kg	0	21	0%	- -	- -	N/A	No	No	(2)
Benzene	mg/kg	15	71	21%	0.0009	0.0026	N/A	Yes	Yes	(5)
Bromobenzene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Bromochloromethane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Bromodichloromethane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Bromoform	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Bromomethane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Carbon disulfide	mg/kg	17	71	24%	0.0008	0.014	N/A	No	Yes	(5)
Carbon tetrachloride	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Chlorobenzene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Chlorodibromomethane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Chloroethane	mg/kg	5	71	7%	- -	- -	N/A	No	Yes	(5)
Chloroform	mg/kg	6	71	8%	0.0009	0.02	N/A	No	Yes	(5)
Chloromethane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
cis-1,2-Dichloroethene	mg/kg	0	161	0%	- -	- -	N/A	No	No	(2)
cis-1,3-Dichloropropene	mg/kg	1	71	1%	0.0056	0.0056	N/A	No	No	(4)

TABLE 4
CHEMICALS OF POTENTIAL CONCERN (COPC) SELECTION
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Chemical	Units	Number of Detects	Total Count	Det %	Minimum Detect	Maximum Detect	Greater than Background?	PBT[(1)] or Class A Carcinogen?	COPC?	Rationale
Cyclohexane	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Cyclohexanone	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Cyclotetrasiloxane, octamethyl	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Cyclotrisiloxane, hexamethyl-	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Dibromomethane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Dichlorodifluoromethane	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Ethanol	mg/kg	0	21	0%	- -	- -	N/A	No	No	(2)
Ethyl acetate	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Ethylbenzene	mg/kg	14	72	19%	0.0008	0.064	N/A	No	Yes	(5)
Hexanal	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Hexane	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Iodomethane	mg/kg	2	71	3%	0.0029	0.0037	N/A	No	No	(4)
Isopropylbenzene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Methyl Cyclohexane	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Methyl n-butyl ketone	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
Methyl tert-butyl ether	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Methylene chloride	mg/kg	10	77	13%	0.011	0.021	N/A	No	Yes	(5)
m-Xylene & p-Xylene	mg/kg	12	71	17%	0.0008	0.0028	N/A	No	Yes	(5)
n-Butylbenzene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
n-Propylbenzene	mg/kg	0	0	0%	- -	- -	N/A	No	No	(2)
o-Xylene	mg/kg	2	71	3%	0.0010	0.097	N/A	No	No	(4)
sec-Butylbenzene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Styrene	mg/kg	1	71	1%	0.0006	0.0006	N/A	No	No	(4)
tert-Butylbenzene	mg/kg	0	71	0%	- -	- -	N/A	No	No	(2)
Tetrachloroethene	mg/kg	0	161	0%	- -	- -	N/A	No	No	(2)
Toluene	mg/kg	19	71	27%	0.002	0.01	N/A	No	Yes	(5)
trans-1,2-Dichloroethene	mg/kg	0	161	0%	- -	- -	N/A	No	No	(2)
trans-1,3-Dichloropropene	mg/kg	0	161	0%	- -	- -	N/A	No	No	(2)
Trichloroethene	mg/kg	0	161	0%	- -	- -	N/A	No	No	(2)
Trichlorofluoromethane	mg/kg	2	71	3%	0.015	0.018	N/A	No	No	(4)
Vinyl acetate	mg/kg	0	53	0%	- -	- -	N/A	No	No	(2)
Vinyl chloride	mg/kg	0	71	0%	- -	- -	N/A	Yes	No	(2)
Xylenes (total)	mg/kg	8	21	38%	0.0024	0.0035	N/A	No	No	(8)

µg/kg - micrograms per kilogram
mg/kg - milligrams per kilogram
MF/g - microfibers per gram
pg/g - picograms per gram
pCi/g - picoCuries per gram
N/A - Data are not available for this chemical in the background data set. Background comparison was not applicable for this chemica
- - = Not detected.
Highlight indicates selected as COPC.
(1) Persistent, Bioaccumulative, and Toxic (PBT) Program
(2) Not detected.
(3) Dioxin congeners are not evaluated separately. Dioxins are evaluated as Total Dioxin TEQs

TABLE 4
CHEMICALS OF POTENTIAL CONCERN (COPC) SELECTION
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Chemical	Units	Number of Detects	Total Count	Det %	Minimum Detect	Maximum Detect	Greater than Background?	PBT[(1)] or Class A Carcinogen?	COPC?	Rationale

(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) Xylenes are evaluated as individual xylene isomers (ortho-, meta-, and para-) data instead of total xylene data
(9) Chemical concentrations are above background
(10) Individual dioxin/furan congeners are considered as COPCs and are evaluated further as TCDD Equivalents
(11) One detection limit for dioxin/furan congeners was above the screening level of 50 ppt.
(12) Considered a COPC based upon the following lines of evidence: although cadmium detection limits (DLs) appear similar between the two datasets, the proportion of detects is much greater for the site data. Furthermore, several of the statistical tests results are marginally above the acceptable p values (Wilcoxon rank sum test, slippage test) or below (t-test).
(13) Chemical not detected in background samples and was detected in almost 30% of the site samples. Furthermore, statistical analysis of the two datasets does not support the conclusion that the two datasets are comparable.
(14) Not considered a COPC because chemical was detected in very few site related samples (1%) compared to background (35%), and the plots in Appendix E suggest that most of the site sample DLs for non-detects are lower than those for the background data set. Furthermore, statistical analysis supports the conclusion that the two datasets are comparable.
(15) Chemical not detected in background samples and was detected in 25% of the site samples. Furthermore, elevated site detection limits coupled with significant overlap (range) of the detection limits for non-detected results renders meaningful statistical comparisons to background difficult. The chemical is therefore selected as a COPC.
(16) U-238 and Pr-234 are greater than background; if secular equilibrium is assumed, then Th-234 must also subsequently be above background. The detection limits for the site and background datasets are sufficiently different (higher for site samples) such that elevated but non-detected Th-234 concentrations may be masked. Th-234 is selected as a COPC.
(17) Po-218, Pb-214, Po-214 are greater than background; if secular equilibrium is assumed, Bi-214 must also be above background. Bi-214 is selected as a COPC.
(18) U-238 was determined to be above background, and the range of activities for all of the radionuclides in this decay chain are similar. If secular equilibrium is assumed it is be concluded the radionuclides in the U-238 chain (Th-234, Pa-234, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210, Pb-206) may be greater than background and are selected as COPCs.
(19) Th-232 and Ac-228 were determined to be consistent with background, as was Th-228 with the exception of the slippage test. Plots of the data suggest the conclusion Th-228 is similar to background. Therefore, if secular equilibrium is assumed, it is also concluded the radionuclides in the Th-232 decay chain (Ra-224, Ra-228, Rn-220, Po-216, Pb-212, Bi-212, Po-212, Tl-208) are similar to background and are not retained as COPCs.

TABLE 5
EXPOSURE POINT CONCENTRATIONS
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(Page 1 of 3)

Chemical	Number of Samples	Number of Detections	Percent Detected	Minimum DL	Maximum DL	Minimum Detection	Maximum Detection	Average	Standard Deviation	Distribution	95% UCL	EPC	EPC Basis
Dioxins / Furans													
TCDD Equivalents	37	11	30%	2.2 E-7	3.2 E-5	4.7 E-7	2.0 E-5	3.6 E-6	6.6 E-6	Non-Normal	6.0 E-6	6.0 E-6	Bootstrap using 1/2 DL
Inorganics													
Arsenic	80	80	100%	- -	- -	1.9	25	7.0	5.3	Non-Normal	8.2	8.2	Bootstrap using DL
Beryllium	80	65	81%	0.47	0.53	0.27	1.1	0.53	0.18	Non-Normal	0.57	0.57	Bootstrap using DL
Boron	48	19	40%	5.1	83	6.7	32	13	14	Non-Normal	18	18	Bootstrap using DL
Cadmium	80	48	60%	0.46	0.53	0.034	0.32	0.25	0.21	Non-Normal	0.29	0.29	Bootstrap using DL
Calcium	48	48	100%	- -	- -	3170	692000	71440	117600	Non-Normal	113300	113300	Bootstrap using 1/2 DL
Chromium (Total)	80	79	99%	6.4	6.4	2.8	110	12	13	Non-Normal	16	16	Bootstrap using 1/2 DL
Lithium	48	46	96%	12	83	7.9	62	22	15	Non-Normal	26	26	Bootstrap using DL
Magnesium	80	80	100%	- -	- -	4110	36500	9217	6458	Non-Normal	10570	10570	Bootstrap using DL
Molybdenum	80	76	95%	0.47	8.3	0.33	5.9	0.92	1.1	Non-Normal	1.21	1.2	Bootstrap using DL
Nickel	80	80	100%	- -	- -	5.0	72	28	20	Non-Normal	31	31	Bootstrap using DL
Niobium	48	14	29%	2.5	41	0.40	2.0	5.0	7.8	Non-Normal	7.3	7.3	Bootstrap using DL
Palladium	48	48	100%	- -	- -	0.14	1.6	0.57	0.31	Non-Normal	0.65	0.65	Bootstrap using 1/2 DL
Phosphorus	48	48	100%	- -	- -	297	2340	1189	426	Normal	1292	1292	Normal 95% UCL
Perchlorate	88	56	64%	0.040	0.40	0.048	46	1.5	6.2	Non-Normal	3.5	3.5	Bootstrap using DL
Potassium	48	48	100%	- -	- -	1260	7300	2789	1190	Non-Normal	3129	3129	Bootstrap using DL
Silver	80	44	55%	0.46	83	0.052	0.70	3.4	13.1	Non-Normal	7.1	7.1	Bootstrap using DL
Sodium	48	48	100%	- -	- -	167	3770	1238	846	Non-Normal	1475	1475	Bootstrap using DL
Tin	48	48	100%	- -	- -	0.22	1.1	0.55	0.20	Non-Normal	0.60	0.60	Bootstrap using Random DL
Titanium	80	80	100%	- -	- -	271	1200	622	219	Non-Normal	664	664	Bootstrap using DL
Tungsten	76	19	25%	0.46	8.3	0.56	2.6	1.0	1.2	Non-Normal	1.4	1.4	Bootstrap using DL
Uranium	48	48	100%	- -	- -	0.54	4.6	1.5	0.89	Non-Normal	1.7	1.7	Bootstrap using DL
Vanadium	80	80	100%	- -	- -	14	78	36	14	Non-Normal	39	39	Bootstrap using DL
Zirconium	48	48	100%	- -	- -	65	497	227	89	Non-Normal	251	251	Bootstrap using 1/2 DL
Organochlorine Pesticides													
2,4'-DDD	48	2	4%	0.0017	0.0056	0.0053	0.12	0.0050	0.017	Non-Normal	0.013	0.013	Bootstrap using DL
2,4'-DDE	48	6	13%	0.0017	0.0056	0.0031	0.022	0.0032	0.0027	Non-Normal	0.0043	0.0043	Bootstrap using DL
4,4'-DDD	102	1	1%	0.0017	0.0056	0.0022	0.0022	0.0038	0.0014	Non-Normal	0.0041	0.0041	Bootstrap using DL
4,4'-DDE	102	10	10%	0.0017	0.0056	0.0017	0.063	0.0047	0.0057	Non-Normal	0.0065	0.0065	Bootstrap using DL
4,4'-DDT	102	13	13%	0.0017	0.0056	0.0018	0.062	0.0047	0.0057	Non-Normal	0.0063	0.0063	Bootstrap using DL
alpha-BHC	102	26	25%	0.0017	0.0056	0.0018	0.073	0.0073	0.011	Non-Normal	0.0097	0.010	Bootstrap using DL
beta-BHC	102	31	30%	0.0018	0.0056	0.0037	0.46	0.020	0.058	Non-Normal	0.036	0.036	Bootstrap using Random DL
delta-BHC	102	22	22%	0.0017	0.0056	0.0046	0.10	0.0082	0.014	Non-Normal	0.011	0.011	Bootstrap using DL
Dieldrin	102	1	1%	0.0017	0.0056	0.015	0.015	0.0039	0.0015	Non-Normal	0.0042	0.0042	Bootstrap using DL
gamma-BHC (Lindane)	102	16	16%	0.0017	0.0056	0.0050	0.022	0.0045	0.0027	Non-Normal	0.0051	0.0051	Bootstrap using DL
gamma-Chlordane	102	1	1%	0.0017	0.0056	0.011	0.011	0.0039	0.0015	Non-Normal	0.0042	0.0042	Bootstrap using DL

TABLE 5
EXPOSURE POINT CONCENTRATIONS
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Chemical	Number of Samples	Number of Detections	Percent Detected	Minimum DL	Maximum DL	Minimum Detection	Maximum Detection	Average	Standard Deviation	Distribution	95% UCL	EPC	EPC Basis
Organophosphorous Pesticides													
O,O,O-Triethyl phosphorothioate	37	2	5%	0.013	0.043	0.014	0.037	0.016	0.0079	Non-Normal	0.018	0.018	Bootstrap using DL
Herbicides													
2,4,5-TP	18	2	11%	0.0012	0.021	0.0011	0.0032	0.012	0.010	Non-Normal	0.015	0.015	Bootstrap using DL
Dicamba	18	2	11%	0.00060	0.042	0.0025	0.0028	0.023	0.020	Non-Normal	0.030	0.030	Bootstrap using DL
Dichlorprop	18	1	6%	0.00080	0.083	0.0016	0.0016	0.045	0.040	Non-Normal	0.062	0.062	Bootstrap using DL
Organic Acids													
Diethyl phosphorodithioic acid	4	4	100%	- -	- -	0.048	9.4	2.8	4.4	Non-Normal	7.2	7.2	Bootstrap using Random DL
Polychlorinated Biphenyls													
Aroclor 1254	37	1	3%	0.033	0.11	0.057	0.057	0.048	0.021	Non-Normal	0.054	0.054	Bootstrap using DL
Radionuclides													
Bismuth-210	12	12	100%	- -	- -	0.10	1.5	0.83	0.44	Normal	1.1	1.1	Normal 95% UCL
Bismuth-214	49	22	45%	0.25	0.68	0.94	1.8	0.76	0.46	Non-Normal	0.87	0.87	Bootstrap using DL
Lead-210	49	3	6%	0.10	40	1.5	2.3	8.0	10	Non-Normal	11	11	Bootstrap using DL
Lead-214	49	49	100%	- -	- -	0.71	2.6	1.4	0.31	Non-Normal	1.4	1.4	Bootstrap using Random DL
Polonium-210	12	12	100%	- -	- -	0.10	1.5	0.83	0.44	Normal	1.1	1.1	Normal 95% UCL
Polonium-214	12	12	100%	- -	- -	0.94	1.6	1.3	0.19	Normal	1.4	1.4	Normal 95% UCL
Polonium-218	12	12	100%	- -	- -	1.7	3.0	2.2	0.41	Normal	2.4	2.4	Normal 95% UCL
Protactinium-234	12	12	100%	- -	- -	1.2	1.7	1.5	0.14	Normal	1.6	1.6	Normal 95% UCL
Radium-226	49	49	100%	- -	- -	0.93	4.5	2.0	0.70	Non-Normal	2.2	2.2	Bootstrap using DL
Radon-222	12	12	100%	- -	- -	1.7	3.0	2.3	0.4	Normal	2.5	2.5	Normal 95% UCL
Thorium-230	49	49	100%	- -	- -	0.84	3.4	1.7	0.56	Non-Normal	1.8	1.8	Bootstrap using 1/2 DL
Thorium-234	49	13	27%	1.2	4.6	1.2	2.3	2.1	0.83	Non-Normal	2.3	2.3	Bootstrap using DL
Uranium-234	49	49	100%	- -	- -	0.56	3.7	1.6	0.61	Non-Normal	1.8	1.8	Bootstrap using DL
Uranium-238	49	49	100%	- -	- -	0.58	2.7	1.4	0.47	Normal	1.5	1.5	Normal 95% UCL
Semi-Volatile Organic Compounds													
Benzoic Acid	49	5	10%	0.33	5.3	0.044	0.17	2.1	1.2	Non-Normal	2.4	2.4	Bootstrap using DL
Cyclic octaatomic sulfur	3	3	100%	- -	- -	0.15	0.50	NA	NA	NA	0.50	0.50	Max Value
p-Chlorothiophenol	37	2	5.4%	0.33	1.1	0.30	1.5	0.54	0.26	Non-Normal	0.63	0.63	Bootstrap using DL
O,o'-diethyl s-methyl thiophos	1	1	100%	- -	- -	0.61	0.61	NA	NA	NA	0.61	0.61	Max Value
Hexachlorobenzene	81	1	1%	0.33	1.1	0.072	0.072	0.43	0.17	Non-Normal	0.46	0.46	Bootstrap using DL
Phosphorothioic acid, s-[2-[(1	1	1	100%	- -	- -	7.7	7.7	NA	NA	NA	7.7	7.7	Max Value
S-methyl methanethiosulphonate	1	1	100%	- -	- -	0.74	0.74	NA	NA	NA	0.74	0.74	Max Value
Volatile Organic Compounds													
1,2,3-Trichlorobenzene	71	4	6%	0.0050	0.62	0.0037	0.0058	0.024	0.072	Non-Normal	0.058	0.058	Bootstrap using DL
2-Butanone (MEK)	47	14	30%	0.025	0.066	0.0038	0.057	0.020	0.011	Non-Normal	0.023	0.023	Bootstrap using DL
Acetone	73	24	33%	0.025	0.62	0.017	0.17	0.040	0.073	Non-Normal	0.067	0.067	Bootstrap using DL
Benzene	71	15	21%	0.0050	0.12	0.00089	0.0026	0.0062	0.014	Non-Normal	0.011	0.011	Bootstrap using DL

TABLE 5
EXPOSURE POINT CONCENTRATIONS
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Chemical	Number of Samples	Number of Detections	Percent Detected	Minimum DL	Maximum DL	Minimum Detection	Maximum Detection	Average	Standard Deviation	Distribution	95% UCL	EPC	EPC Basis
Carbon disulfide	71	17	24%	0.0050	0.12	0.00075	0.014	0.0064	0.014	Non-Normal	0.011	0.011	Bootstrap using DL
Chloroethane	71	5	7%	0.0050	0.12	0.0026	0.0067	0.0076	0.014	Non-Normal	0.014	0.014	Bootstrap using DL
Chloroform	71	6	8%	0.0050	0.12	0.00085	0.019	0.0075	0.014	Non-Normal	0.012	0.012	Bootstrap using DL
Ethylbenzene	72	14	19%	0.0050	0.12	0.00076	0.064	0.0080	0.015	Non-Normal	0.013	0.013	Bootstrap using DL
Methylene chloride	77	10	13%	0.0050	0.25	0.011	0.021	0.013	0.027	Non-Normal	0.022	0.022	Bootstrap using DL
m-Xylene & p-Xylene	71	12	17%	0.0050	0.25	0.00080	0.0028	0.011	0.029	Non-Normal	0.022	0.022	Bootstrap using DL
Toluene	71	19	27%	0.0050	0.12	0.0016	0.0067	0.0064	0.014	Non-Normal	0.011	0.011	Bootstrap using DL

Note: Exposure point concentrations were calculated using GISdT® (Neptune and Company 2007).

EPC - Exposure point concentration.

NA - Statistic not evaluated because number of samples was three or less.

ND - Statistic not evaluated because all results were non-detect.

Units are in mg/kg or pCi/g.

TABLE 6
OUTDOOR AIR EXPOSURE POINT CONCENTRATIONS
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	Construction Worker Outdoor Air			Maintenance Worker/Trespasser Outdoor Air		
Chemical	**Soil Conc. (mg/kg)**	**PEF/VF[1] (kg/m^3)**	**Air Conc.[2] (mg/m^3)**	**Soil Conc. (mg/kg)**	**PEF/VF[3] (kg/m^3)**	**Air Conc.[2] (mg/m^3)**
TCDD Equivalents	6.0 E-6	1.0 E-6	6.2 E-12	6.0 E-6	7.4 E-10	4.4 E-15
Inorganics						
Arsenic	8.2 E+0	1.0 E-6	8.5 E-6	8.2 E+0	7.4 E-10	6.1 E-9
Beryllium	5.7 E-1	1.0 E-6	5.9 E-7	5.7 E-1	7.4 E-10	4.2 E-10
Boron	1.8 E+1	1.0 E-6	1.8 E-5	1.8 E+1	7.4 E-10	1.3 E-8
Cadmium	2.9 E-1	1.0 E-6	3.0 E-7	2.9 E-1	7.4 E-10	2.1 E-10
Calcium	1.1 E+5	1.0 E-6	1.2 E-1	1.1 E+5	7.4 E-10	8.3 E-5
Chromium (Total)	1.6 E+1	1.0 E-6	1.7 E-5	1.6 E+1	7.4 E-10	1.2 E-8
Lithium	2.6 E+1	1.0 E-6	2.7 E-5	2.6 E+1	7.4 E-10	1.9 E-8
Magnesium	1.1 E+4	1.0 E-6	1.1 E-2	1.1 E+4	7.4 E-10	7.8 E-6
Molybdenum	1.2 E+0	1.0 E-6	1.3 E-6	1.2 E+0	7.4 E-10	8.9 E-10
Nickel	3.1 E+1	1.0 E-6	3.3 E-5	3.1 E+1	7.4 E-10	2.3 E-8
Niobium	7.3 E+0	1.0 E-6	7.6 E-6	7.3 E+0	7.4 E-10	5.4 E-9
Palladium	6.5 E-1	1.0 E-6	6.8 E-7	6.5 E-1	7.4 E-10	4.8 E-10
Perchlorate	3.5 E+0	1.0 E-6	3.7 E-6	3.5 E+0	7.4 E-10	2.6 E-9
Phosphorus	1.3 E+3	1.0 E-6	1.3 E-3	1.3 E+3	7.4 E-10	9.5 E-7
Potassium	3.1 E+3	1.0 E-6	3.2 E-3	3.1 E+3	7.4 E-10	2.3 E-6
Silver	7.1 E+0	1.0 E-6	7.4 E-6	7.1 E+0	7.4 E-10	5.2 E-9
Sodium	1.5 E+3	1.0 E-6	1.5 E-3	1.5 E+3	7.4 E-10	1.1 E-6
Tin	6.0 E-1	1.0 E-6	6.2 E-7	6.0 E-1	7.4 E-10	4.4 E-10
Titanium	6.6 E+2	1.0 E-6	6.9 E-4	6.6 E+2	7.4 E-10	4.9 E-7
Tungsten	1.4 E+0	1.0 E-6	1.4 E-6	1.4 E+0	7.4 E-10	1.0 E-9
Uranium	1.7 E+0	1.0 E-6	1.8 E-6	1.7 E+0	7.4 E-10	1.3 E-9
Vanadium	3.9 E+1	1.0 E-6	4.0 E-5	3.9 E+1	7.4 E-10	2.8 E-8
Zirconium	2.5 E+2	1.0 E-6	2.6 E-4	2.5 E+2	7.4 E-10	1.8 E-7
Organochlorine Pesticides						
2,4'-DDD	1.3 E-2	1.0 E-6	1.3 E-8	1.3 E-2	7.4 E-10	9.4 E-12
2,4'-DDE	4.3 E-3	1.0 E-6	4.5 E-9	4.3 E-3	7.4 E-10	3.2 E-12
4,4'-DDD	4.1 E-3	1.0 E-6	4.2 E-9	4.1 E-3	7.4 E-10	3.0 E-12
4,4'-DDE	6.5 E-3	1.0 E-6	6.8 E-9	6.5 E-3	7.4 E-10	4.8 E-12
4,4'-DDT	6.3 E-3	1.0 E-6	6.5 E-9	6.3 E-3	7.4 E-10	4.6 E-12
alpha-BHC	9.7 E-3	1.0 E-6	1.0 E-8	9.7 E-3	7.4 E-10	7.1 E-12
beta-BHC	3.6 E-2	1.0 E-6	3.7 E-8	3.6 E-2	7.4 E-10	2.6 E-11
delta-BHC	1.1 E-2	1.0 E-6	1.2 E-8	1.1 E-2	7.4 E-10	8.2 E-12
Dieldrin	4.2 E-3	1.0 E-6	4.3 E-9	4.2 E-3	7.4 E-10	3.1 E-12
gamma-BHC (Lindane)	5.1 E-3	1.0 E-6	5.2 E-9	5.1 E-3	7.4 E-10	3.7 E-12
gamma-Chlordane	4.2 E-3	1.0 E-6	4.4 E-9	4.2 E-3	7.4 E-10	3.1 E-12
Organophosphorous Pesticides						
O,O,O-Triethyl phosphorothioate	1.8 E-2	1.0 E-6	1.9 E-8	1.8 E-2	7.4 E-10	1.4 E-11
Herbicides						
2,4,5-TP	1.5 E-2	1.0 E-6	1.6 E-8	1.5 E-2	7.4 E-10	1.1 E-11
Dicamba	3.0 E-2	1.0 E-6	3.1 E-8	3.0 E-2	7.4 E-10	2.2 E-11
Dichlorprop	6.2 E-2	1.0 E-6	6.5 E-8	6.2 E-2	7.4 E-10	4.6 E-11
Organic Acids						
Diethyl phosphorodithioic acid	7.2 E+0	1.0 E-6	7.5 E-6	7.2 E+0	7.4 E-10	5.3 E-9
Polychlorinated Biphenyls						
Aroclor 1254	5.4 E-2	1.0 E-6	5.6 E-8	5.4 E-2	7.4 E-10	3.9 E-11

TABLE 6
OUTDOOR AIR EXPOSURE POINT CONCENTRATIONS
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	Construction Worker Outdoor Air			Maintenance Worker/Trespasser Outdoor Air		
Chemical	**Soil Conc. (mg/kg)**	**PEF/VF[1] (kg/m^3)**	**Air Conc.[2] (mg/m^3)**	**Soil Conc. (mg/kg)**	**PEF/VF[3] (kg/m^3)**	**Air Conc.[2] (mg/m^3)**
Semi-Volatile Organic Compounds						
Benzoic Acid	2.4 E+0	1.0 E-6	2.5 E-6	2.4 E+0	7.4 E-10	1.8 E-9
Cyclic octaatomic sulfur	5.0 E-1	1.0 E-6	5.2 E-7	5.0 E-1	7.4 E-10	3.7 E-10
p-Chlorothiophenol	6.3 E-1	1.0 E-6	6.5 E-7	6.3 E-1	7.4 E-10	4.6 E-10
O,o'-diethyl s-methyl thiophos	6.1 E-1	1.0 E-6	6.3 E-7	6.1 E-1	7.4 E-10	4.5 E-10
Hexachlorobenzene	4.6 E-1	1.0 E-6	4.8 E-7	4.6 E-1	7.4 E-10	3.4 E-10
Phosphorothioic acid, s-[2-[(1	7.7 E+0	1.0 E-6	8.0 E-6	7.7 E+0	7.4 E-10	5.7 E-9
S-methyl methanethiosulphonate	7.4 E-1	1.0 E-6	7.7 E-7	7.4 E-1	7.4 E-10	5.4 E-10
Volatile Organic Compounds						
1,2,3-Trichlorobenzene	5.8 E-2	2.1 E-5	1.2 E-6	5.8 E-2	2.1 E-5	1.2 E-6
2-Butanone (MEK)	2.3 E-2	3.7 E-4	8.5 E-6	2.3 E-2	3.7 E-4	8.5 E-6
Acetone	6.7 E-2	7.3 E-5	4.9 E-6	6.7 E-2	7.3 E-5	4.9 E-6
Benzene	1.1 E-2	3.4 E-4	3.8 E-6	1.1 E-2	3.4 E-4	3.8 E-6
Carbon disulfide	1.1 E-2	7.7 E-4	8.9 E-6	1.1 E-2	7.7 E-4	8.9 E-6
Chloroethane	1.4 E-2	7.0 E-4	9.6 E-6	1.4 E-2	7.0 E-4	9.6 E-6
Chloroform	1.2 E-2	3.5 E-4	4.3 E-6	1.2 E-2	3.5 E-4	4.3 E-6
Ethylbenzene	1.3 E-2	1.7 E-4	2.2 E-6	1.3 E-2	1.7 E-4	2.2 E-6
Methylene chloride	2.2 E-2	3.7 E-4	8.2 E-6	2.2 E-2	3.7 E-4	8.2 E-6
m-Xylene & p-Xylene	2.2 E-2	1.5 E-4	3.4 E-6	2.2 E-2	1.5 E-4	3.4 E-6
Toluene	1.1 E-2	2.3 E-4	2.7 E-6	1.1 E-2	2.3 E-4	2.7 E-6
Radionuclides						
	(pCi/g)		**(pCi/m^3)**	**(pCi/g)**		**(pCi/m^3)**
Bismuth-210	1.1 E+0	1.0 E-6	1.1 E-9	1.1 E+0	7.4 E-10	7.8 E-13
Bismuth-214	8.7 E-1	1.0 E-6	9.1 E-10	8.7 E-1	7.4 E-10	6.4 E-13
Lead-210	1.1 E+1	1.0 E-6	1.2 E-8	1.1 E+1	7.4 E-10	8.3 E-12
Lead-214	1.4 E+0	1.0 E-6	1.5 E-9	1.4 E+0	7.4 E-10	1.1 E-12
Polonium-210	1.1 E+0	1.0 E-6	1.1 E-9	1.1 E+0	7.4 E-10	7.8 E-13
Polonium-214	1.4 E+0	1.0 E-6	1.4 E-9	1.4 E+0	7.4 E-10	1.0 E-12
Polonium-218	2.4 E+0	1.0 E-6	2.5 E-9	2.4 E+0	7.4 E-10	1.8 E-12
Protactinium-234	1.6 E+0	1.0 E-6	1.6 E-9	1.6 E+0	7.4 E-10	1.1 E-12
Radium-226	2.2 E+0	1.0 E-6	2.3 E-9	2.2 E+0	7.4 E-10	1.6 E-12
Radon-222	2.5 E+0	1.0 E-6	2.6 E-9	2.5 E+0	7.4 E-10	1.8 E-12
Thorium-230	1.8 E+0	1.0 E-6	1.9 E-9	1.8 E+0	7.4 E-10	1.3 E-12
Thorium-234	2.3 E+0	1.0 E-6	2.4 E-9	2.3 E+0	7.4 E-10	1.7 E-12
Uranium-234	1.8 E+0	1.0 E-6	1.8 E-9	1.8 E+0	7.4 E-10	1.3 E-12
Uranium-238	1.5 E+0	1.0 E-6	1.6 E-9	1.5 E+0	7.4 E-10	1.1 E-12
Asbestos						
Chysotile	**(10^6 s/gPM$_{10}$)**		**(s/cm^3)**	**(10^6 s/gPM$_{10}$)**		**(s/cm^3)**
Best Estimate	2.7 E-1	1.0 E-6	2.8 E-4	2.7 E-1	7.4 E-10	2.0 E-7
Upper Bound	6.9 E-1	1.0 E-6	7.1 E-4	6.9 E-1	7.4 E-10	5.1 E-7
Amphibole						
Best Estimate	0.0 E+0	1.0 E-6	0.0 E+0	0.0 E+0	7.4 E-10	0.0 E+0
Upper Bound	2.7 E-1	1.0 E-6	2.8 E-4	2.7 E-1	7.4 E-10	2.0 E-7

(1) From Appendix F; Table F-3.

(2) For non-rads, soil concentration × PEF (or VF). For rads, soil concentration (pCi/g)/1000 mg/g × PEF
For asbestos, soil concentration × PEF × 1000 ug/cm^3.

(3) From Appendix F; Table F-2.

TABLE 7
DETERMINISTIC EXPOSURE FACTORS - CONSTRUCTION WORKERS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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Parameter	Abbrev.	Value	Units	Reference
Dermal absorption fraction	ABS	---See Table 10---		USEPA 2004e
Dermal adherence factor, soil	AF_s	0.3	mg/cm^2	USEPA 2002a
Averaging time, carcinogenic	AT_c	70	years	USEPA 2002a
Averaging time, non-carcinogenic	AT_{nc}	1	years	Based on ED_{cw}
Adult body weight	BW_a	70	kg	USEPA 2002a
Exposure frequency, soil	$EF_{s,cw}$	250	days/year	USEPA 2002a
Exposure frequency, dust	$EF_{s,cw}$	250	days/year	USEPA 2002a
Exposure frequency, volatiles	$EF_{s,cw}$	250	days/year	USEPA 2002a
Exposure duration	ED_{cw}	1	years	(1)
Exposure time	ET_{cw}	8	hrs/day	(2)
Adult inhalation rate	$IR_{a'}$	20	m^3/day	USEPA 2002a
Construction worker exposed surface area, soil	$SA_{cw,s}$	3,300	cm^2/day	USEPA 2002a
Construction worker soil ingestion rate	$IR_{s,cw}$	330	mg/day	USEPA 2002a
Radionuclide-specific factors				
Exposure time fraction, indoors	ET_i	0	unitless	(2)
Exposure time fraction, outdoors	ET_o	0.33	unitless	(2)
Area correction factor	ACF_{cw}	0.9	unitless	USEPA 2000, 2007b
Gamma shielding factor	GSF	0.4	unitless	USEPA 2000, 2007b

(1) Based on site data. A one-year exposure duration is appropriate for carcinogenic effects, because the methodology averages exposures over a lifetime (see USEPA 2002a).

(2) Assumes worker spends 100% of time outdoors, 8 hours a day. ET of 8 hrs is used for both the radiological and asbestos risk calculations.

TABLE 8
DETERMINISTIC EXPOSURE FACTORS - MAINTENANCE WORKERS[(1)]
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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Parameter	Abbrev.	Value	Units	Reference
Dermal absorption fraction	ABS	---See Table 10---		USEPA 2004e
Maintenance worker dermal adherence factor	AF_{mw}	0.2	mg/cm^2	USEPA 2002a
Averaging time, carcinogenic	AT_c	70	years	USEPA 2002a
Averaging time, non-carcinogenic	AT_{nc}	25	years	Based on ED_{mw}
Adult body weight	BW_a	70	kg	USEPA 2002a
Maintenance worker exposure frequency	EF_{mw}	225	days/year	USEPA 2002a
Exposure duration	ED	25	years	USEPA 2002a
Exposure time	ET_{mw}	8	hrs/day	(2)
Adult inhalation rate	$IR_{a'}$	20	m^3/day	USEPA 2002a
Maintenance worker exposed surface area	SA_{mw}	3,300	cm^2/day	USEPA 2002a
Maintenance worker soil ingestion rate	$IR_{s,mw}$	100	mg/day	USEPA 2002a
Radionuclide-specific factors				
Maintenance worker exposure time fraction, indoors	$ET_{mw,i}$	0	unitless	(2)
Maintenance worker exposure time fraction, outdoors	$ET_{mw,o}$	0.33	unitless	(2)
Maintenance worker area correction factor	ACF_{cw}	0.9	unitless	USEPA 2000, 2007b
Maintenance worker gamma shielding factor	GSF	0.4	unitless	USEPA 2000, 2007b

(1) Exposure parameters for maintenance workers are based on outdoor worker exposure factors from USEPA (2002a).

(2) Assumes worker spends 100% of time outdoors, 8 hours a day. ET of 8 hrs is used for both the radiological and asbestos risk calculations.

TABLE 9
DETERMINISTIC EXPOSURE FACTORS - TRESPASSER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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Parameter	Abbrev.	Value	Units	Reference
Dermal absorption fraction	ABS	---See Table 10---		USEPA 2004e
Trespasser dermal adherence factor	AFt	0.2	mg/cm^2	USEPA 2002a
Averaging time, carcinogenic	ATc	70	years	USEPA 2002a
Averaging time, non-carcinogenic	ATnc	6	years	Based on EDt
Trespasser body weight	BWt	60.2	kg	USEPA 1997a
Trespasser exposure frequency	EFt	50	days/year	Professional judgment
Trespasser exposure time	ET	4	hrs/day	(1)
Exposure duration	EDt	6	years	USEPA 1997a
Exposure time	ETt			
Trespasser inhalation rate	$IR_{t'}$	1.2	m^3/hr	USEPA 1997a
Trespasser inhalation rate	$IR_{a'}$	4.80	m^3/day	(1)
Trespasser exposed surface area[b]	SA_t	4,400	cm^2/day	USEPA 1997a, 2004e
Trespasser soil ingestion rate	IRs,t	100	mg/day	USEPA 1997a
Radionuclide-specific factors				
Trespasser exposure fraction, outdoors	ETt,o	0.17	unitless	(1)
Trespasser exposure fraction, indoors	ETt,i	0	unitless	(1)
Trespasser area correction factor	ACFt	0.9	unitless	USEPA 2000, 2007b
Trespasser gamma shielding factor	GSF	0.4	unitless	USEPA 2000, 2007b

[a]Assumes a teenager from 13 to 19 years of age. Age-specific exposure factors reflect this age range (that is, body weight, inhalation rate, exposure surface area, and ingestion rate).

[b]Average from 13 to 19 years of age for head, forearms, hands, and lower legs.

(1) Assumes trespasser spends 100% of time outdoors, 4 hours a day. ET of 4 hrs is used for both the radiological and asbestos risk calculations.

TABLE 10
NON-CARCINOGENIC TOXICITY CRITERIA
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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		Inhalation - Chronic		Inhalation - Subchronic		Oral[1] - Chronic		Oral[1] - Subchronic					
Chemical	CAS Number	Value	Reference	Value	Reference	Value	Reference			Oral BIO	Dermal ABS[2]	% GI ABS	Dermal Chronic Value
Non-Carcinogenic (mg/kg-day)													
Inorganics													
Arsenic	7440-38-2	3.0 E-4	route-to-route	3.0 E-4	Chronic	3.0 E-4	USEPA 2007c	3.0 E-4	USEPA 1997b	0.3	0.03		
Asbestos	1332-21-4	see text		NA		see text				--	--		
Beryllium	7440-41-7	5.7 E-6	USEPA 2007c	5.7 E-6	Chronic	2.0 E-3	USEPA 2007c	5.0 E-3	USEPA 1997b	1.0	NA		
Boron	7440-42-8	5.7 E-3	USEPA 1997b	NA		2.0 E-1	USEPA 2007c	2.0 E-1	Chronic	1.0	NA		
Cadmium	7440-43-9	1.0 E-3	route-to-route	1.0 E-3	Chronic	1.0 E-3	USEPA 2007c	1.0 E-3	Chronic	1.0	0.001	2.5%	2.5 E-5
Calcium	7440-70-2	NA		NA		NA		NA		1.0	NA		
Chromium (Total)	16065-83-1	1.5 E+0	route-to-route	1.5 E+0	Chronic	1.5 E+0	USEPA 2007c[3]	1.5 E+0	USEPA 1997b	1.0	NA		
Lithium	7439-93-2	2.0 E-2	route-to-route	2.0 E-2	Chronic	2.0 E-2	withdrawn by EPA	2.0 E-2	Chronic	1.0	NA		
Magnesium	7439-95-4	NA		NA		NA		NA		1.0	NA		
Molybdenum	7439-98-7	5.0 E-3	route-to-route	5.0 E-3	Chronic	5.0 E-3	USEPA 2007c	5.0 E-3	USEPA 1997b	1.0	NA		
Nickel	7440-02-0	2.6 E-5	ATSDR 2004	5.7 E-5	ATSDR 2004	2.0 E-2	USEPA 2007c	2.0 E-2	USEPA 1997b	1.0	NA		
Niobium	7440-03-1	NA		NA		NA		NA		1.0	NA		
Palladium	7440-05-3	NA		NA		NA		NA		1.0	NA		
Phosphorus	7723-14-0	NA		NA		NA		NA		1.0	NA		
Perchlorate	14797-73-0	7.0 E-4	route-to-route	7.0 E-4	Chronic	7.0 E-4	USEPA 2007c	7.0 E-4	Chronic	1.0	NA		
Potassium	7440-09-7	NA		NA		NA		NA		1.0	NA		
Silver	7440-22-4	5.0 E-3	route-to-route	5.0 E-3	Chronic	5.0 E-3	USEPA 2007c	5.0 E-3	USEPA 1997b	1.0	NA		
Sodium	7440-23-5	NA		NA		NA		NA		1.0	NA		
Tin	7440-31-5	6.0 E-1	route-to-route	6.0 E-1	Chronic	6.0 E-1	USEPA 1997b	6.0 E-1	USEPA 1997b	1.0	NA		
Titanium	7440-32-6	8.6 E-3	NCEA	8.6 E-3	Chronic	4.0 E+0	NCEA	4.0 E+0	Chronic	1.0	NA		
Tungsten	7440-33-7	NA		NA		NA		NA		1.0	NA		
Uranium	7440-61-1	8.6 E-5	ATSDR 2004	1.1 E-4	ATSDR 2004	2.0 E-4	NCEA	2.0 E-3	ATSDR 2004	1.0	NA		
Vanadium	7440-62-2	NA		NA		1.0 E-3	NCEA	7.0 E-3	USEPA 1997b	1.0	NA		
Zirconium	14940-68-2	NA		NA		NA		NA		1.0	NA		
Organic Compounds													
1,2,3-Trichlorobenzene	87-61-6	1.0 E-3	,2,4-TCB as surrogate	1.0 E-3	Chronic	1.0 E-2	,2,4-TCB as surrogate	1.0 E-2	2,4-TCB as surroga	1.0	NA		
2,4'-DDD	53-19-0	NA		NA		NA		NA		1.0	0.03		
2,4'-DDE	3424-82-6	NA		NA		NA		NA		1.0	0.03		
4,4'-DDE	72-55-9	NA		NA		NA		NA		1.0	0.03		
4,4'-DDD	72-54-8	NA		NA		NA		NA		1.0	0.03		
4,4'-DDT	50-29-3	5.0 E-4	route-to-route	5.0 E-4	Chronic	5.0 E-4	USEPA 2007c	5.0 E-4	USEPA 1997b	1.0	0.03		
2,4,5-TP	93-72-1	8.0 E-3	route-to-route	8.0 E-3	Chronic	8.0 E-3	USEPA 2007c	8.0 E-3	USEPA 1997b	1.0	NA		
Acetone	67-64-1	9.0 E-1	route-to-route	8.8 E+0	ATSDR 2004	9.0 E-1	USEPA 2007c	1.0 E+0	USEPA 1997b	1.0	NA		
alpha-BHC	319-84-6	5.0 E-4	route-to-route	5.0 E-4	Chronic	5.0 E-4	NCEA	5.0 E-4	Chronic	1.0	0.04		
Aroclor 1254	11097-69-1	2.0 E-5	route-to-route	2.0 E-5	Chronic	2.0 E-5	USEPA 2007c	5.0 E-5	USEPA 1997b	1.0	0.14		

TABLE 10
NON-CARCINOGENIC TOXICITY CRITERIA
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		Inhalation - Chronic		Inhalation - Subchronic		Oral[1] - Chronic		Oral[1] - Subchronic					
Chemical	CAS Number	Value	Reference	Value	Reference	Value	Reference			Oral BIO	Dermal ABS[2]	% GI ABS	Dermal Chronic Value
Non-Carcinogenic (mg/kg-day)													
Benzene	71-43-2	8.6 E-3	USEPA 2007c	3.7 E-3	ATSDR 2004	4.0 E-3	USEPA 2007c	4.0 E-3	Chronic	1.0	NA		
Benzoic Acid	65-85-0	4.0 E+0	route-to-route	4.0 E+0	Chronic	4.0 E+0	USEPA 2007c	4.0 E+0	USEPA 1997b	1.0	0.10		
beta-BHC	319-85-7	2.0 E-4	route-to-route	2.0 E-4	Chronic	2.0 E-4	NCEA	6.0 E-4	ATSDR 2004	1.0	0.04		
Carbon Disulfide	75-15-0	2.0 E-1	USEPA 2007c	2.0 E-1	Chronic	1.0 E-1	USEPA 2007c	1.0 E-1	USEPA 1997b	1.0	NA		
Chloroethane	75-00-3	2.9 E+0	USEPA 2007c	2.9 E+0	Chronic	2.9 E+0	route-to-route	2.9 E+0	Chronic	1.0	NA		
Chloroform	67-66-3	1.4 E-2	NCEA	7.0 E-2	ATSDR 2004	1.0 E-2	USEPA 2007c	1.0 E-2	USEPA 1997b	1.0	NA		
Cyclic octaatomic sulfur	10544-50-0	NA		NA		NA		NA		1.0	0.1		
p-Chlorothiophenol	106-54-7	NA		NA		NA		NA		1.0	0.1		
delta-BHC	319-86-8	NA		NA		NA		NA		1.0	0.04		
Dicamba	1918-00-9	3.0 E-2	route-to-route	3.0 E-2	Chronic	3.0 E-2	USEPA 2007c	3.0 E-2	USEPA 1997b	1.0	NA		
Dichlorprop	120-36-5	8.0 E-3	route-to-route	8.0 E-2	Chronic	8.0 E-3	DBA[4] as surrogate	8.0 E-2	DBA[4] as surrogate	1.0	0.05		
Dieldrin	60-57-1	5.0 E-5	route-to-route	5.0 E-5	Chronic	5.0 E-5	USEPA 2007c	5.0 E-5	USEPA 1997b	1.0	NA		
Diethyl phosphorodithioic acid	298-06-6	NA		NA		NA		NA		1.0	NA		
Ethylbenzene	100-41-4	2.9 E-1	USEPA 2007c	2.9 E-1	Chronic	1.0 E-1	USEPA 2007c	1.0 E-1	Chronic	1.0	NA		
gamma-BHC (Lindane)	58-89-9	3.0 E-4	route-to-route	3.0 E-4	Chronic	3.0 E-4	USEPA 2007c	1.0 E-5	ATSDR 2004	1.0	0.04		
gamma-Chlordane	5103-74-2	2.0 E-4	USEPA 2007c	2.0 E-4	Chronic	5.0 E-4	USEPA 2007c	5.0 E-4	Chronic	1.0	0.04		
Hexachlorobenzene	118-74-1	8.0 E-4	route-to-route	8.0 E-4	Chronic	8.0 E-4	USEPA 2007c	4.0 E+0	Chronic	1.0	0.1		
Methylene chloride	75-09-2	8.6 E-1	USEPA 1997b	8.6 E-1	USEPA 1997b	6.0 E-2	USEPA 2007c	6.0 E-2	USEPA 1997b	1.0	NA		
2-Butanone (MEK)	78-93-3	1.4 E+0	USEPA 2007c	1.4 E+0	Chronic	6.0 E-1	USEPA 2007c	2.0 E+0	USEPA 1997b	1.0	NA		
TCDD Equivalents	various	NA		NA		1.0 E-9	ATSDR 2004	2.0 E-8	ATSDR 2004	1.0	0.03		
O,o'-diethyl s-methyl thiophos	100022-65-2	NA		NA		NA		NA		1.0	0.1		
Phosphorothioic acid, s-[2-[(1	3734-95-0	NA		NA		NA		NA		1.0	0.1		
Toluene	108-88-3	1.4 E+0	USEPA 2007c	2.6 E-1	PPRTV	8.0 E-2	USEPA 2007c	2.0 E+0	USEPA 1997b	1.0	NA		
S-methyl methanethiosulphonate	2949-92-0	NA		NA		NA		NA		1.0	0.1		
O,O,O-Triethyl phosphorothioate	78-30-8	NA		NA		NA		NA		1.0	NA		
m-Xylene & p-Xylene	136777-61-2	2.9 E-2	USEPA 2007c	2.9 E-2	Chronic	2.0 E-1	USEPA 2007c	2.0 E-1	Chronic	1.0	NA		

NA = Not applicable. Data is either not applicable for this chemical (*e.g.* , not carcinogenic) or not available.

BIO = bioavailability - NOTE: The basis for the arsenic oral bioavailability is presented in Section 6.3.2.

ABS = dermal absorption efficiency

PPRTV = Provisional Peer Reviewed Toxicity Values, National Center for Environmental Assessment (USEPA), as referenced in Region 9 PRG Table (USEPA 2004c).

NCEA = National Center for Environmental Assessment (USEPA), as referenced in Region 9 PRG Table (USEPA 2004c).

(1) Only cadmium required the adjustment of the oral toxicity criteria for the dermal soil exposure pathway (USEPA 2004e).

(2) Dermal absorption factors obtained from USEPA 2004e.

(3) Because Cr (VI) is analyzed for separately total chromium is assessed using Cr(III) toxicity criteria.

(4) DBA = 4-(2,4-Dichlorophenoxy)butyric acid

TABLE 11
CARCINOGENIC TOXICITY CRITERIA
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	CAS Number	Inhalation		Oral[1]		Cancer Weight of Evidence	Oral BIO	Dermal ABS[2]
		Value	Reference	Value	Reference			
		Carcinogenic (mg/kg-day)$^{-1}$						
Inorganics								
Arsenic	7440-38-2	1.5 E+1	USEPA 2007c	1.5 E+0	USEPA 2007c	A	0.3	0.03
Asbestos	1332-21-4	see text		see text		A	--	--
Beryllium	7440-41-7	8.4 E+0	USEPA 2007c	NA	USEPA 2007c[3]	B1	1.0	NA
Boron	7440-42-8	NA		NA		D	1.0	NA
Cadmium	7440-43-9	6.3 E+0	USEPA 2007c	NA		B1	1.0	0.001
Calcium	7440-70-2	NA		NA		D	1.0	NA
Chromium (Total)	16065-83-1	NA		NA		D	1.0	NA
Lithium	7439-93-2	NA		NA		D	1.0	NA
Magnesium	7439-95-4	NA		NA		D	1.0	NA
Molybdenum	7439-98-7	NA		NA		D	1.0	NA
Nickel	7440-02-0	NA		NA		D	1.0	NA
Niobium	7440-03-1	NA		NA		D	1.0	NA
Palladium	7440-05-3	NA		NA		D	1.0	NA
Phosphorus	7723-14-0	NA		NA		D	1.0	NA
Perchlorate	14797-73-0	NA		NA		D	1.0	NA
Potassium	7440-09-7	NA		NA		D	1.0	NA
Silver	7440-22-4	NA		NA		D	1.0	NA
Sodium	7440-23-5	NA		NA		D	1.0	NA
Tin	7440-31-5	NA		NA		D	1.0	NA
Titanium	7440-32-6	NA		NA		D	1.0	NA
Tungsten	7440-33-7	NA		NA		D	1.0	NA
Uranium	7440-61-1	NA		NA		D	1.0	NA
Vanadium	7440-62-2	NA		NA		D	1.0	NA
Zirconium	14940-68-2	NA		NA		D	1.0	NA
Organic Compounds								
1,2,3-Trichlorobenzene	87-61-6	NA		NA		D	1.0	NA
2,4'-DDD	53-19-0	2.4 E-1	route-to-route	2.4 E-1	4,4'-DDD as surrogat	B2	1.0	0.03
2,4'-DDE	3424-82-6	3.4 E-1	route-to-route	3.4 E-1	4,4'-DDE as surrogat	B2	1.0	0.03
4,4'-DDE	72-55-9	3.4 E-1	route-to-route	3.4 E-1	USEPA 2007c	B2	1.0	0.03
4,4'-DDD	72-54-8	2.4 E-1	route-to-route	2.4 E-1	USEPA 2007c	B2	1.0	0.03
4,4'-DDT	50-29-3	3.4 E-1	USEPA 2007c	3.4 E-1	USEPA 2007c	B2	1.0	0.03
2,4,5-TP	93-72-1	NA		NA		D	1.0	NA
Acetone	67-64-1	NA		NA		D	1.0	NA
alpha-BHC	319-84-6	6.3 E+0	USEPA 2007c	6.3 E+0	USEPA 2007c	B2	1.0	0.04
Aroclor 1254	11097-69-1	4.0 E-1	USEPA 2007c	2.0 E+0	USEPA 2007c	B2	1.0	0.14

TABLE 11
CARCINOGENIC TOXICITY CRITERIA
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	CAS Number	Inhalation		Oral[1]		Cancer Weight of Evidence	Oral BIO	Dermal ABS[2]
		Value	Reference	Value	Reference			
Carcinogenic (mg/kg-day)$^{-1}$								
Benzene	71-43-2	2.7 E-2	USEPA 2007c	5.5 E-2	USEPA 2007c	A	1.0	NA
Benzoic Acid	65-85-0	NA		NA		D	1.0	0.10
beta-BHC	319-85-7	1.8 E+0	USEPA 2007c	1.8 E+0	USEPA 2007c	C	1.0	0.04
Carbon Disulfide	75-15-0	NA		NA		D	1.0	NA
Chloroethane	75-00-3	NA		NA		D	1.0	NA
Chloroform	67-66-3	8.1 E-2	USEPA 2007c	NA		B2	1.0	NA
Cyclic octaatomic sulfur	10544-50-0	NA		NA		D	1.0	0.1
p-Chlorothiophenol	106-54-7	NA		NA		D	1.0	0.1
delta-BHC	319-86-8	NA		NA		D	1.0	NA
Dicamba	1918-00-9	NA		NA		D	1.0	NA
Dichlorprop	120-36-5	NA		NA		D	1.0	NA
Dieldrin	60-57-1	1.6 E+1	USEPA 2007c	1.6 E+1	USEPA 2007c	B2	1.0	NA
Diethyl phosphorodithioic acid	298-06-6	NA		NA		D	1.0	NA
Ethylbenzene	100-41-4	NA		NA		D	1.0	NA
gamma-BHC (Lindane)	58-89-9	1.3 E+0	route-to-route	1.3 E+0	USEPA 1997b	C/B2	1.0	0.04
gamma-Chlordane	5103-74-2	3.5 E-1	USEPA 2007c	3.5 E-1	USEPA 2007c	B2	1.0	0.04
Hexachlorobenzene	118-74-1	1.6 E+0	USEPA 2007c	1.6 E+0	USEPA 2007c	B2	1.0	0.1
Methylene chloride	75-09-2	1.6 E-3	USEPA 2007c	7.5 E-3	USEPA 2007c	B2	1.0	NA
2-Butanone (MEK)	78-93-3	NA		NA		D	1.0	NA
TCDD Equivalents	various	1.5 E+5	USEPA 1997b	1.5 E+5	USEPA 1997b	B2	1.0	0.03
O,o'-diethyl s-methyl thiophos	100022-65-2	NA		NA		D	1.0	0.1
Phosphorothioic acid, s-[2-[(1	3734-95-0	NA		NA		D	1.0	0.1
Toluene	108-88-3	NA		NA		D	1.0	NA
S-methyl methanethiosulphonate	2949-92-0	NA		NA		D	1.0	0.1
O,O,O-Triethyl phosphorothioate	78-30-8	NA		NA		D	1.0	NA
m-Xylene & p-Xylene	136777-61-2	NA		NA		D	1.0	NA

NA = Not applicable. Data is either not applicable for this chemical (*i.e.* , not carcinogenic) or not available.

Cancer weight of evidence classification:

A - human carcinogen
B1/B2 - probable human carcinogen
C - possible human carcinogen
D - not classifiable as to human carcinogenicity

BIO = bioavailability - NOTE: The basis for the arsenic oral bioavailability is presented in Section 6.3.2.

ABS = dermal absorption efficiency

NCEA = National Center for Environmental Assessment (USEPA), as referenced in Region 9 PRG Table (USEPA 2004c).

(1) No COPCs required oral toxicity criteria adjustment for the dermal soil exposure pathway (USEPA 2004e).

(2) Dermal absorption factors obtained from USEPA 2004e.

(3) Carcinogenic via inhalation only.

TABLE 12
RADIONUCLIDE TOXICITY CRITERIA
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

		Slope Factor						
Radionuclide	GI Absorption Fraction	Water Ingestion (Risk/pCi)	Food Ingestion (Risk/pCi)	Soil Ingestion (Risk/pCi)	Soil Ingestion - Adult (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/y per pCi/g)	Decay Constant[(1)]
Bismuth-210	0.05	8.90 E-12	1.30 E-11	2.55 E-11	3.74 E-12	3.17 E-10	2.76 E-09	5.1 E+1
Bismuth-214	0.05	1.92 E-13	2.65 E-13	4.33 E-13	1.47 E-13	2.90 E-11	7.48 E-06	1.8 E+4
Lead-210	0.2	1.27 E-09	3.44 E-09	2.66 E-09	2.04 E-09	1.39 E-08	4.21 E-09	3.1 E-2
Lead-214	0.2	3.44 E-13	4.85 E-13	8.51 E-13	2.21 E-13	3.63 E-11	9.82 E-07	1.4 E+4
Polonium-210	0.5/0.1	3.77 E-10	2.25 E-09	7.96 E-10	2.96 E-10	1.08 E-08	3.95 E-11	1.8 E+0
Polonium-214	NA	NA	NA	NA	NA	NA	3.86E-10	2.2 E+7
Polonium-218	NA	NA	NA	NA	NA	NA	4.26E-11	7.3 E+6
Protactinium-234	0.0005	2.56 E-12	3.70 E-12	7.03 E-12	1.20 E-12	1.46 E-12	8.71 E-06	2.2 E+7
Radium-226	0.2	3.86 E-10	5.15 E-10	7.30 E-10	2.95 E-10	1.16 E-08	8.49 E-06	4.3 E-4
Radon-222	NA	NA	NA	NA	NA	NA	1.74 E-09	6.3 E+1
Thorium-230	0.0005	9.10 E-11	1.19 E-10	2.02 E-10	7.73 E-11	2.85 E-08	8.19 E-10	9.0 E-6
Thorium-234	0.0005	2.31 E-11	3.40 E-11	6.70 E-11	9.51 E-12	3.07 E-11	1.63 E-08	1.0 E+1
Uranium-234	0.02	7.18 E-11	9.69 E-11	1.60 E-10	5.22 E-11	1.16 E-08	9.82 E-10	4.3 E-6
Uranium-238	0.02	8.71 E-11	1.21 E-10	2.10 E-10	5.62 E-11	9.35 E-09	1.14 E-07	1.6 E-10

Notes:

All values are from USEPA 2007b "Preliminary Remediation Goals for Radionuclides."

USEPA classifies all radionuclides as Group A (known human) carcinogens.

(+D) indicates that the risks from associated short-lived radioactive decay products (i.e., those decay products with radioactive half-lives less than or equal to six months) are also included.

(1) Decay Constant = 0.693/Half-Life.

TABLE 13
CHEMICAL RISK SUMMARY FOR THE FUTURE ON-SITE/OFF-SITE CONSTRUCTION WORKER
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BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Inhal HQ	Total HI	Oral ILCR	Dermal ILCR	Inhal ILCR	Total ILCR
				Dioxins / Furans					
TCDD Equivalents	6.0 E-6	9.7 E-4	8.7 E-5	NA	0.001	4 E-8	4 E-9	3 E-9	5 E-8
				Inorganics					
Arsenic	8.2 E+0	2.7 E-2	8.0 E-3	5.6 E-3	0.04	2 E-7	5 E-8	4 E-7	6 E-7
Beryllium	5.7 E-1	3.7 E-4	0.0 E+0	2.0 E-2	0.02	NA	NA	1 E-8	1 E-8
Boron	1.8 E+1	2.8 E-4	0.0 E+0	NA	0.0003	NA	NA	NA	NA
Cadmium	2.9 E-1	9.4 E-4	1.1 E-4	5.9 E-5	0.001	NA	NA	5 E-9	5 E-9
Calcium	1.1 E+5	NA	NA	NA	NA	NA	NA	NA	NA
Chromium (Total)	1.6 E+1	3.5 E-5	0.0 E+0	2.2 E-6	0.00004	NA	NA	NA	NA
Lithium	2.6 E+1	4.3 E-3	0.0 E+0	2.7 E-4	0.005	NA	NA	NA	NA
Magnesium	1.1 E+4	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	1.2 E+0	7.8 E-4	0.0 E+0	4.9 E-5	0.0008	NA	NA	NA	NA
Nickel	3.1 E+1	5.1 E-3	0.0 E+0	1.1 E-1	0.1	NA	NA	NA	NA
Niobium	7.3 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Palladium	6.5 E-1	NA	NA	NA	NA	NA	NA	NA	NA
Perchlorate	3.5 E+0	1.6 E-2	0.0 E+0	1.0 E-3	0.02	NA	NA	NA	NA
Potassium	3.1 E+3	NA	NA	NA	NA	NA	NA	NA	NA
Silver	7.1 E+0	4.6 E-3	0.0 E+0	2.9 E-4	0.005	NA	NA	NA	NA
Sodium	1.5 E+3	NA	NA	NA	NA	NA	NA	NA	NA
Tin	6.0 E-1	3.2 E-6	0.0 E+0	2.0 E-7	0.000003	NA	NA	NA	NA
Titanium	6.6 E+2	5.4 E-4	0.0 E+0	1.6 E-2	0.02	NA	NA	NA	NA
Tungsten	1.4 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Uranium	1.7 E+0	2.8 E-3	0.0 E+0	3.1 E-3	0.006	NA	NA	NA	NA
Vanadium	3.9 E+1	1.8 E-2	0.0 E+0	NA	0.02	NA	NA	NA	NA
Zirconium	2.5 E+2	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 13
CHEMICAL RISK SUMMARY FOR THE FUTURE ON-SITE/OFF-SITE CONSTRUCTION WORKER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Inhal HQ	Total HI	Oral ILCR	Dermal ILCR	Inhal ILCR	Total ILCR
Organochlorine Pesticides									
2,4'-DDD	1.3 E-2	NA	NA	NA	NA	1 E-10	1 E-11	9 E-12	2 E-10
2,4'-DDE	4.3 E-3	NA	NA	NA	NA	7 E-11	6 E-12	4 E-12	8 E-11
4,4'-DDD	4.1 E-3	NA	NA	NA	NA	5 E-11	4 E-12	3 E-12	5 E-11
4,4'-DDE	6.5 E-3	NA	NA	NA	NA	1 E-10	9 E-12	6 E-12	1 E-10
4,4'-DDT	6.3 E-3	4.1 E-5	3.7 E-6	2.6 E-6	0.00005	1 E-10	9 E-12	6 E-12	1 E-10
alpha-BHC	9.7 E-3	6.3 E-5	7.5 E-6	3.9 E-6	0.00007	3 E-9	3 E-10	2 E-10	3 E-9
beta-BHC	3.6 E-2	1.9 E-4	2.3 E-5	3.6 E-5	0.0003	3 E-9	4 E-10	2 E-10	3 E-9
delta-BHC	1.1 E-2	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	4.2 E-3	2.7 E-4	0.0 E+0	1.7 E-5	0.0003	3 E-9	0 E+0	2 E-10	3 E-9
gamma-BHC (Lindane)	5.1 E-3	1.6 E-3	2.0 E-4	3.4 E-6	0.002	3 E-10	4 E-11	2 E-11	4 E-10
gamma-Chlordane	4.2 E-3	2.7 E-5	3.3 E-6	4.3 E-6	0.00003	7 E-11	8 E-12	4 E-12	8 E-11
Herbicides									
O,O,O-Triethyl phosphorothio	1.8 E-2	NA	NA	NA	NA	NA	NA	NA	NA
Organophosphate Pesticides									
2,4,5-TP	1.5 E-2	6.2 E-6	0.0 E+0	3.9 E-7	0.000007	NA	NA	NA	NA
Dicamba	3.0 E-2	3.3 E-6	0.0 E+0	2.0 E-7	0.000003	NA	NA	NA	NA
Dichlorprop	6.2 E-2	2.5 E-6	3.8 E-7	1.6 E-7	0.000003	NA	NA	NA	NA
Organic Acids									
Diethyl phosphorodithioic acid	7.2 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Polychlorinated Biphenyls									
Aroclor 1254	5.4 E-2	3.5 E-3	1.5 E-3	5.4 E-4	0.005	5 E-9	2 E-9	6 E-11	7 E-9
Semi-Volatile Organic Compounds									
Benzoic Acid	2.4 E+0	1.9 E-6	5.8 E-7	1.2 E-7	0.0000026	NA	NA	NA	NA
Cyclic octaatomic sulfur	5.0 E-1	NA	NA	NA	NA	NA	NA	NA	NA
p-Chlorothiophenol	6.3 E-1	NA	NA	NA	NA	NA	NA	NA	NA
O,o'-diethyl s-methyl thiophos	6.1 E-1	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	4.6 E-1	3.7 E-7	1.1 E-7	1.2 E-4	0.0001	3 E-8	1 E-8	2 E-9	5 E-8
Phosphorothioic acid, s-[2-[(1	7.7 E+0	NA	NA	NA	NA	NA	NA	NA	NA
S-methyl methanethiosulphona	7.4 E-1	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 13
CHEMICAL RISK SUMMARY FOR THE FUTURE ON-SITE/OFF-SITE CONSTRUCTION WORKER
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Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Inhal HQ	Total HI	Oral ILCR	Dermal ILCR	Inhal ILCR	Total ILCR
Volatile Organic Compounds									
1,2,3-Trichlorobenzene	5.8 E-2	1.9 E-5	0.0 E+0	2.4 E-4	0.0003	NA	NA	NA	NA
2-Butanone (MEK)	2.3 E-2	3.7 E-8	0.0 E+0	1.2 E-6	0.000001	NA	NA	NA	NA
Acetone	6.7 E-2	2.2 E-7	0.0 E+0	1.1 E-7	0.0000003	NA	NA	NA	NA
Benzene	1.1 E-2	9.2 E-6	0.0 E+0	2.1 E-4	0.0002	3 E-11	0 E+0	3 E-10	3 E-10
Carbon disulfide	1.1 E-2	3.7 E-7	0.0 E+0	8.7 E-6	0.000009	NA	NA	NA	NA
Chloroethane	1.4 E-2	1.6 E-8	0.0 E+0	6.6 E-7	0.0000007	NA	NA	NA	NA
Chloroform	1.2 E-2	4.0 E-6	0.0 E+0	1.2 E-5	0.00002	NA	NA	1 E-9	1 E-9
Ethylbenzene	1.3 E-2	4.2 E-7	0.0 E+0	1.5 E-6	0.000002	NA	NA	NA	NA
Methylene chloride	2.2 E-2	1.2 E-6	0.0 E+0	1.9 E-6	0.000003	8 E-12	0 E+0	4 E-11	5 E-11
m-Xylene & p-Xylene	2.2 E-2	3.6 E-7	0.0 E+0	2.3 E-5	0.00002	NA	NA	NA	NA
Toluene	1.1 E-2	1.9 E-8	0.0 E+0	2.0 E-6	0.000002	NA	NA	NA	NA
Total		0.09	0.01	0.2	0.3	3 E-7	7 E-8	4 E-7	7 E-7

HQ = hazard quotient
HI - hazard index
ILCR = incremental lifetime cancer risk

TABLE 14
CHEMICAL RISK SUMMARY FOR THE FUTURE OFF-SITE MAINTENANCE WORKER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Inhal HQ	Total HI	Oral ILCR	Dermal ILCR	Inhal ILCR	Total ILCR
				Dioxins / Furans					
TCDD Equivalents	6.0 E-6	5.3 E-3	1.0 E-3	NA	0.006	3 E-7	6 E-8	4 E-11	3 E-7
				Inorganics					
Arsenic	8.2 E+0	7.2 E-3	4.8 E-3	4 E-6	0.01	1 E-6	8 E-7	6 E-9	2 E-6
Beryllium	5.7 E-1	2.5 E-4	0.0 E+0	1 E-5	0.0003	NA	NA	2 E-10	2 E-10
Boron	1.8 E+1	7.8 E-5	NA	4 E-7	0.00008	NA	NA	NA	NA
Cadmium	2.9 E-1	2.6 E-4	6.8 E-5	4 E-8	0.0003	NA	NA	8 E-11	8 E-11
Calcium	1.1 E+5	NA	NA	NA	NA	NA	NA	NA	NA
Chromium (Total)	1.6 E+1	9.6 E-6	0.0 E+0	1 E-9	0.00001	NA	NA	NA	NA
Lithium	2.6 E+1	1.2 E-3	0.0 E+0	2 E-7	0.001	NA	NA	NA	NA
Magnesium	1.1 E+4	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	1.2 E+0	2.1 E-4	0.0 E+0	3 E-8	0.0002	NA	NA	NA	NA
Nickel	3.1 E+1	1.4 E-3	0.0 E+0	2 E-4	0.002	NA	NA	NA	NA
Niobium	7.3 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Palladium	6.5 E-1	NA	NA	NA	NA	NA	NA	NA	NA
Perchlorate	3.5 E+0	4.5 E-3	0.0 E+0	7 E-7	0.004	NA	NA	NA	NA
Potassium	3.1 E+3	NA	NA	NA	NA	NA	NA	NA	NA
Silver	7.1 E+0	1.3 E-3	0.0 E+0	2 E-7	0.001	NA	NA	NA	NA
Sodium	1.5 E+3	NA	NA	NA	NA	NA	NA	NA	NA
Tin	6.0 E-1	8.8 E-7	0.0 E+0	1 E-10	0.0000009	NA	NA	NA	NA
Titanium	6.6 E+2	1.5 E-4	0.0 E+0	1 E-5	0.0002	NA	NA	NA	NA
Tungsten	1.4 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Uranium	1.7 E+0	7.7 E-3	0.0 E+0	3 E-6	0.008	NA	NA	NA	NA
Vanadium	3.9 E+1	3.4 E-2	0.0 E+0	NA	0.03	NA	NA	NA	NA
Zirconium	2.5 E+2	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 14
CHEMICAL RISK SUMMARY FOR THE FUTURE OFF-SITE MAINTENANCE WORKER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Inhal HQ	Total HI	Oral ILCR	Dermal ILCR	Inhal ILCR	Total ILCR
Organochlorine Pesticides									
2,4'-DDD	1.3 E-2	NA	NA	NA	NA	1 E-9	2 E-10	1 E-13	1 E-9
2,4'-DDE	4.3 E-3	NA	NA	NA	NA	5 E-10	9 E-11	7 E-14	6 E-10
4,4'-DDD	4.1 E-3	NA	NA	NA	NA	3 E-10	6 E-11	5 E-14	4 E-10
4,4'-DDE	6.5 E-3	NA	NA	NA	NA	7 E-10	1 E-10	1 E-13	8 E-10
4,4'-DDT	6.3 E-3	1.1 E-5	2.2 E-6	2 E-9	0.00001	7 E-10	1 E-10	1 E-13	8 E-10
alpha-BHC	9.7 E-3	1.7 E-5	4.5 E-6	3 E-9	0.00002	2 E-8	5 E-9	3 E-12	2 E-8
beta-BHC	3.6 E-2	1.6 E-4	4.1 E-5	2 E-8	0.0002	2 E-8	5 E-9	3 E-12	3 E-8
delta-BHC	1.1 E-2	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	4.2 E-3	7.4 E-5	0.0 E+0	1 E-8	0.00007	2 E-8	0 E+0	3 E-12	2 E-8
gamma-BHC (Lindane)	5.1 E-3	1.5 E-5	3.9 E-6	2 E-9	0.00002	2 E-9	5 E-10	3 E-13	3 E-9
gamma-Chlordane	4.2 E-3	7.4 E-6	2.0 E-6	3 E-9	0.000009	5 E-10	1 E-10	7 E-14	6 E-10
Herbicides									
O,O,O-Triethyl phosphorothio	1.8 E-2	NA	NA	NA	NA	NA	NA	NA	NA
Organophosphate Pesticides									
2,4,5-TP	1.5 E-2	1.7 E-6	0.0 E+0	3 E-10	0.000002	NA	NA	NA	NA
Dicamba	3.0 E-2	8.9 E-7	0.0 E+0	1 E-10	0.0000009	NA	NA	NA	NA
Dichlorprop	6.2 E-2	6.9 E-6	2.3 E-6	1 E-9	0.000009	NA	NA	NA	NA
Organic Acids									
Diethyl phosphorodithioic acid	7.2 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Polychlorinated Biphenyls									
Aroclor 1254	5.4 E-2	2.4 E-3	2.2 E-3	3 E-7	0.005	3 E-8	3 E-8	1 E-12	6 E-8
Semi-Volatile Organic Compounds									
Benzoic Acid	2.4 E+0	5.3 E-7	3.5 E-7	8 E-11	0.0000009	NA	NA	NA	NA
Cyclic octaatomic sulfur	5.0 E-1	NA	NA	NA	NA	NA	NA	NA	NA
p-Chlorothiophenol	6.3 E-1	NA	NA	NA	NA	NA	NA	NA	NA
O,o'-diethyl s-methyl thiophos	6.1 E-1	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	4.6 E-1	5.1 E-4	3.4 E-4	8 E-8	0.0008	2 E-7	2 E-7	3 E-11	4 E-7
Phosphorothioic acid, s-[2-[(1	7.7 E+0	NA	NA	NA	NA	NA	NA	NA	NA
S-methyl methanethiosulphona	7.4 E-1	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 14
CHEMICAL RISK SUMMARY FOR THE FUTURE OFF-SITE MAINTENANCE WORKER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Inhal HQ	Total HI	Oral ILCR	Dermal ILCR	Inhal ILCR	Total ILCR
Volatile Organic Compounds									
1,2,3-Trichlorobenzene	5.8 E-2	5.1 E-6	0.0 E+0	2 E-4	0.0002	NA	NA	NA	NA
2-Butanone (MEK)	2.3 E-2	3.4 E-8	0.0 E+0	1 E-6	0.000001	NA	NA	NA	NA
Acetone	6.7 E-2	6.5 E-8	0.0 E+0	1 E-6	0.000001	NA	NA	NA	NA
Benzene	1.1 E-2	2.5 E-6	0.0 E+0	8 E-5	0.00008	2 E-10	0 E+0	7 E-9	7 E-9
Carbon disulfide	1.1 E-2	1.0 E-7	0.0 E+0	8 E-6	0.000008	NA	NA	NA	NA
Chloroethane	1.4 E-2	4.3 E-9	0.0 E+0	6 E-7	0.0000006	NA	NA	NA	NA
Chloroform	1.2 E-2	1.1 E-6	0.0 E+0	5 E-5	0.00006	NA	NA	2 E-8	2 E-8
Ethylbenzene	1.3 E-2	1.2 E-7	0.0 E+0	1 E-6	0.000001	NA	NA	NA	NA
Methylene chloride	2.2 E-2	3.3 E-7	0.0 E+0	2 E-6	0.000002	5 E-11	0 E+0	9 E-10	9 E-10
m-Xylene & p-Xylene	2.2 E-2	9.9 E-8	0.0 E+0	2 E-5	0.00002	NA	NA	NA	NA
Toluene	1.1 E-2	1.3 E-7	0.0 E+0	3 E-7	0.0000005	NA	NA	NA	NA
Total		0.07	0.008	0.0006	0.08	2 E-6	1 E-6	4 E-8	3 E-6

HQ = hazard quotient
HI - hazard index
ILCR = incremental lifetime cancer risk

TABLE 15
CHEMICAL RISK SUMMARY FOR THE CURRENT/FUTURE ON-SITE TRESPASSER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 3)

Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Inhal HQ	Total HI	Oral ILCR	Dermal ILCR	Inhal ILCR	Total ILCR
				Dioxins / Furans					
TCDD Equivalents	6.0 E-6	1.4 E-3	3.6 E-4	NA	0.002	2 E-8	5 E-9	6 E-13	2 E-8
				Inorganics					
Arsenic	8.2 E+0	1.9 E-3	1.6 E-3	2.2 E-7	0.004	7 E-8	6 E-8	8 E-11	1 E-7
Beryllium	5.7 E-1	6.5 E-5	0.0 E+0	8.0 E-7	0.00007	NA	NA	3 E-12	3 E-12
Boron	1.8 E+1	2.0 E-5	0.0 E+0	2.5 E-8	0.00002	NA	NA	NA	NA
Cadmium	2.9 E-1	6.6 E-5	2.3 E-5	2.3 E-9	0.00009	NA	NA	1 E-12	1 E-12
Calcium	1.1 E+5	NA	NA	NA	NA	NA	NA	NA	NA
Chromium (Total)	1.6 E+1	2.5 E-6	0.0 E+0	8.8 E-11	0.000002	NA	NA	NA	NA
Lithium	2.6 E+1	3.0 E-4	0.0 E+0	1.1 E-8	0.0003	NA	NA	NA	NA
Magnesium	1.1 E+4	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	1.2 E+0	5.5 E-5	0.0 E+0	1.9 E-9	0.00005	NA	NA	NA	NA
Nickel	3.1 E+1	3.6 E-4	0.0 E+0	9.8 E-6	0.0004	NA	NA	NA	NA
Niobium	7.3 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Palladium	6.5 E-1	NA	NA	NA	NA	NA	NA	NA	NA
Perchlorate	3.5 E+0	1.2 E-3	0.0 E+0	4.1 E-8	0.001	NA	NA	NA	NA
Potassium	3.1 E+3	NA	NA	NA	NA	NA	NA	NA	NA
Silver	7.1 E+0	3.2 E-4	0.0 E+0	1.1 E-8	0.0003	NA	NA	NA	NA
Sodium	1.5 E+3	NA	NA	NA	NA	NA	NA	NA	NA
Tin	6.0 E-1	2.3 E-7	0.0 E+0	8.1 E-12	0.0000002	NA	NA	NA	NA
Titanium	6.6 E+2	3.8 E-5	0.0 E+0	6.2 E-7	0.00004	NA	NA	NA	NA
Tungsten	1.4 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Uranium	1.7 E+0	2.0 E-3	0.0 E+0	1.6 E-7	0.002	NA	NA	NA	NA
Vanadium	3.9 E+1	8.8 E-3	0.0 E+0	NA	0.009	NA	NA	NA	NA
Zirconium	2.5 E+2	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 15
CHEMICAL RISK SUMMARY FOR THE CURRENT/FUTURE ON-SITE TRESPASSER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Inhal HQ	Total HI	Oral ILCR	Dermal ILCR	Inhal ILCR	Total ILCR
Organochlorine Pesticides									
2,4'-DDD	1.3 E-2	NA	NA	NA	NA	6 E-11	2 E-11	2 E-15	8 E-11
2,4'-DDE	4.3 E-3	NA	NA	NA	NA	3 E-11	8 E-12	1 E-15	4 E-11
4,4'-DDD	4.1 E-3	NA	NA	NA	NA	2 E-11	5 E-12	7 E-16	2 E-11
4,4'-DDE	6.5 E-3	NA	NA	NA	NA	4 E-11	1 E-11	2 E-15	5 E-11
4,4'-DDT	6.3 E-3	2.9 E-6	7.6 E-7	1.0 E-10	0.000004	4 E-11	1 E-11	1 E-15	5 E-11
alpha-BHC	9.7 E-3	4.4 E-6	1.6 E-6	1.6 E-10	0.000006	1 E-9	4 E-10	4 E-14	2 E-9
beta-BHC	3.6 E-2	4.0 E-5	1.4 E-5	1.4 E-9	0.00005	1 E-9	4 E-10	4 E-14	2 E-9
delta-BHC	1.1 E-2	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	4.2 E-3	1.9 E-5	0.0 E+0	6.7 E-10	0.00002	1 E-9	0 E+0	5 E-14	1 E-9
gamma-BHC (Lindane)	5.1 E-3	3.8 E-6	1.3 E-6	1.4 E-10	0.000005	1 E-10	5 E-11	5 E-15	2 E-10
gamma-Chlordane	4.2 E-3	1.9 E-6	6.7 E-7	1.7 E-10	0.000003	3 E-11	1 E-11	1 E-15	4 E-11
Herbicides									
O,O,O-Triethyl phosphorothio	1.8 E-2	NA	NA	NA	NA	NA	NA	NA	NA
Organophosphate Pesticides									
2,4,5-TP	1.5 E-2	4.4 E-7	0.0 E+0	1.6 E-11	0.0000004	NA	NA	NA	NA
Dicamba	3.0 E-2	2.3 E-7	0.0 E+0	8.1 E-12	0.0000002	NA	NA	NA	NA
Dichlorprop	6.2 E-2	1.8 E-6	7.8 E-7	6.3 E-11	0.000003	NA	NA	NA	NA
Organic Acids									
Diethyl phosphorodithioic acid	7.2 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Polychlorinated Biphenyls									
Aroclor 1254	5.4 E-2	6.1 E-4	7.5 E-4	2.1 E-8	0.001	2 E-9	3 E-9	1 E-14	5 E-9
Semi-Volatile Organic Compounds									
Benzoic Acid	2.4 E+0	1.4 E-7	1.2 E-7	4.8 E-12	0.0000003	NA	NA	NA	NA
Cyclic octaatomic sulfur	5.0 E-1	NA	NA	NA	NA	NA	NA	NA	NA
p-Chlorothiophenol	6.3 E-1	NA	NA	NA	NA	NA	NA	NA	NA
O,o'-diethyl s-methyl thiophos	6.1 E-1	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	4.6 E-1	1.3 E-4	1.2 E-4	4.7 E-9	0.0002	1 E-8	1 E-8	5 E-13	3 E-8
Phosphorothioic acid, s-[2-[(1	7.7 E+0	NA	NA	NA	NA	NA	NA	NA	NA
S-methyl methanethiosulphona	7.4 E-1	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 15
CHEMICAL RISK SUMMARY FOR THE CURRENT/FUTURE ON-SITE TRESPASSER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Inhal HQ	Total HI	Oral ILCR	Dermal ILCR	Inhal ILCR	Total ILCR
Volatile Organic Compounds									
1,2,3-Trichlorobenzene	5.8 E-2	1.3 E-6	0.0 E+0	1.3 E-5	0.00001	NA	NA	NA	NA
2-Butanone (MEK)	2.3 E-2	8.8 E-9	0.0 E+0	6.7 E-8	0.00000008	NA	NA	NA	NA
Acetone	6.7 E-2	1.7 E-8	0.0 E+0	5.9 E-8	0.00000008	NA	NA	NA	NA
Benzene	1.1 E-2	6.5 E-7	0.0 E+0	4.9 E-6	0.000006	1 E-11	0 E+0	1 E-10	1 E-10
Carbon disulfide	1.1 E-2	2.6 E-8	0.0 E+0	4.8 E-7	0.0000005	NA	NA	NA	NA
Chloroethane	1.4 E-2	1.1 E-9	0.0 E+0	3.7 E-8	0.00000004	NA	NA	NA	NA
Chloroform	1.2 E-2	2.8 E-7	0.0 E+0	3.4 E-6	0.000004	NA	NA	3 E-10	3 E-10
Ethylbenzene	1.3 E-2	3.0 E-8	0.0 E+0	8.5 E-8	0.0000001	NA	NA	NA	NA
Methylene chloride	2.2 E-2	8.5 E-8	0.0 E+0	1.1 E-7	0.0000002	3 E-12	0 E+0	1 E-11	2 E-11
m-Xylene & p-Xylene	2.2 E-2	2.6 E-8	0.0 E+0	1.3 E-6	0.000001	NA	NA	NA	NA
Toluene	1.1 E-2	3.3 E-8	0.0 E+0	2.0 E-8	0.00000005	NA	NA	NA	NA
Total		0.02	0.003	0.00004	0.02	1 E-7	8 E-8	5 E-10	2 E-7

HQ = hazard quotient
HI - hazard index
ILCR = incremental lifetime cancer risk

TABLE 16
RADIONUCLIDE RISK SUMMARY FOR THE FUTURE ON-SITE/OFF-SITE CONSTRUCTION WORKER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

Radionuclide	Soil Concentration (pCi/g)	Ingestion ILCR	Inhalation ILCR	External ILCR	Total ILCR
Bismuth-210	1.1 E+0	6 E-12	1 E-11	1 E-11	3 E-11
Bismuth-214	8.7 E-1	6 E-16	2 E-15	7 E-11	7 E-11
Lead-210	1.1 E+1	2 E-6	3 E-7	1 E-8	2 E-6
Lead-214	1.4 E+0	2 E-15	7 E-15	2 E-11	2 E-11
Polonium-210	1.1 E+0	1 E-8	9 E-9	4 E-12	2 E-8
Polonium-214	1.4 E+0	NA	NA	5 E-18	5 E-18
Polonium-218	2.4 E+0	NA	NA	3 E-18	3 E-18
Protactinium-234	1.6 E+0	7 E-18	2 E-19	1 E-13	1 E-13
Radium-226	2.2 E+0	5 E-8	4 E-8	4 E-6	4 E-6
Radon-222	2.5 E+0	NA	NA	1 E-11	1 E-11
Thorium-230	1.8 E+0	1 E-8	9 E-8	3 E-10	1 E-7
Thorium-234	2.3 E+0	2 E-10	1 E-11	7 E-10	9 E-10
Uranium-234	1.8 E+0	8 E-9	4 E-8	4 E-10	4 E-8
Uranium-238	1.5 E+0	7 E-9	2 E-8	4 E-8	7 E-8
Total		2 E-6	5 E-7	4 E-6	6 E-6

ILCR = incremental lifetime cancer risk

TABLE 17
RADIONUCLIDE RISK SUMMARY FOR THE FUTURE OFF-SITE MAINTENANCE WORKER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

Radionuclide	Soil Concentration (pCi/g)	Ingestion ILCR	Inhalation ILCR	External ILCR	Total ILCR
Bismuth-210	1.1 E+0	2 E-12	7 E-15	1 E-11	1 E-11
Bismuth-214	8.7 E-1	2 E-16	2 E-18	7 E-11	7 E-11
Lead-210	1.1 E+1	9 E-6	3 E-9	2 E-7	9 E-6
Lead-214	1.4 E+0	5 E-16	4 E-18	2 E-11	2 E-11
Polonium-210	1.1 E+0	4 E-9	7 E-12	4 E-12	4 E-9
Polonium-214	1.4 E+0	NA	NA	4 E-18	4 E-18
Polonium-218	2.4 E+0	NA	NA	3 E-18	3 E-18
Protactinium-234	1.6 E+0	2 E-18	1 E-22	1 E-13	1 E-13
Radium-226	2.2 E+0	4 E-7	7 E-10	9 E-5	9 E-5
Radon-222	2.5 E+0	NA	NA	1 E-11	1 E-11
Thorium-230	1.8 E+0	8 E-8	1 E-9	7 E-9	9 E-8
Thorium-234	2.3 E+0	5 E-11	8 E-15	7 E-10	7 E-10
Uranium-234	1.8 E+0	5 E-8	6 E-10	8 E-9	6 E-8
Uranium-238	1.5 E+0	5 E-8	4 E-10	8 E-7	8 E-7
Total		1 E-5	6 E-9	9 E-5	1 E-4

ILCR = incremental lifetime cancer risk

TABLE 18
RADIONUCLIDE RISK SUMMARY FOR THE CURRENT/FUTURE ON-SITE TRESPASSER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

Radionuclide	Soil Concentration (pCi/g)	Ingestion ILCR	Inhalation ILCR	External ILCR	Total ILCR
Bismuth-210	1.1 E+0	4 E-13	2 E-16	1 E-12	2 E-12
Bismuth-214	8.7 E-1	4 E-17	4 E-20	7 E-12	7 E-12
Lead-210	1.1 E+1	6 E-7	3 E-11	5 E-9	6 E-7
Lead-214	1.4 E+0	1 E-16	1 E-19	2 E-12	2 E-12
Polonium-210	1.1 E+0	9 E-10	2 E-13	5 E-13	9 E-10
Polonium-214	1.4 E+0	NA	NA	5 E-19	5 E-19
Polonium-218	2.4 E+0	NA	NA	3 E-19	3 E-19
Protactinium-234	1.6 E+0	4 E-19	3 E-24	1 E-14	1 E-14
Radium-226	2.2 E+0	2 E-8	5 E-12	2 E-6	2 E-6
Radon-222	2.5 E+0	NA	NA	1 E-12	1 E-12
Thorium-230	1.8 E+0	4 E-9	9 E-12	2 E-10	4 E-9
Thorium-234	2.3 E+0	1 E-11	2 E-16	8 E-11	9 E-11
Uranium-234	1.8 E+0	3 E-9	4 E-12	2 E-10	3 E-9
Uranium-238	1.5 E+0	3 E-9	3 E-12	2 E-8	2 E-8
Total		7 E-7	5 E-11	2 E-6	3 E-6

ILCR = incremental lifetime cancer risk

TABLE 19
ASBESTOS RISK SUMMARY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

Scenario	Estimated Airborne Chrysotile Concentrations (s/cm^3)	Estimated Airborne Amphibole Concentrations (s/cm^3)	Adjusted Chrysotile URF[a] $(s/cm^3)^{-1}$	Adjusted Amphibole URF[a] $(s/cm^3)^{-1}$	Estimated Chrysotile Risk	Estimated Amphibole Risk
LONG FIBERS						
Future On-Site/Off-Site Construction Worker-Best Estimate	2.8 E-4	0.0 E+0	1.86 E-4	2.06 E-2	5 E-8	0 E+0
Future On-Site/Off-Site Construction Worker-Upper Bound	7.1 E-4	2.8 E-4	1.86 E-4	2.06 E-2	1 E-7	6 E-6
Future Off-Site Maintenance Worker-Best Estimate	2.0 E-7	0.0 E+0	4.18 E-3	4.64 E-1	8 E-10	0 E+0
Future Off-Site Maintenance Worker-Upper Bound	5.1 E-7	2.0 E-7	4.18 E-3	4.64 E-1	2 E-9	9 E-8
Current/Future On-Site Trespasser-Best Estimate	2.0 E-7	0.0 E+0	1.11 E-4	1.24 E-2	2 E-11	0 E+0
Current/Future On-Site Trespasser-Upper Bound	5.1 E-7	2.0 E-7	1.11 E-4	1.24 E-2	6 E-11	2 E-9

Notes:

Best Estimate - Based on the pooled analytical sensitivity multiplied by the number of asbestos fibers found.

Upper Bound - Based on the 95% UCL of the Poisson distribution.

[a] The adjusted URF = unadjusted URF × (time of exposure [sec]/lifetime exposure [sec]) as presented in Appendix G.
The unadjusted URF is derived from Table 8-2 of Berman and Crump 2003 times a multiplier of 0.00001/0.00010 as presented in Appendix G.

TABLE 20
UNCERTAINTY ANALYSIS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 3)

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		
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.*, off-site receptors) were not assessed.	Low		
Only primary exposure pathways were evaluated. Other pathways were not assessed.	Low		
Some of the exposure point concentrations used in the exposure assessment were based on modeled, rather than measured, levels in various media (*e.g.*, outdoor air).			Moderate

TABLE 20
UNCERTAINTY ANALYSIS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 2 of 3)

Source of Uncertainty	May Underestimate Risk	May Overestimate Risk	May Under or Overestimate Risk
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 at the point of maximum chemical concentration.		Moderate	
Exposure point concentrations and the amount of media intake were assumed to be constant over time.		Low	
Toxicological Data			
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 20
UNCERTAINTY ANALYSIS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 3 of 3)

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		

TABLE 21
RISK SUMMARY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

	Borrow Area			Background	
	Chemical		Radiation	Soil Chemical	Soil Radiation
Receptor	Total HI	Total ILCR	Total Cancer Risk	Total ILCR	Total Cancer Risk
Future On-Site/Off-Site Construction Worker	0.3	7 E-7	6 E-6	3 E-7	2 E-6
Future Off-Site Maintenance Worker	0.08	3 E-6	1 E-4	1 E-6	5 E-5
Current/Future On-Site Trespasser	0.02	2 E-7	3 E-6	7 E-8	1 E-6

HI = hazard index
ILCR = incremental lifetime cancer risk

TABLE 22
VLEACH MODELING RESULTS SUMMARY
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA
(Page 1 of 2)

Parameter	Comparison Level (mg/L)[c]	Max. Borrow Area Material Leachate Concentration (mg/L)[a]			Max. Placement Site Pore Water Concentration (mg/L)[b]			
		Borrow Area Soil 1	Borrow Area Soil 2	Maximum Borrow Area Soil	Site 1	Site 4	Site 5	Maximum
1,2,3-Trichlorobenzene	0.07	0.004	0.004	0.0004	0.00000004	0.00001	0.0000005	0.00001
2-Butanone (MEK)	7.0	0.5	0.4	0.3	0.5	0.5	0.5	0.5
Acetone	5.5	2.1	1.4	1.6	2.0	2.0	1.9	2.0
alpha-BHC	0.0002	0.001	0.001	0.002	0.00000001	0.000005	0.0000002	0.000005
Arsenic	0.01	0.3	0.3	0.3	0.00004	0.00004	0.00009	0.00009
Benzene	0.005	0.02	0.02	0.005	0.001	0.002	0.001	0.002
Benzoic Acid	146	75	49	5.3	74	73	73	74
Beryllium	0.004	0.000006	0.09	0.08	0.0002	0.00005	0.00005	0.0002
beta-BHC	0.0002	0.004	0.004	0.006	0.0000003	0.0001	0.00001	0.0001
Cadmium	0.005	0.00007	0.00007	0.00005	1.2 E-12	9.6 E-12	1.8 E-11	1.8 E-11
Carbon disulfide	1.0	0.02	0.02	0.01	0.00009	0.00003	0.00004	0.00009
Chloroethane	0.0046	0.1	0.1	0.05	0.009	0.002	0.002	0.009
Chloroform	0.08	0.03	0.03	0.02	0.002	0.003	0.002	0.003
Chromium (Total)	0.1	1.9	2.3	2.5	0.005	0.001	0.001	0.005
4,4'-DDD	0.00028	0.0000005	0.0000005	0.0000003	4.0 E-15	1.3 E-12	9.0 E-14	1.3 E-12
4,4'-DDE	0.00020	0.0000002	0.0000002	0.0000002	3.2 E-16	1.0 E-13	7.2 E-15	1.0 E-13
4,4'-DDT	0.00020	0.0000003	0.0000003	0.0000003	9.0 E-16	2.9 E-13	2.0 E-14	2.9 E-13
delta-BHC	0.0002	0.001	0.001	0.002	0.00000001	0.000006	0.0000002	0.000006
Dieldrin	4.2E-06	0.00002	0.00003	0.00001	9.3 E-12	0.000000003	0.0000000002	0.000000003
Ethylbenzene	0.7	0.004	0.005	0.004	0.0000005	0.00001	0.000002	0.00001
gamma-BHC (Lindane)	0.0002	0.0006	0.0006	0.0006	0.000000007	0.000004	0.0000001	0.000004
gamma-Chlordane	0.002	0.00004	0.00005	0.00002	3.1 E-11	0.00000001	0.0000000007	0.00000001
Hexachlorobenzene	0.001	0.001	0.001	0.0002	2.1 E-10	0.00000005	0.000000003	0.00000005
Hexavalent Chromium	0.11	0.02	0.02	0.02	0.0000007	0.000007	0.00002	0.00002
Iron	11	3080	3050	3050	0.9	6.3	**12**	12

TABLE 22
VLEACH MODELING RESULTS SUMMARY
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA
(Page 2 of 2)

Parameter	Comparison Level (mg/L)[c]	Max. Borrow Area Material Leachate Concentration (mg/L)[a]			Max. Placement Site Pore Water Concentration (mg/L)[b]			
		Borrow Area Soil 1	Borrow Area Soil 2	Maximum Borrow Area Soil	Site 1	Site 4	Site 5	Maximum
Mercury	0.002	0.0002	0.0002	0.0002	0.0000000001	0.0000000007	0.000000001	0.000000001
Methylene chloride	0.0043	0.2	0.2	0.1	**0.06**	**0.03**	**0.03**	0.06
m-Xylene & p-Xylene	10	0.007	0.008	0.0009	0.0000007	0.00002	0.000003	0.00002
Nickel	0.73	0.02	0.02	0.02	0.000000003	0.00000004	0.0000001	0.00000008
Selenium	0.05	0.5	0.5	0.3	0.0005	0.003	0.005	0.005
Silver	0.18	0.06	0.06	0.006	0.0000003	0.000004	0.000008	0.000008
Thallium	0.0005	0.006	0.006	0.004	0.000000005	0.00000004	0.00000008	0.00000008
Toluene	0.72	0.008	0.008	0.003	0.000002	0.00003	0.000006	0.00003
Vanadium	0.036	0.04	0.04	0.04	0.00000001	0.0000002	0.0000004	0.0000004

[a]Based VLEACH output using twenty feet of Borrow Area material thickness and 30-year duration.

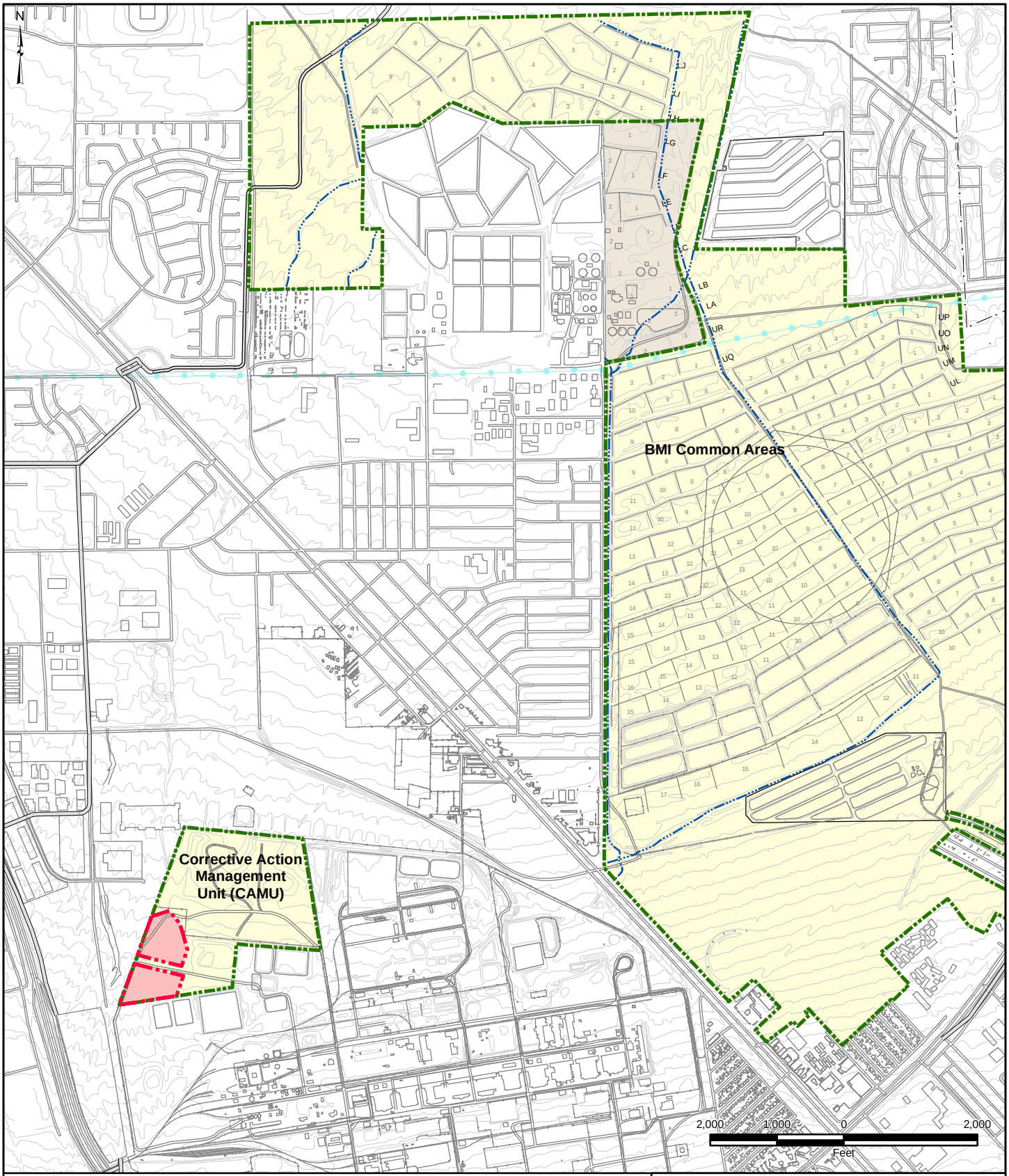
[b]Based VLEACH output using twenty-five feet of native soil thickness, 30-year duration, and recharge water concentration equal to maximum Borrow Area material leachate concentration.

[c] For chemicals with USEPA Maximum Contaminant Levels (MCLs), the MCL was used for comparison, otherwise the USEPA Region 9 Tap Water Preliminary Remediation Goal (Tap Water PRG) was selected for comparison. The MCL for total trihalomethanes (TTHMs) is used as the comparison value for chloroform. It is not conservative to use the TTHM MCL to evaluate the potential water concentration for a single TTHM constituent like chloroform. However since chloroform is the only TTHM COPC it would also represent the TTHM concentration and as such the use of the TTHM MCL is appropriate.

Shaded cells indicate the comparison value is the Tap Water PRG, otherwise the comparison value is the MCL.

Bold indicates exceeds Comparison Level.

FIGURES



Borrow Area Boundary

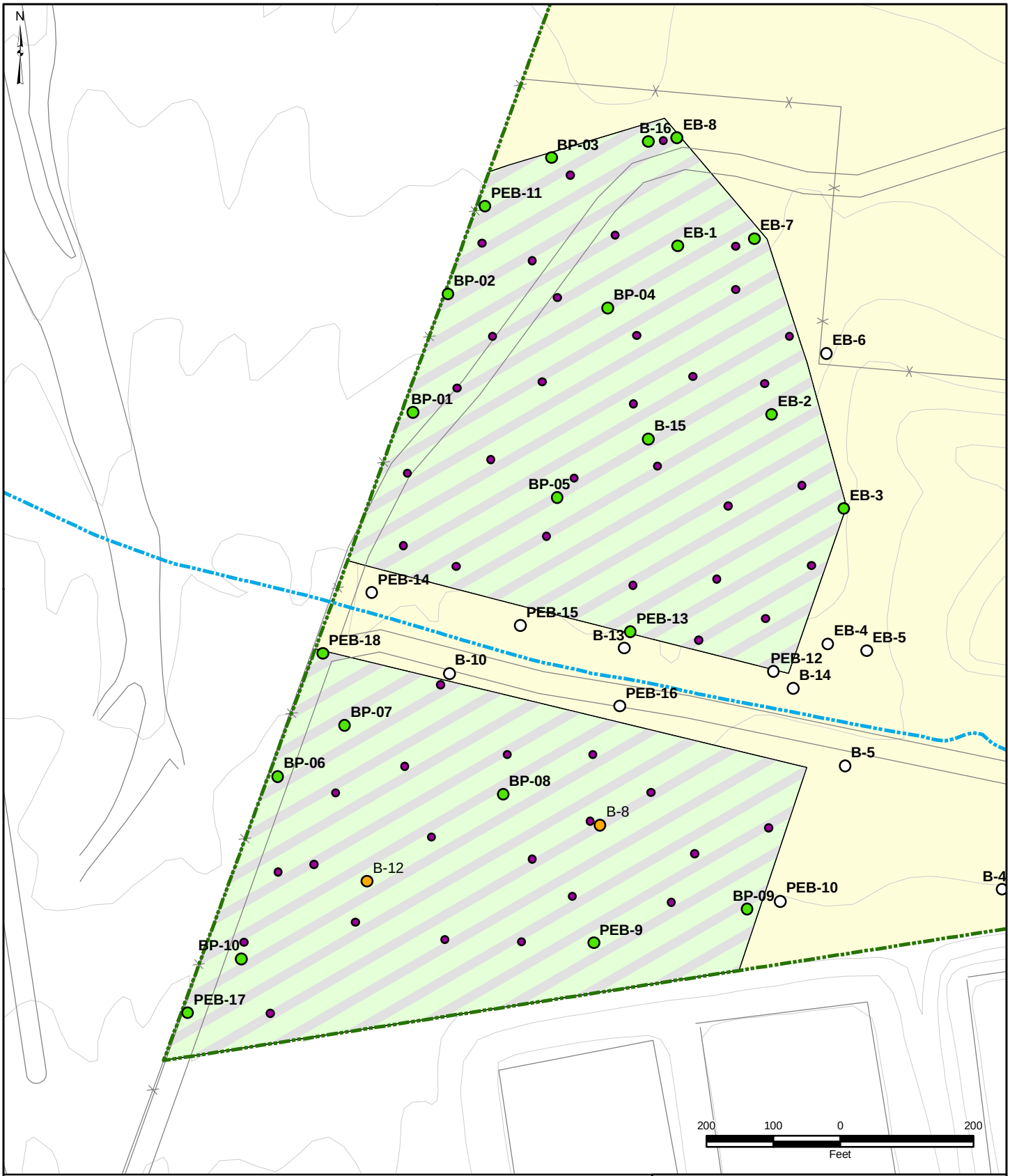
Borrow Area
BMI Complex, Clark County, Nevada

FIGURE 1

BORROW AREA LOCATION

Basic Remediation COMPANY

Prepared by:	Date	JOB No. 1881459
MKJ	03/21/07	FILE: GIS/BRC/BA_FIGURE1.MXD



CAMU Boundary

Borrow Area

Western Ditch

Borrow Area Sample Locations

- Inside Borrow Area (included in HHRA)
- Outside Borrow Area (not included)
- Locations with unvalidated data (not included in HHRA)
- 2003 Asbestos Composite Locations

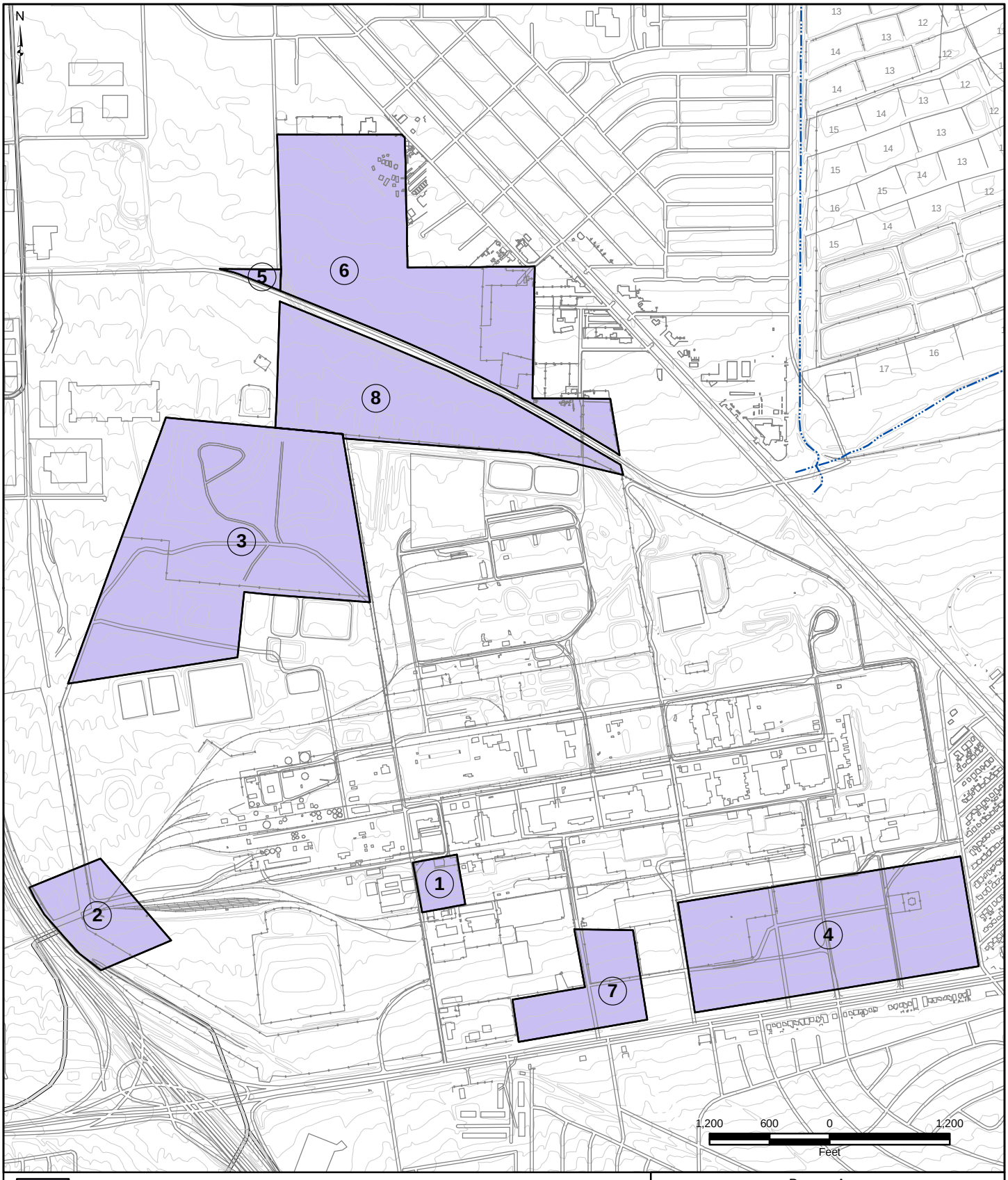
Borrow Area
BMI Complex, Clark County, Nevada

FIGURE 2

SITE PLAN AND SAMPLING LOCATIONS

Basic Remediation COMPANY

Prepared by:	Date	JOB No. 1881459
MKJ	03/21/07	FILE: GIS/BRC/BA_FIGURE2.MXD



Potential Placement Site

1. 4th & F Street
2. Eastgate Rd. Crossing
3. CAMU Capping Material
4. TRECO 73 Acres
5. Warm Springs/Burns
6. Northgate
7. Gate 2
8. Gate 7

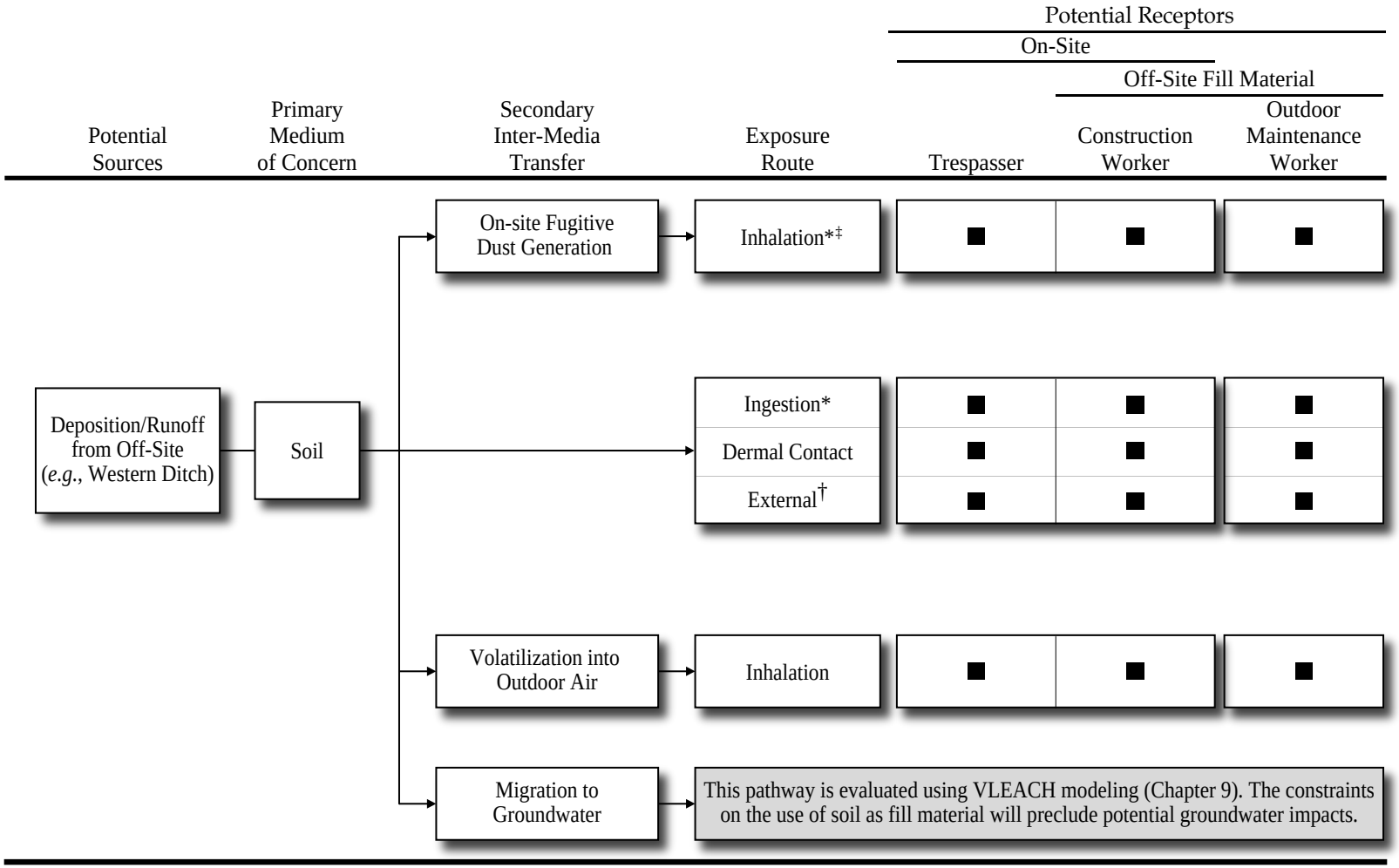
Borrow Area
BMI Complex, Clark County, Nevada

FIGURE 3

POTENTIAL BORROW AREA MATERIAL USER SITES

Basic Remediation Company

Prepared by:	Date	JOB No. 1881459
MKJ	03/21/07	FILE: GIS/BRC/BA_FIGURE3.MXD



□ - Incomplete or insignificant exposure pathway.

■ - Complete exposure pathway to Borrow Area soil.

*Includes radionuclide exposures.

†Only radionuclide exposures.

‡Includes asbestos exposures; evaluated separately.

Notes:

- Construction worker exposures include on-site excavation activities and off-site fill material placement activities.
- Current receptors that may access the property include construction workers and trespassers. Outdoor maintenance workers are assumed to only access the soil following its use as fill material at off-site locations.
- Because the future anticipated use of Borrow Area soil precludes use in residential areas, the risk assessment does not evaluate a hypothetical future residential exposure scenario.
- One of the constraints on the future use of Borrow Area soil is that such soils cannot be placed in environmentally sensitive areas, nor be exposed to ambient conditions (see Section 4.3); thus, ecological risks are not assessed.
- Risks to potential nearby, off-site receptors that may be impacted during mining and placement activities are addressed qualitatively in the Uncertainty Analysis, Chapter 7 of the HHRA, based on the risk characterization for the on-site receptors.

Borrow Area
BMI Complex, Clark County, Nevada

FIGURE 4

CONCEPTUAL SITE MODEL DIAGRAM FOR POTENTIAL SOIL EXPOSURES

Basic Remediation COMPANY

Prepared by:	Date	JOB No. 1881459
MKJ	03/21/07	FILE: GIS/BRC/BA_FIGURE4.AI

APPENDIX A

HUMAN HEALTH RISK ASSESSMENT WORK PLAN AND NDEP COMMENTS ON THE DECEMBER 2006 BORROW AREA HUMAN HEALTH RISK ASSESSMENT AND BRC RESPONSE TO COMMENTS

ATTACHMENT A-1

HUMAN HEALTH RISK ASSESSMENT WORK PLAN

BRC HUMAN HEALTH RISK ASSESSMENT WORK PLAN

BORROW AREA
CLARK COUNTY, NEVADA

Prepared for:
Basic Remediation Company (BRC)
875 West Warm Springs Road
Henderson, Nevada 89015

Prepared by:
MWH
3321 Power Inn Road, Suite 300
Sacramento, California 95826

OCTOBER 2006

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 2, 2006

Dr. Ranajit Sahu, C.E.M. (No. EM-1699, Exp. 10/07/2007) Date
BRC Project Manager

I hereby certify that I also reviewed the document for quality control purposes myself.

October 2, 2006

Dr. Ranajit Sahu, C.E.M. (No. EM-1699, Exp. 10/07/2007) Date
BRC Project Manager

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1 INTRODUCTION

MWH has prepared this Human Health Risk Assessment (HHRA) Work Plan on behalf of Basic Remediation Company (BRC). The purpose of this work plan is to provide the approach and methods for the HHRA to be performed for off-site uses of Borrow Area (Site) soil following excavation. The Borrow Area is within the area proposed for the BRC Corrective Action Management Unit (CAMU) in Clark County, Nevada. Figure 1 shows the location and configuration of the Borrow Area.

Findings of the HHRA are intended to support the use of excavated Borrow Area soils as off-site fill material. BRC's proposed risk assessment approach for the Site follows basic procedures outlined in the U.S. Environmental Protection Agency's (USEPA) *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual* (USEPA 1989). A full list of guidance documents consulted is provided in the Reference section at the end of this document. This revision of the work plan (Revision 3) also incorporates Nevada Division of Environmental Protection (NDEP) comments dated May 19, 2006 on the April 2006 revision (Revision 0) of the work plan; NDEP comments dated July 10, 2006 on the June 2006 revision (Revision 1) of the work plan; NDEP comments dated August 25, 2006 on the June 2006 revision (Revision 2) of the work plan; and NDEP comments dated November 9, 2006 on the October 2006 revision (Revision 3) of the work plan. NDEP comments and BRC response to comments are provided in Appendix A. Each of these comments and responses will also be included in the HHRA report.

1.1 SITE DESCRIPTION

The following description of the Site was obtained from the *Revised Sampling and Analysis Plan to Conduct Soil Characterization of Borrow Areas* (DBS&A 2006) submitted to NDEP on February 13, 2006. The Site is comprised of the north and south Borrow Areas, excluding the portion of the Western Ditch that separates these areas. As currently envisioned, soils from the Borrow Area will be used as general backfill material subject to the constraints discussed in Section 2.1.2.

The north Borrow Area is in the southwest portion of the CAMU, north of the Western Ditch, and encompasses an area of approximately 9.3 acres. The north Borrow Area is bordered on the west by the western CAMU boundary along Eastgate Road, on the north by the westernmost portion of the existing landfill (approximately 300 feet north of the Borrow Area), on the east by the southern lobe of the existing landfill, and to the south by the Western Ditch. The north Borrow Area is shown on Figure 1.

The south Borrow Area is in the southwest portion of the CAMU, south of the Western Ditch, and encompasses an area of approximately 8.5 acres. The south Borrow Area is bordered on the west by the western CAMU boundary along Eastgate Road, on the north by the Western Ditch, on the east by vacant land, and to the south by southern CAMU boundary. The south Borrow Area is shown on Figure 1.

As shown in Figure 1, the two areas are bisected by the known contaminated area of the previous Western Ditch, which will not be used as the source of any of the borrow materials. Even though there is no evidence of disposal of any waste materials in the proposed Borrow Area, because the area, in general, lies in the midst of other waste disposal areas, it is possible that some surface contamination due to water run-off and airborne deposition may have occurred. Historically, there have been drainage channels in the Borrow Area created by storm water runoff from adjoining CAMU and plant areas. It is possible that the soil in the Borrow Area has been impacted by runoff from neighboring sites.

Groundwater underlying the Site is known to be contaminated. As discussed in Section 2.1 below, exposure pathways associated with groundwater will not be evaluated in the HHRA. Excavations within the Borrow Area will stop prior to reaching groundwater. A full discussion on groundwater quality will be provided in the conceptual site model (CSM) being prepared for the CAMU. The objective of the various investigations and assessments within the Borrow Area were to demonstrate to NDEP that it is acceptable to use soil within this area as off-site fill material. Because locations for placement of Borrow Area soil as off-site fill material have not been determined for certain, groundwater quality at these locations is unknown. It is expected that most, if not all of the Borrow materials will be used in the BMI industrial complex, including for CAMU construction. Potential Borrow Area material use sites within the BMI industrial complex are shown on Figure 2.

1.2 EXCAVATION AND PROCESSING OF BORROW AREA MATERIAL

Excavation and processing of Borrow Area material will require activity both in the two portions (Northern and Southern) of the Area and in the processing yard adjacent to the Area. Various grades of materials will then be used on and off-site depending on customer needs.

In each of the two portions (Northern and Southern), material will be mass-graded and gathered using a bull dozier and belly scraper in tandem. The dozier will cut or rake the material, creating a soft bed of dirt that can be easily gathered by the belly scraper. Once the material is gathered by the scraper, it will be transported to a central location along the boundary between the Area

and the processing center. There, the material will be dumped into a pile to be located into the material crusher. A front loader will place the material on a crusher conveyor belt to be dumped in the actual crusher.

As the material is processed it will be separated into two piles. The first pile is Type II aggregate material. Type II aggregate is a granular, structure material used to construct building pads and roadway beds. This material is of high value and is structural in nature. The second pile is reject sand. This is material that is too small to be included in the Type II material. This material has a smaller granular consistency and is used at bedding material for pipeline construction and in landscape applications. Rejected sand will be stockpiled for use in CAMU construction or in off-site uses such as pipeline bed or landscape applications. Should rejected sand be needed for off-site uses, its use will be subject to the same constraints as Type II material.

The definition of Type II is as follows (Ref: Section 704.03.04, found at http://www.rtcsouthernnevada.com/streets/streets_specsindex.htm). Type II can consist of a distribution of sizes, within acceptable ranges as indicated below. For example, Type II materials can contain materials that pass sieve size No. 16 but only as long as such materials do not comprise less than 15% or more than 40% of the material.

Sieve Sizes	Nom. Sieve Opening (mm)	% of Dry Weight Passing Sieve
1”	25.4	100
¾”	6.35	90-100
No. 4	4.76	35-65
No. 16	1.19	15-40
No. 200	0.074 (74 microns)	2-10

2 CONCEPTUAL SITE MODEL AND SUMMARY OF DATA USABILITY EVALUATION

2.1 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 data quality objectives and developing exposure scenarios.

The HHRA will evaluate both current and potential future uses of Borrow Area soils. Currently, the Site is undeveloped. Current and future receptors that may access the property include construction workers involved in the excavation of Borrow Area soil and trespassers.[1] Once Borrow Area soil is excavated and after placement as off-site fill material, potential future receptors would be maintenance workers who may be involved in digging or trenching activities in locations where such soils may have been placed. One of the constraints on the future use of Borrow Area soil is that such soils cannot be placed in environmentally sensitive areas, nor be exposed to ambient conditions (see Section 2.1.2). In addition, the Borrow Area itself is within the CAMU boundary. No viable habitat is present in the Borrow Area based on field observations. The area (except for the intervening portion of the Western Ditch) has already been graded in anticipation of gravel mining. The Western Ditch contains sparse vegetation and no discernable habitat. Thus, current and future ecological impacts at the Borrow Area will not be assessed in the HHRA.

The potentially exposed populations and their potential routes of exposure to on-site soil and off-site fill material are presented in Figure 3 and summarized below.

2.1.1 Potential Impacts to Groundwater

Impacts to groundwater considering the use of Borrow Area soil as off-site fill material will be conducted using the VLEACH vertical migration model and site-specific soil analytical results. The VLEACH modeling will be conducted for the chemicals of potential concern (COPCs) identified in the HHRA.

In order to evaluate heterogeneous soil layers using VLEACH, multiple iterations of VLEACH will be performed, where the output of one run would be used as the input into another run. VLEACH would be run separately for each of the distinctly different soil layers (*e.g.* Borrow material and underlying native soil). For each VLEACH run the user is allowed to input an initial recharge water concentration that comes in the top of the soil layer. At the end of a run, VLEACH provides the concentration in the bottom soil layer and the recharge (or soil moisture) leaving the bottom of the soil layers. Hence from the first VLEACH run for the upper Borrow

[1] Trespassers are assumed to be teenagers from 13 to 19 years of age. Trespasser exposure parameters reflect this age range (see Section 5.1.1).

material the output of soil moisture concentration at the bottom of this soil layer can be used as the input concentration of recharge for the VLEACH evaluation of the subsequent native soil layer below. Likewise the estimated contaminant soil concentration at the bottom of the Borrow material will be used as the initial soil concentration for the upper cell of the underlying native material VLEACH run. Although the use of the model in the fashion is not explicitly mentioned in the VLEACH manual (Model Version 2.2a, USEPA, 1997a), staff at the USEPA Robert S. Kerr Environmental Research Laboratory, Center for Subsurface Modeling Support in Ada, Oklahoma have indicated that this is an appropriate use of the model to account for heterogeneous soil layers.[2]

VLEACH model input values are presented in Table 1. The intent of this evaluation is to predict impacts to groundwater considering the use of Borrow Area soils as off-site fill material. Constraints on the placement of the soil as fill material will ensure that impacts to groundwater will not occur, and therefore exposure pathways associated with groundwater will not be evaluated in the HHRA.

2.1.2 Inter-Media Transfers

Exposure to Site chemicals may be direct, as in the case of impacted soil, or indirect following inter-media transfers. These transfers can be primary or secondary and impacted soil is the initial source. For example, upward migration of volatile organic compounds (VOCs) from impacted subsurface soil into ambient air thereby reaching a point of human inhalation represents a primary 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 3 presents a conceptualized diagram of the inter-media transfers and fate and transport modeling for the HHRA.

Four 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. The second primary transfer pathway is via fugitive dust emissions

[2] Personal communications between Ken Kiefer (MWH) and Robert Earle (USEPA), September 27, 2006.

into ambient air. The third primary transfer pathway is downward migration of chemicals from soil to groundwater. However, as discussed above, this pathway will be evaluated elsewhere as a constraint to soil placement. Finally, chemicals in soil can be transferred to plants grown in Borrow Area soil via uptake through the roots. The plant uptake pathway is typically evaluated for residential receptors; however, as discussed in Section 2.1.2 below, because the Borrow Area soil will not be used as fill material for residential development, this pathway will not be evaluated in the HHRA.

2.1.3 Potential Human Exposure Scenarios

The following section summarizes Borrow Area soil exposures and the potential human exposure scenarios. 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, soil);
- A point of potential human contact with the medium; and
- A route of exposure (*e.g.*, inhalation, ingestion, dermal contact).

The Borrow Area soil is proposed for use as fill material for various construction projects. Any such project will involve limited or no post-construction exposures to the Borrow Area soil. The constraints placed on the use of Borrow Area soil as fill material are: (1) the materials will be used in non-residential areas; (2) the placement of soils will be such that there are no exposure pathways for receptors; (3) a minimum soil column height will be maintained between where these soils are placed and the local groundwater such that impacts to groundwater demonstrated via the leaching evaluation are negligible; (4) to the extent possible, these materials will be placed in significant quantities (approximately 50,000 yards) at each location (DBS&A 2006). An additional constraint on the use of Borrow Area soil as fill material is that it will not be placed in environmentally sensitive areas.[3] Therefore, the following presents the primary exposure pathways for each of the potential receptors to Borrow Area soil. These populations

[3] These areas may include wetlands, National and State parks, critical habitats for endangered or threatened species, wilderness and natural resource areas, marine sanctuaries and estuarine reserves, conservation areas, preserves, wildlife areas, wildlife refuges, wild and scenic rivers, recreational areas, national forests, Federal and State lands that are research national areas, heritage program areas, land trust areas, and historical and archaeological sites and parks. These areas may also include unique habitats such as aquaculture sites and agricultural surface water intakes, bird nesting areas, critical biological resource areas, designated migratory routes, designated seasonal habitats, State designated Natural Areas, State designated areas for protection or maintenance of aquatic life, and particular areas, relatively small in size, important to maintenance of unique biotic communities.

and complete/potentially complete exposure pathways for each of the receptors will be evaluated in the HHRA.

- Construction workers (on-site soil/off-site fill material)
  - incidental soil ingestion*
  - external exposure from soil†
  - dermal contact with soil
  - outdoor inhalation of dust*‡
  - outdoor inhalation of VOCs from soil

- Trespassers (on-site soil)
  - incidental soil ingestion*
  - external exposure from soil†
  - dermal contact with soil
  - outdoor inhalation of dust*‡
  - outdoor inhalation of VOCs from soil

- Outdoor maintenance workers (off-site fill material)
  - incidental soil ingestion*
  - external exposure from soil†
  - dermal contact with soil
  - outdoor inhalation of dust*‡
  - outdoor inhalation of VOCs from soil

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

As indicated above and in Figure 3, outdoor maintenance workers, construction workers, and trespassers could be exposed to chemicals in soil through skin contact, inhalation of VOCs in outdoor air, inhalation of chemicals absorbed to fugitive dust, or incidental ingestion of soil when soiled hands or objects are placed in or near the mouth. For radionuclides, external radiation is also a potential soil-related exposure pathway for all receptors. For asbestos, inhalation of fugitive dust is considered the only potential soil-related exposure pathway for all receptors. Risks to potential nearby, off-site receptors that may be impacted during mining and placement activities will be addressed qualitatively in the uncertainty analysis section of the HHRA based on the risk characterization for the on-site receptors.

2.2 SUMMARY OF DATA USABILITY EVALUATION

This section describes the procedures that will be used to evaluate the acceptability of data for use in the HHRA. Overall, the quality of sample results is a function of proper sample management. Management of samples begins at the time of collection and continues throughout the analysis process. The collection of environmental data in 2006 followed the quality assurance/quality control (QA/QC) procedures identified in the Quality Assurance Project Plan (QAPP; BRC and MWH 2006a)[4] prepared for the BRC project, as well as the *Revised Sampling and Analysis Plan to Conduct Soil Characterization of Borrow Areas* (DBS&A 2006). Standard operating procedures (SOPs) that are wholly consistent with the risk assessment 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. Field methods are discussed in the field SOPs (BRC and MWH 2006b), the *Revised Sampling and Analysis Plan to Conduct Soil Characterization of Borrow Areas* (DBS&A 2006), and adhere to practices consistent with the policies of the NDEP.

A QA/QC review of the analytical results will be conducted prior to conducting the HHRA. The analytical data will be reviewed for applicability and usability following procedures in the *Guidance for Data Usability in Risk Assessment (Part A)* (USEPA 1992a) and USEPA (1989).

2.2.1 Borrow Area HHRA Datasets

A number of investigations have been performed within the Borrow Area since 2000. These include:

- 2000 Environmental Assessment by Parsons Engineering Science, Inc. (Parsons 2000) (Dataset 10);
- 2003 Limited Environmental Phase II Investigation by Geotechnical & Environmental Services, Inc. (GES 2003a,b) (Datasets 26a and 26b);
- 2003 Asbestos Investigation by MWH and Aeolus Inc. (Aeolus 2003); and
- 2006 Soil Investigation by BRC (Dataset 36).

Data from these investigations included in the project database are:

[4] Both the QAPP and SOPs were under review and not yet approved by NDEP at the time of the 2006 Borrow Area sample collection.

- Borings B-1, B-4, B-5, B-8, B-10, and B-12 from the 2000 Parsons environmental assessment;
- Borings B-13, B-14, B-15, and B-16 from the 2003 GES investigation;
- Borings EB-1 through EB-8, B-5, B-10, and PEB-9 through PEB-18 from the 2003 GES investigations;
- Asbestos samples BEC-1Sb, BEC2Sa through BEC5Sa, and BEC1Da though BEC5Da from the 2003 MWH and Aeolus investigation; and
- Borings BP-01 through BP-10 from the 2006 BRC investigation.

All valid data from these investigations will be included in the HHRA. One exception to this is data from sample PEB-10 from the 2003 GES investigation since soils in the vicinity of this sample location will not be used as Borrow Area fill material. Further elimination of any other data will only occur following discussions with and concurrence from NDEP. These datasets do not include several chemicals that are on the project site-related chemicals list. A discussion of those chemicals that are on the site-related chemicals list but that were not analyzed for will be presented in the uncertainty section of the HHRA report. Data validation reports for all of the datasets that will be used in the risk assessment have been submitted and approved by the NDEP.

2.2.2 Overview of the Data Evaluation Process

The primary objective of the data review and usability evaluation is to identify appropriate data for use in the HHRA. The analytical data are reviewed for applicability and usability following procedures in USEPA's (1992a) *Guidance for Data Usability in Risk Assessment (Part A)* and USEPA's (1989) *Risk Assessment Guidance for Superfund (RAGS).* According to USEPA's *Data Usability Guidance*, there are six principal evaluation criteria by which data are judged for usability in risk assessment. These six criteria are:

- 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 in the HHRA is described in this section.

2.2.3 Criterion I – 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.

2.2.4 Criterion II – Documentation Review

The objective of the documentation review is to confirm that the analytical results provided are associated with a specific 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 will be reviewed and compared to the analytical data results provided by the laboratory to ensure completeness of the data set. Based on the documentation review, all samples analyzed by the laboratory will be correlated to the correct geographic location at the Site. Field procedures that will be verified include documentation of sample times, dates and locations, other sample specific information such as depth below ground surface (bgs) will be reviewed.

The analytical data will be reported in a format that provides adequate information for evaluation, including appropriate QC measures and acceptance criteria. Each laboratory report will describe the analytical method used, provide results on a sample by sample basis along with sample specific detection limits, and provide the results of appropriate QC samples such as laboratory control spike samples, sample surrogates and internal standards (organic analyses only), and matrix spike samples. All laboratory reports, except for asbestos,[5] will provide the documentation required by USEPA's Contract Laboratory Program (USEPA 2000a, 2005a,b,c). This documentation 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

[5] At the time of analyses, there were no Nevada-certified laboratories for providing asbestos data that are useful for risk assessment purposes. The recommended method was performed by EMS Laboratory in Pasadena, California. This laboratory is not certified in the State of Nevada, but has California and national accreditation for asbestos analysis.

generated during sample analysis. Reported sample analysis results will be imported into the project database.

2.2.5 Criterion III –Data Sources

The review of data sources is performed to determine whether the analytical techniques used in the site characterization process are appropriate to identify the COPCs in the HHRA. The site data collection activities have been developed to characterize a broad spectrum of chemicals potentially present on the Site. Laboratory analyses for the most recent soil investigation are identified in the *Revised Sampling and Analysis Plan to Conduct Soil Characterization of Borrow Areas* (DBS&A 2006) and Table 2.

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.

2.2.6 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 whether the analytical methods appropriately identify COPCs and whether the detection limits are low enough to allow adequate characterization of risks. At a minimum, this data usability criterion can typically be met by using standard USEPA and U.S. Department of Energy (DOE) analytical methods to analyze samples collected at the Site. USEPA and USDOE methods will be used in conducting the laboratory analysis of samples and are considered the most appropriate method for the respective constituent class.

For the analytical data, the associated reference method is provided in the following guidelines:

- USEPA (2000a) *Contract Laboratory Program Statement of Work for Low Concentration Organic Analysis*;
- USEPA (2005a) *Contract Laboratory Program Statement of Work for Organic Analysis*;
- USEPA (2005b) *Contract Laboratory Program Statement of Work for Inorganic Analysis*;
- USEPA (2005c) *Contract Laboratory Program Statement of Work for Chlorinated Dioxins and Furans Analysis*;

- USEPA (1996a) *Test Methods for Evaluation Solid Wastes, SW-846 Third Edition;*
- USDOE (1997) *Procedures Manual of the Environmental Measurements Laboratory, HASL-300*; and
- Berman and Kolk (2000) *Modified Elutriator Method for the Determination of Asbestos in Soils and Bulk Material*.

Laboratory reporting limits are based on those outlined in the reference method and the sampling and analysis plan. In accordance with respective laboratory SOPs, the analytical processes include performing instrument calibration, laboratory method blanks, and other verification standards used to ensure QC during the analyses of collected samples. An evaluation of detection limits will be performed using appropriate risk-based screening levels identified in the QAPP (BRC and MWH 2006a).

2.2.7 Criterion V – Data Review

The data review portion of the data usability process focuses primarily of the quality of the analytical data that will be received from the laboratory. A Data Validation Summary Report will be prepared for all data collection efforts. Any analytical errors and/or limitations in the data will be addressed and an explanation for data qualification will be provided in respective data tables.

2.2.8 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 the HHRA. The DQIs include PARCC. The QAPP (BRC and MWH 2006a) 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 data set. Data validation activities include the evaluation of PARCC parameters, and all data not meeting the established PARCC criteria will be qualified during the validation process using the guidelines presented in the National Functional Guidelines for Laboratory Data Review, Organics and Inorganics and Dioxin/Furans (USEPA 1999, 2001a, 2004a, 2005d).

For some analytical results, quality criteria will not be met and various data qualifiers will be 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 USEPA guidelines (USEPA 1999, 2001a, 2004a, 2005d). Data validation flags indicate when results are considered non-detect (U), estimated (J), or rejected (R). Sample results may be rejected based on findings of serious deficiencies in the ability to properly collect or analyze the sample and meet QC criteria. Only rejected data will be considered unusable for decision-making purposes and rejected analytical results will not be used in the HHRA. Sample results qualified as estimated may be affected by special circumstances and are likely to be quantitatively biased to some degree; estimated analytical results will be used in the HHRA. Data qualified as non-detect represents an analyte or compound that is not detected above the sample quantitative limit and such data will be used in the HHRA. These data usability decisions follow the guidelines provided in USEPA's (1992a) *Guidance for Data Usability in Risk Assessment – Part A.*

2.2.9 Data Adequacy

The concept of data adequacy incorporates: (i) an analytical program that seeks to quantify all relevant Site chemicals that have the potential to affect risk calculations, and (ii) a spatial density of sampling points that provides confidence that the Site has been sufficiently characterized. The risk assessment analytical program for the Site represents a broad suite of analyses that cover all chemicals that might be conceivably expected to be present at elevated levels at the Site as a result of historical operations on the Site or adjacent to the Site.

An evaluation of the adequacy of the sampling for use in risk assessment will be presented in the HHRA report. The evaluation may incorporate the results from three analyses. The first qualitatively evaluates whether the sample collection appears to be adequately representative in relation to the CSM. The second analysis addresses data quality using traditional classical statistics-based process. The third analysis presents a probabilistic analysis of the data.

3 SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR HUMAN HEALTH RISK ASSESSMENT

The broad suite of analytes presented in the project analyte list (Table 2) is considered to be the initial list of potential COPCs at the Site, based on site characterization conducted to date. However, in order to ensure that the HHRA focuses on those substances that contribute the greatest to the overall risk (USEPA 1989); two procedures will be used to identify the COPCs for quantitative evaluation in the HHRA:

- Identification of chemicals with detected levels which are greater than background concentrations (where applicable), and

- Identification of chemicals that are frequently detected at the Site.

As to the latter, chemicals that are infrequently detected within an area will be discussed on a case-by-case basis with NDEP. Consistent with USEPA guidance (1989), compounds reliably associated with Site activities based on historical information will not be eliminated from the HHRA, even if the results of the procedures given in this section indicate that such elimination is possible. The procedure for evaluating COPCs relative to background conditions is presented below.

3.1 EVALUATION OF SITE CONCENTRATIONS RELATIVE TO BACKGROUND CONDITIONS

USEPA (1989, 2002a,b) guidance allows for the elimination of chemicals from further quantitative evaluation if detected levels are not elevated above naturally occurring levels. Typically for purposes of selecting COPCs for risk assessment, COPCs are chemicals that are shown to be elevated above naturally occurring levels based on statistical analyses. For the purpose of selecting COPCs for the HHRA, appropriate statistical methods will be applied for the comparison with background data. When the results of the statistical analyses indicate that a particular chemical is within background levels, then the chemical will not be identified as a COPC and will not be quantitatively evaluated in the HHRA. That is, a chemical is selected as a COPC based on background conditions if it is determined to be above background levels in any individual background comparison test. A chemical will be excluded as a COPC only if it is determined to be at or below background levels in all statistical comparison tests. The chemical will, however, be addressed qualitatively in the uncertainty analysis section of the HHRA report (USEPA, 2002a). Also consistent with USEPA guidance (2002a), for chemicals that exceed their respective background levels, risks will be calculated considering both background and site-related risks.

Background concentrations of metals and radionuclides considered representative of the Site soils will be evaluated. The comparison of site-related soil concentrations to background levels will be conducted using the soils background data set presented in the draft *Background Soil Summary Report, BMI Complex and Common Area Vicinity* (BRC/TIMET 2006, currently in revision). This soils background data set includes both the Environ (2003) data set and the BRC/TIMET data set collected in 2005. This combined background data set is still draft and has not yet been approved by NDEP.

Background comparisons will be performed using the Quantile test, Slippage test, the *t*-test, and the Wilcoxon Rank Sum test with Gehan modification. The Quantile test, Slippage test, and Wilcoxon Rank Sum test are non-parametric. That is, the tests are distribution free, thus an assumption of whether the data are normally or lognormally distributed is not necessary. The computer statistical software program GISdT® (Neptune and Company 2006), will be used to perform all statistical comparisons, with a decision error of alpha = 0.025. An alpha = 0.025 is adequate to identify differences between the two datasets since multiple statistical tests are proposed (Black 2006).

The Wilcoxon Rank Sum test performs a test for a difference between two population measures of center. This is a non-parametric method that relies on the relative rankings of data values and the measure of center is quantified by the sum of the ranks in both Site and background data. Knowledge of the precise form of the population distributions is not necessary. The Wilcoxon Rank Sum test has less power than the two-sample t-test when the data are in fact normally distributed; however the assumptions are not as restrictive. The GISdT® version of the Wilcoxon Rank Sum test uses the Mantel approach which is equivalent to using the Gehan ranking system.

The Quantile test addresses tail effects which are not addressed in the Wilcoxon rank-sum test. The Quantile test looks for differences in the right tails (upper-end of the data set) rather than central tendency like the Wilcoxon rank-sum test. The Quantile test will be performed using a defined quantile = 0.80.

The Slippage test evaluates whether there are an unreasonable number of site data points that exceed the maximum background value.

Typically an alpha = 0.05 is used to evaluate a statistically significant result. Since several tests will be conducted, a lower alpha is selected. As more tests are performed, it is more likely that a statistically significant result will be obtained purely by chance. Given the use of the multiple statistical tests, an alpha = 0.025 is selected as a reasonable significance level for the COPC selection. Any chemical that resulted in a p value less than 0.025 in one of the four tests will be retained as a COPC. Additionally, these tests are set up with one-sided hypotheses. Consequently, not only are differences between the two samples able to be detected, a directional determination can be made as well (*e.g.*, Site is greater than background).

Cumulative probability plots and side-by-side box-and-whisker plots will also be prepared to evaluate whether the Site data and background data are representative of a single population. These plots will not necessarily be used in the selection of COPCs, but will be presented for

qualitative purposes. These plots give a visual indication of the similarities between the Site and background data sets. A determination to eliminate a chemical as a COPC on the basis of these visual indications will be made on a case-by-case basis with NDEP.

3.2 FURTHER SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Initially, as discussed above, the broad-suite analytes are considered to be potential COPCs at the Site. From this list, a preliminary list of COPCs will be derived for purposes of risk assessment that includes chemicals that are:

- Positively identified in at least one sample in a given medium, including: (1) chemicals with no qualifiers attached (excluding non-detect results with unusually high detection limits, if warranted), and (2) chemicals with qualifiers attached that indicate known identities but estimated concentrations (*e.g.*, J-qualified data);

- Detected at levels significantly elevated above levels of the same chemicals detected in associated blank samples (this protocol includes an analyte if it is known to be site-related and its concentration is greater than five times the maximum amount detected in any blank; if the chemical is a common laboratory contaminant [as defined by USEPA 1989], it is included only if its concentration is greater than 10 times the maximum amount detected in any blank);

- Detected at levels significantly elevated above naturally-occurring levels of the same chemicals;

- Tentatively identified but presumed to be present because of association with the Site based on historical information; and

- Transformation (*e.g.*, degradation) products of chemicals demonstrated to be present.

In deriving the preliminary list of COPCs, the following criteria established by USEPA (1989) will also be considered:

Historical Information – Examine historical information on the Site. Chemicals likely to be associated with Site activities, based on historical information, will not be eliminated, even if the results of other "COPC reduction" steps indicate that such elimination is warranted.

Concentration and Toxicity - Aspects of concentration and toxicity will be considered prior to eliminating a chemical as a COPC. For example, weight-of-evidence for human toxicity will be

considered in conjunction with Site exposure concentrations. Thus, Class A carcinogens will be retained as COPCs.

Consistent with Agency for Toxic Substances and Disease Registry (ATSDR) guidance (De Rosa *et al.*, 1997), if the maximum dioxins/furans toxic equivalency (TEQ) concentration in an exposure area does not exceed the ATSDR screening value of 50 parts per trillion (ppt), dioxins/furans will generally not be retained as COPCs, following consultation with NDEP. This screening value is consistent with a recent review of the scientific evidence for the risks posed by dioxins (Paustenbach *et al.*, 2006).

Availability of Toxicity Criteria – Some chemicals have not been assigned toxicity criteria (*i.e.*, cancer slope factor [CSF] or reference dose [RfD]). Prior to eliminating such chemicals, structure-activity relationship (SAR) analysis and applicability of surrogate toxicity values will be considered.

Mobility, Persistence and Bioaccumulation – Chemicals that are highly mobile, are persistent or tend to bioaccumulate will generally be retained as COPCs.

Special Exposure Routes – For some chemicals under special site-specific scenarios, certain exposure routes need to be considered carefully before eliminating COPCs.

Treatability – Chemicals that are difficult to treat should remain as COPCs because of their importance during the selection of groundwater remedial alternatives if needed.

Documentation of Rationale – Rationale for the exclusion of any chemicals from the risk assessment will be documented in the HHRA report.

Need for Further Reduction of COPCs – The need for further reduction of COPCs will be considered prior to applying reduction criteria. It may be appropriate to narrow the number of COPCs included in fate and transport modeling by grouping COPCs with similar fate and transport properties. That is, the modeled behavior of a given COPC will likely reflect that of other COPCs with similar properties. The selection of appropriate COPCs to be included in fate and transport modeling will be discussed with, and approval sought from, NDEP prior to modeling. A discussion of the COPCs that are not included in fate and transport modeling will be presented in the uncertainty section of the HHRA report.

Approval by NDEP – NDEP approval will be sought prior to the elimination of any potential COPCs from the HHRA.

Frequency of detection (FOD) is another criterion that may warrant COPC reduction. Chemicals exhibiting a low FOD within a specific exposure area generally will not contribute significantly to risk and hazard estimates when hot spots are not present. USEPA (1989) suggests that chemicals with a FOD less than or equal to five percent, with the exception of metals and known human carcinogens, may be considered for elimination. Prior to eliminating a COPC based on the FOD criteria, (1) any elevated detection limits will be addressed, and (2) data distributions within exposure areas will be considered (*e.g.*, potential hot spots will be assessed). Additionally, the detection of the COPC in all sampled media will be considered. For example, USEPA recommends that a chemical infrequently detected in soil should not be eliminated if it is frequently detected in groundwater and exhibits mobility in soil. As stated above, chemicals that are infrequently detected will be addressed on an exposure area-specific basis and will be discussed on a case-by-case basis with NDEP.

3.3 SUMMARY AND PRESENTATION OF CHEMICALS OF POTENTIAL CONCERN

A summary of the site COPC data (*i.e.*, chemical, range of concentration, background levels, FOD, retained/eliminated as COPC, and rationale for elimination) will be presented in table form. Any additional discussion of COPC selection will be made in the text as necessary.

4 DETERMINATION OF REPRESENTATIVE EXPOSURE CONCENTRATIONS

A representative exposure concentration is a COPC-specific and media-specific concentration value used in the dose equation for each receptor and each exposure pathway. As described below, the methods, rationale, and assumptions employed in deriving the representative exposure concentrations will be consistent with USEPA guidance and will reflect site-specific conditions.

4.1 SOIL

The HHRA will incorporate representative exposure concentration estimates (*e.g.*, 95 percent upper confidence limit [UCL] on the arithmetic mean [USEPA 1992b, 2002c]) that specifically relate to potential site-specific human exposure conditions. For the 95 percent UCL concentration approach, the 95 percent UCL will be computed in order to represent the area-wide exposure point concentrations. The UCL incorporates the uncertainty of the estimate of the mean and is the value that, with repeated sets of samples, will be greater than the true mean 95 percent of the time. Based on USEPA (1989) guidance, non-detects for COPCs will be assigned a value of one-half the detection limit. Other methods for addressing non-detects may be considered. For radionuclide uncensored data, the actual reported value will be used. Data identified in the data

usability evaluation as unusable due to elevated reporting limits will not be used in the calculation of representative exposure concentrations. The formulas for calculating the 95 percent UCL COPC concentration (as the representative exposure concentration) are presented in USEPA (1992b, 2002c). The 95 percent UCL statistical calculations will be performed using the computer statistical software program GISdT® (Neptune and Company 2006).

The 95 percent UCL of the arithmetic mean concentration is used as the average concentration, because it is not possible to know the true mean. The 95 percent UCL, therefore, accounts for uncertainties due to limited sampling data. An estimate of average concentration is used because: carcinogenic and chronic non-carcinogenic toxicity criteria are based on lifetime average exposures; and, average concentration is most representative of the concentration that would be contacted at a site, over time (USEPA 1992b).

Representative exposure concentrations for soil are typically based on the potential exposure depth for each of the receptors. However, given that the HHRA will assess exposures to soil following excavation and use as off-site fill material, it is proposed that a 95 percent UCL be generated for all data collected within the excavation extent and depth. This 95 percent UCL will be used for all potentially exposed receptors. For indirect exposures, this concentration will be used in fate and transport modeling.

4.2 OUTDOOR AIR

Long–term exposure to COPCs bound to dust particles will be evaluated using the USEPA's Particulate Emission Factor (PEF) approach (USEPA 2002d). 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 2002d]) values in this equation will be for Las Vegas, Nevada (Appendix D of USEPA 2002d; see Table 2). The USEPA guidance for dust generated by construction activities (USEPA 2002d) will be used for short-term on-site and off-site construction worker exposures. Input soil concentrations for the model will be the 95 percent UCL concentrations as described above. For exposures to VOCs in outdoor air, the USEPA volatilization factor approach will be used (USEPA 2002d). The same volatilization factors will be used for all scenarios. The volatilization factors for the construction worker will not be adjusted to account for soil intrusion activities. Soil intrusion associated with construction activities could results in increased volatilization from the subsurface to outdoor. However, the volatilization factors to be used are conservative and are not likely to underestimate exposures. Fate and transport model input values are presented in Table 3.

5 HUMAN HEALTH RISK ASSESSMENT APPROACH

The following risk assessment approach will be conducted for all COPCs, with the exception of lead. A project-specific cleanup goal of 400 mg/kg has been established for lead during previous meetings with NDEP.

5.1 DETERMINISTIC HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

The deterministic risk assessment will follow procedures outlined in the USEPA's *Risk Assessment Guidance for Superfund: Volume I -Human Health Evaluation Manual* (USEPA 1989). Other guidance documents that will be relied on include:

- *Guidelines for Exposure Assessment*. USEPA. 1992c.
- *Exposure Factors Handbook, Volumes I-III*. USEPA 1997b.
- *Soil Screening Guidance: Technical Background Document*. USEPA 1996b.
- *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*. USEPA 2002d.
- *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual*. Supplemental Guidance. USEPA. 1991.
- Nevada Administrative Code Chapter NAC 445A. Adopted Permanent Regulation of the Nevada State Environmental Commission. LCB File No. R119-96. NDEP. 1996.

5.1.1 Deterministic Exposure Parameters

The exposure parameters proposed to be used in the deterministic risk assessment are presented in Tables 4 through 6. These conservative default values are primarily based on standard USEPA guidance values. In some instances standard USEPA guidance values are unavailable. This is the case for trespasser exposure frequency and time. In these instances, professional judgment was used to select appropriate exposure factors. For the trespasser exposure frequency and time, it is assumed that a trespasser could access the Site for 50 days per year (or one day per week) and spend four hours on the Site per visit. Exposure parameters that have significant impact on the results will be discussed in the uncertainty section of the HHRA report.

5.1.2 Deterministic Exposure Assessment

Reasonable maximum exposure levels to chemicals will be calculated for each receptor of concern, using the exposure parameters identified in Tables 4 through 6. The methodology used to estimate the average daily dose (ADD) of the chemicals via each of the complete exposure pathways is based on USEPA (1989, 1992c) guidance. For carcinogens, lifetime ADD (LADD) estimates are based on chronic lifetime exposure extrapolated over the estimated average 70-year lifetime (USEPA 1989). This is performed in order to be consistent with CSFs, which are based on chronic lifetime exposures. For non-carcinogens, ADD estimates will be averaged over the estimated exposure period. The generic equation for calculating the ADDs and LADDs is:

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

where:

Dose	=	ADD for non-carcinogens and LADD for carcinogens (in mg/kg-day)
C	=	chemical concentration in the contact medium (mg/kg soil)
IR	=	intake rate (*e.g.*, mg/day soil ingestion and dermal contact; m^3/day for inhalation)
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)
AT	=	averaging time; same as the ED for non-carcinogens and 70 years (average lifetime) for carcinogens

With the exception of arsenic, the relative oral bioavailability (BIO) of all COPCs will be 100 percent. For arsenic, consistent with scientific literature recommendations on arsenic bioavailability (Roberts *et al*. 2001; Ruby *et al*. 1999; USEPA 2001b), an arsenic oral bioavailability of 30 percent will be used. The actual oral bioavailability of arsenic (as well as other metals at the Site, for which an oral bioavailability of 100 percent will be used) is likely to be lower than this value. Chemical-specific dermal absorption values from USEPA guidance (USEPA 2004b [Part E RAGS]) will be used in the HHRA.

Exposure levels of potentially-carcinogenic and non-carcinogenic chemicals will be calculated separately because different exposure assumptions apply (*i.e.*, ADD for non-carcinogens and LADD for carcinogens). Exposure levels will be estimated for each relevant exposure pathway

(*i.e.*, soil, air), and for each exposure route (*i.e.*, oral, inhalation, and dermal). Daily doses for the same route of exposure will be summed. The total dose of each chemical is the sum of doses across all applicable exposure routes.

The results of the exposure assessment will be used with information on the toxicity of the COPCs in the risk characterization step of the HHRA to estimate the potential risks to human health posed by exposure to the COPCs. This process is discussed in Section 7.

5.2 RADIONUCLIDE RISK ASSESSMENT METHODOLOGY

Risks associated with radionuclides will be evaluated separately from chemicals. Recently available USEPA risk assessment methodologies for radionuclides will be used (USEPA 2000b). There are several important differences between evaluating risks pertinent to radionuclides and those pertinent to chemicals. These differences include:

- Concentrations are based on units of activity (*e.g.*, pCi) instead of units of mass (*e.g.*, mg) in soil;
- Only the carcinogenic effects of radionuclides due to ionizing radiation are considered. A radionuclide may also have a chemical toxicity (*e.g.* uranium or lead). These risks are addressed separately by using the concentration of mass of chemical in soil, rather than activity; and
- CSFs are based on the total theoretical age-averaged incremental lifetime cancer risk per intake of the radionuclide, or per unit external radiation exposure to gamma-emitting radionuclides. An adult only soil ingestion CSF is available and will be used for all receptors. Except for external CSFs, which are presented as risk/year per pCi/g soil, CSFs for radionuclides are not expressed as a function of body weight or time as are CSFs for chemicals.

Exposure equations and parameter values used will be the standard deterministic risk assessment exposure parameters based on typical USEPA (2000b, 2006a) default values. The exposure equations are modified to include radionuclide decay as used in USEPA's radionuclide PRG equations (USEPA 2006a). Default parameter values are presented in Tables 4 through 6. These factors will also be used in the calculation of background radionuclide risk levels.

5.3 ASBESTOS RISK ASSESSMENT METHODOLOGY

Although final guidance is unavailable at this time, USEPA recommends that site-specific risk assessments be performed for asbestos (USEPA 2004d). Risks associated with asbestos in soil will be evaluated using the most recent 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). Exposure pathways, equations, and parameters to be used will be those presented in USEPA (2003b). Adjustments for exposure duration and exposure intensity, consistent with the methodology, will be made for each of the receptor populations, based on the respective exposure parameters presented in Tables 4 through 6.

The exposure point concentration for asbestos is based on the pooled analytical sensitivity of the dataset. 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 will be evaluated. The estimate of the mean asbestos concentration is the number of asbestos fibers detected multiplied by the pooled analytical sensitivity. The upper bound estimate is the upper confidence bound of the mean of the assumed underlying Poisson distribution used to model the number of structures found multiplied by the pooled analytical sensitivity. The intent of the risk assessment methodology is to predict the amount of airborne asbestos which can be inhaled by a receptor. In addition, it will be assumed that asbestos only occurs at the soil surface (*i.e.*, upper two inches).

For assessing asbestos risks, Table 8-2 (Based on Optimum Risk Coefficients) of USEPA (2003b) will be used. Population averaged risks will be evaluated based on Eqn. 8-1 of USEPA (2003b). This equation considers male smokers, male non-smokes, female smokers, and female non-smokers. In addition, because both chrysotile and amphibole have been detected in the general area (for example, from the City of Henderson wastewater reclamation facility [WRF] sampling), both could be expected to occur at the Site. Therefore, both amphibole and chrysotile fibers will be conservatively evaluated in the HHRA, regardless as to whether either is detected (as calculated using the 95 percent UCL of the mean of the assumed underlying Poisson distribution).

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, USEPA 2003b). In fact, the Modified Elutriator Method (Berman and Kolk 2000), which was the method employed to perform the analyses to be used in the HHRA, was designed specifically to facilitate prediction of airborne asbestos exposures based on bulk measurements (see, for example, Berman and Chatfield 1990). The method of sample preparation and analysis for asbestos involves collection of composite samples that are re-suspended and then forced through an airway and filter. Because of this, coupled with the very low response (few detections), there is probably very limited value, if any, to compositing the samples before analysis.

6 TOXICITY ASSESSMENT

This section identifies how toxicity values to be used for the HHRA will be obtained. Toxicity values are published by the USEPA in the on-line Integrated Risk Information System [IRIS]; USEPA 2006b). CSFs are chemical-specific and experimentally derived potency values that are used to calculate the risk of cancer resulting from exposure to potentially carcinogenic chemicals. A higher value implies a more potent carcinogenic potential. RfDs are experimentally derived "no-effect" levels used to quantify the extent of toxic effects other than cancer due to exposure to chemicals. With RfDs, 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. Toxicity criteria will not be developed *de novo* by BRC for elements or compounds that do not have criteria published in the above sources. Should COPCs be found which do not have established toxicity criteria; these will be discussed on a case-by-case basis with NDEP and qualitatively addressed in the uncertainty analysis of the HHRA report. Where appropriate, and only as approved by NDEP, non-carcinogenic surrogate RfDs may be applied.

Like any biological reaction, the toxicity of a chemical on humans can be described as a range of possible outcomes (severities and levels that cause an endpoint of concern). Available toxicity values for all Site COPCs to be used in the HHRA will be obtained from the USEPA. The following hierarchy for selecting toxicity criteria will be used (based on USEPA 2003c):

1. IRIS

2. USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs)

3. National Center for Environmental Assessment (NCEA, 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. Agency for Toxic Substances and Disease Registry (ATSDR) toxicological profiles

7. USEPA's Environmental Criteria and Assessment Office (ECAO)

8. Peer-reviewed scientific literature

For carcinogens, the USEPA weight-of-evidence classification will be identified for each carcinogenic COPC. Available RfDs will be obtained for all COPCs, including carcinogens. A list of COPC-specific non-carcinogenic and carcinogenic toxicity criteria, current at the time of the HHRA, will be submitted to NDEP for approval prior to initiation of the risk assessment. Radionuclides toxicity criteria will be obtained from the USEPA's *Radionuclide Toxicity and Preliminary Remediation Goals for Superfund* (USEPA 2006a). For some radionuclides, two different toxicity criteria are available: for that radionuclide only, and for the radionuclide and associated short-lived radioactive decay products (*i.e.*, those decay products with radioactive half-lives less than or equal to six months). To be conservative, the toxicity criteria that include radioactive decay products will be used, even though toxicity criteria are available for some of their respective radioactive decay products, which are also assessed separately.

Although route-to-route extrapolation is generally inappropriate without adequate toxicological information, in this case route-to-route extrapolation will be applied based on USEPA's approach (USEPA 2004c). The uncertainties associated with this approach will be addressed in the HHRA report. CSFs that account for risks from associated short-lived radioactive decay products (*i.e.*, radon) will be used in the HHRA.

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 2004b). Although a review draft, USEPA stated 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 the dioxins/furans (CDD/CDFs), the USEPA toxicity equivalency procedure, developed to describe the cumulative toxicity of these compounds, will be applied. This procedure involves assigning individual toxicity equivalency factors (TEFs) to the 2,3,7,8 substituted CDD/CDF congeners. TEFs are estimates of the toxicity of dioxin-like compounds relative to the toxicity of 2,3,7,8-TCDD, which is assigned a TEF of 1.0. Calculating the toxic equivalency (TEQ) of a mixture involves multiplying the concentration of individual congeners by their respective TEF. One-half the detection limit will be 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 TEQ concentration for the mixture. TEFs from USEPA (2000c) will be used in the HHRA.

For carcinogenic polycyclic aromatic hydrocarbons (PAHs), provisional USEPA guidance for estimating cancer risks will be used (USEPA 1993). The procedure uses information from the scientific literature to estimate the carcinogenic potency of several PAHs relative to benzo(a)pyrene. These relative potencies may be used to modify the CSF developed for benzo(a)pyrene for each PAH, or to calculate benzo(a)pyrene equivalent concentrations for each of the PAH's (which would then be used with the benzo(a)pyrene CSF). The former approach will be used in the HHRA. If one carcinogenic PAH is considered a COPC then all seven carcinogenic PAHs will be considered COPCs, regardless of whether or not they were detected at the Site. Although route-to-route extrapolation is inappropriate without adequate toxicological information, route-to-route extrapolation will be applied based on USEPA's approach.

The USEPA has not derived toxicity criteria to evaluate the potential non-cancer health hazards associated with exposure to the carcinogenic PAH COPCs. For the HHRA, a toxicological surrogate (*i.e.*, pyrene) will be used to quantify the potential non-carcinogenic effects of the carcinogenic PAHs. This surrogate was selected from a list of six PAHs for which non-cancer oral toxicity criteria have been assigned by the USEPA based on a careful consideration of their relevant toxicity data, target organ(s), dose-response information, and structure-activity relationships. From the available oral non-cancer toxicity data reported by the USEPA, the most sensitive target organs are the liver, kidney, and blood (hematological effects) (IRIS, USEPA 2006b; ATSDR 1990, 1995; ORNL 1993). For the carcinogenic PAHs, the non-cancer target organs were found to be the same and the reported toxicological thresholds for these effects are generally in the range for those reported for the non-cancer PAHs (ATSDR 1995). Although naphthalene (2-ring structure) has the most stringent oral non-cancer toxicity criterion (0.02 mg/kg day), pyrene (4-ring structure; oral reference dose of 0.03 mg/kg-day) was selected to be

the best surrogate due to (1) non-cancer toxicity endpoints are more consistent with those for carcinogenic PAHs and (2) the greater number of rings in the pyrene chemical structure.

7 RISK CHARACTERIZATION

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

7.1 METHODS FOR ASSESSING CANCER RISKS

In the risk characterization, carcinogenic risk will be estimated as the incremental probability of an individual developing cancer over a lifetime as a result of a chemical exposure. Carcinogenic risks will be evaluated by multiplying the estimated average exposure rate (*i.e.*, LADD calculated in the exposure assessment) by the chemical's CSF. The CSF converts estimated daily doses averaged over a lifetime to incremental risk of an individual developing cancer. 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. According to USEPA (1989), this approach is appropriate for theoretical upper-bound incremental lifetime cancer risks of less than 1×10^{-2}. The following equations will be used to calculate chemical-specific risks and total risks:

$$Risk = LADD \times CSF$$

where:

LADD = lifetime average daily dose (mg/kg-d)
CSF = cancer slope factor $(mg/kg\text{-}d)^{-1}$

and

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

It will be assumed that cancer risks from various exposure routes are additive. Thus, the result of the assessment is necessarily a high-end estimate of the total carcinogenic risk. High-end

carcinogenic risk estimates will be evaluated by NDEP in light of site-specific risk management decision criteria.

7.2 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 (*i.e.*, the RfDs).

ADDs and RfDs are compared by dividing the ADD by the RfD to obtain the ADD:RfD ratio, as follows:

$$Hazard\ Quotient = \frac{ADD}{RfD}$$

where:

ADD = average daily dose (mg/kg-d)
RfD = reference dose (mg/kg-d)

The ADD-to-RfD ratio is known as a hazard quotient. If a person's average exposure is less than the RfD (*i.e.*, if the hazard quotient 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, a hazard quotient 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 hazard quotients for each pathway, for all COPCs, will be summed to determine whether exposure to a combination of pathways poses a health concern. This sum of the hazard quotients is known as an HI.

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

A total HI that includes all COPCs and all exposure pathways will be presented in the HHRA. The NDEP non-cancer risk management target is an HI value of less than or equal to 1.

For any HI that exceeds 1, the potential for adverse health effects will be further evaluated by considering the target organs upon which each chemical could have an adverse effect. Target

organ-specific HIs will be assessed only after approval by NDEP. The target organ specific HIs will be summed for all relevant COPCs. The segregation of HI by target organ is consistent with USEPA guidance for non-carcinogens, including metals (USEPA 1989, 1998, 2001c).

8 UNCERTAINTY ANALYSIS

Consistent with USEPA (1989) guidance, for the deterministic risk assessment, a qualitative discussion of the uncertainties associated with the estimation of risks for the Site will be presented in the HHRA report. The uncertainty analysis will discuss uncertainties associated with each step of the risk assessment, including site characterization data, data usability, selection of COPCs, representative exposure concentrations, fate and transport modeling, exposure assessment, toxicity assessment, and risk characterization. For both non-carcinogens and carcinogens, the relative contribution of specific COPCs and pathways to total risk and HI will be identified.

9 INTERPRETATION OF FINDINGS

The risk characterization results will be presented in tabular format in the HHRA report. Key exposure (*e.g.*, estimated intakes, important modeling assumptions, summary of exposure pathways for each receptor) and toxicity information (*e.g.*, CSFs, RfDs, target organs) will be provided. In addition, the risk characterization results will be placed into proper perspective, including a discussion of the concept of *de minimis* risk. The cancer risk assessment results will be presented for both total cancer risk and background cancer risk estimates, as well as presentation of the percent contribution of the background cancer risk to the total cancer risk. In addition, those COPCs and exposure pathways having the greatest influence on the risk assessment results will be identified. As appropriate, graphical presentation of the results will also be included in the HHRA report.

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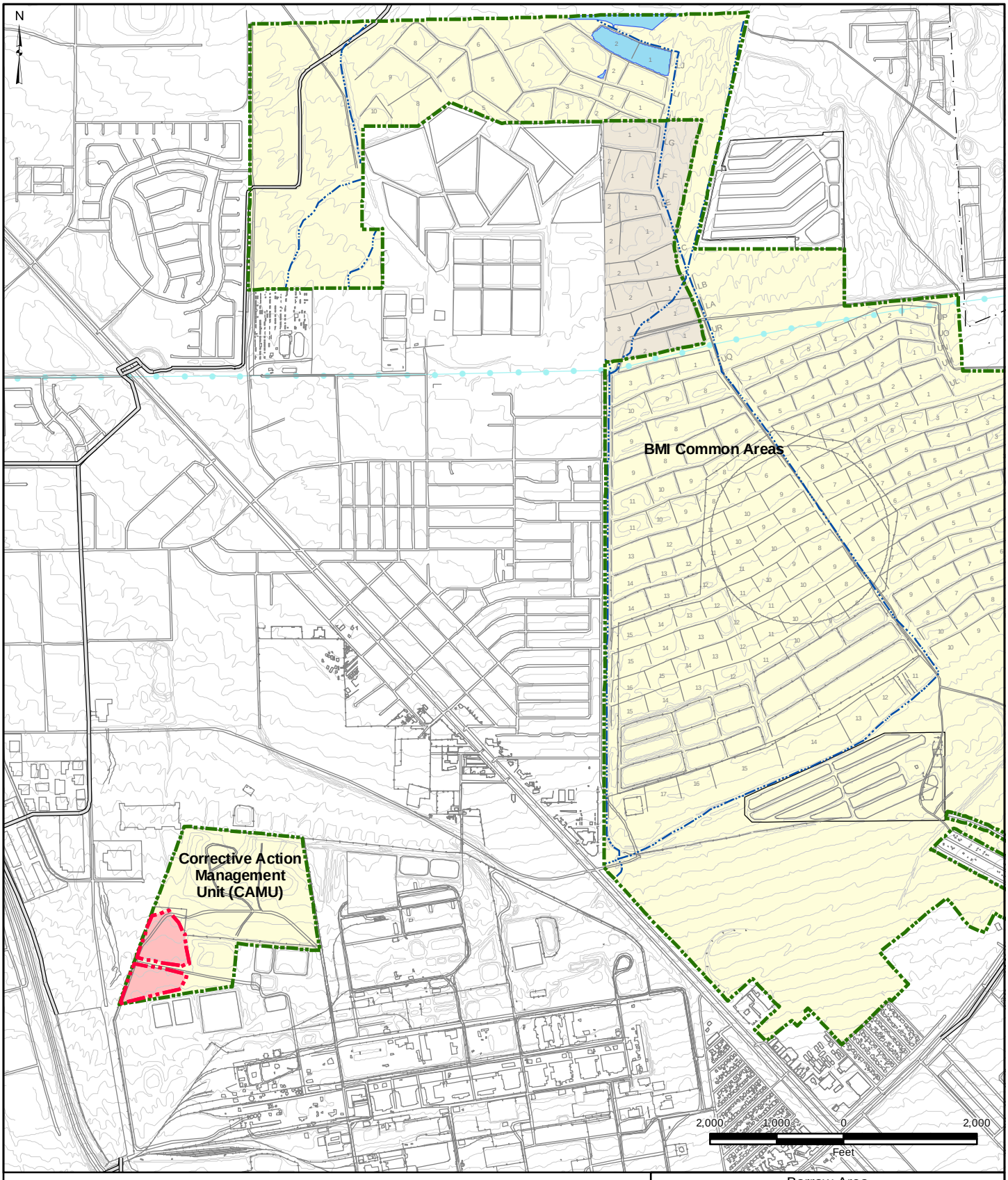
FIGURES



Borrow Area Boundary

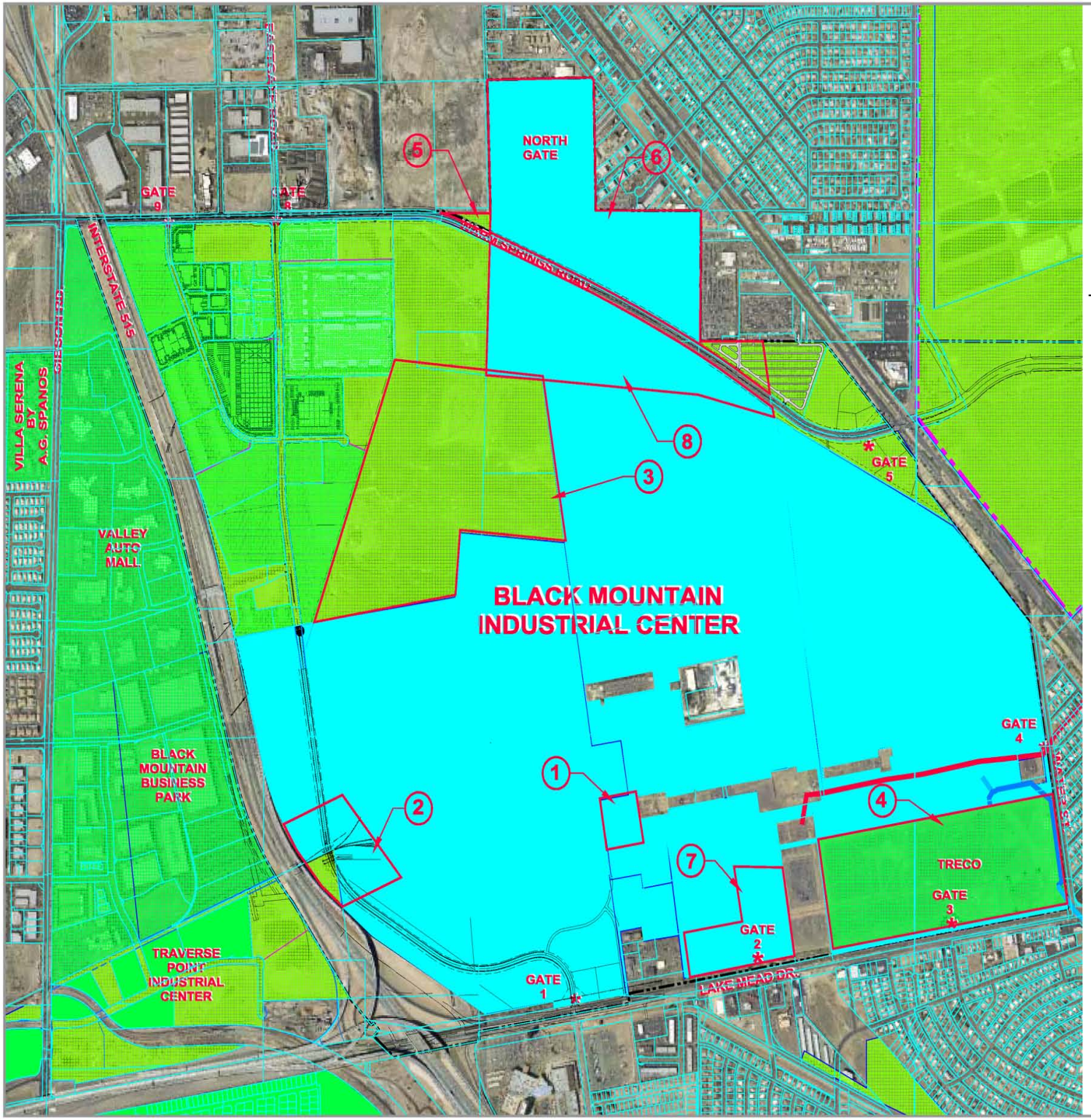
Borrow Area
BMI Complex, Clark County, Nevada

FIGURE 1

BORROW AREA LOCATION

Basic Remediation COMPANY

Prepared by:	Date	JOB No. 1881459
MWH MKJ	03/21/06	FILE: GIS/BRC/BA_FIGURE1.MXD



THE LANDWELL COMPANY

FIGURE 2

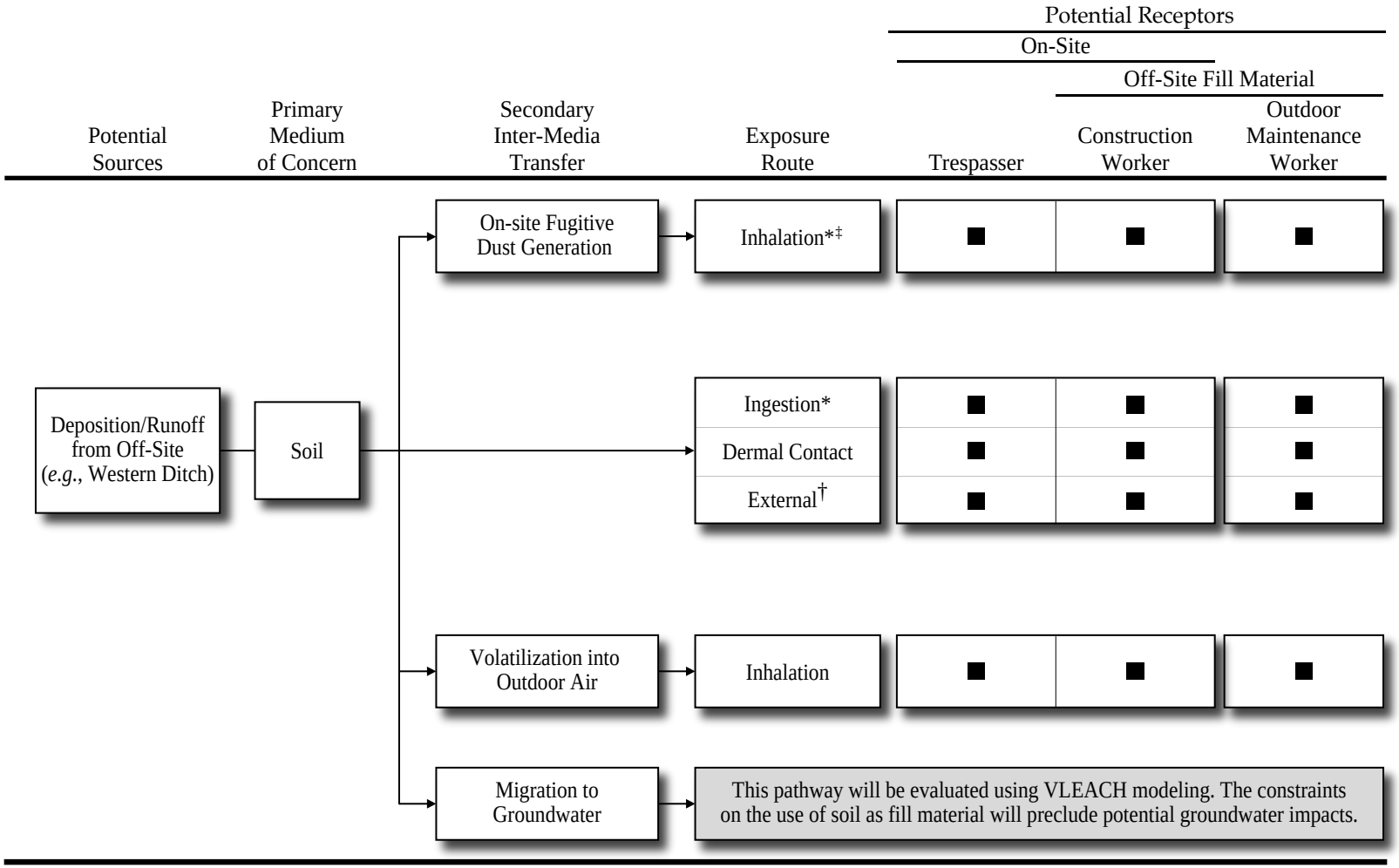
POTENTIAL BORROW AREA
MATERIAL USER SITES
(SPRING 2006 AERIALS)

1. 4TH & F STREET
2. EASTGATE RD. CROSSING
3. CAMU CAPPING MAT.
4. TRECO 73 ACRES
5. WARM SPRINGS/BURNS
6. NORTHGATE
7. GATE 2
8. GATE 7

N

1" = 500'

PBS&J



□ - Incomplete or insignificant exposure pathway.

■ - Complete exposure pathway to Borrow Area soil.

*Includes radionuclide exposures.

†Only radionuclide exposures.

‡Includes asbestos exposures.

Notes:

- Construction workers exposures include on-site excavation activities and off-site fill material placement activities.
- Current receptors that may access the property include construction workers and trespassers. Outdoor maintenance workers are assumed to only access the soil following its use as fill material at off-site locations.
- Because the future anticipated use of Borrow Area soil precludes use in residential areas, the risk assessment will not evaluate a hypothetical future residential exposure scenario.
- One of the constraints on the future use of Borrow Area soil is that such soils cannot be placed in environmentally sensitive areas, nor be exposed to ambient conditions (see Section 2.1.2); thus, ecological impacts will not be assessed.
- Risks to potential nearby, off-site receptors that may be impacted during mining and placement activities will be addressed qualitatively in the uncertainty analysis section of the HHRA based on the risk characterization for the on-site receptors.

Borrow Area
BMI Complex, Clark County, Nevada

FIGURE 3

CONCEPTUAL SITE MODEL DIAGRAM FOR POTENTIAL SOIL EXPOSURES

Basic Remediation COMPANY

Prepared by: MWH MKJ | Date 10/02/06 | JOB No. 1881459 | FILE: GIS/BRC/BA_FIGURE3.AI

TABLES

TABLE 1
VLEACH MODEL INPUT PARAMETERS
BORROW AREA RISK ASSESSMENT WORK PLAN
CLARK COUNTY, NEVADA

Case Settings and Initial Conditions Input Parameters	Units	Top Layer 1 (Borrow Materials)	Bottom Layer 2 (Native Soils)
Simulation Timestep	days	365	365
Simulation Length	years	30	30
Simulation Length[a]	days	10,958	10,958
Number of Cells[a]	--	1	10
Recharge Rate[b]	cm/day	0.0139 - 0.0417	0.0139 - 0.0417
Output Timestep[a]	days	365	365
Depth below grade to water table	feet	0[c]	Actual, based on placement location
Fill depth	feet	Actual, based on placement location	NA
Chemical Property Input Parameters	**Units**	**Value**	**Value**
Water solubility	mg/L	chemical-specific values to be obtained from USEPA 2002d.	chemical-specific values to be obtained from USEPA 2002d.
Soil pore water partition coefficient	ml/g		
organic carbon partition coefficient	ml/g		
Henry's Law constant	unitless		
Free air dispersion coefficient	cm^2/sec		
Soil Input Parameters[d]	**Units**	**Value**	**Value**
Bulk density	g/cm^3	material-specific values to be obtained by field measurements.	material-specific values to be obtained by field measurements.
Effective porosity	cm^3/cm^3		
Volumetric water content in vadose zone soils	cm^3/cm^3		
Volumetric air content in vadose zone soils[e]	cm^3/cm^3		
Percent organic carbon	%		

[a]The mass balance will be checked to confirm that the simulation length, timestep and number of cells provide a stable solution.

[b]A sensitivity analysis will be performed using a range of values for this parameter. The range shown is from 2 to 6 inches per year. Four inches per year is equivalent to 100 percent of rainfall. It should be noted that this recharge rate is much higher than the highest recharge rate for Las Vegas, Nevada from USEPA's Composite Model for Leachate Migration with Transformation Products (EPACMTP) Parameters/Data: Background Document (2003a). In addition, the assumption of 100 percent recharge from precipitation is much higher than that calculated in a recent study by UNLV which indicated a recharge rate of approximately 3 percent (James et al. 2006). This also assumes no additional water application to the site/location.

[c] Not necessary for the first (top) Borrow material layer since it is assumed that this material will be placed immediately on top of the native material, and that the concentration at the bottom of this layer will be used as input into next lower native soil layer.

[d]Soil input parameters will be the average of all available site-specific data to be collected from the Borrow Area for each of the different Borrow materials. Laboratory reports for the data, sample locations, data validation, and data usability evaluation for those data, will be provided to NDEP.

[e]Total porosity minus volumetric water content in vadose zone soils.

TABLE 2
2006 BORROW AREA INVESTIGATION PROJECT LIST OF ANALYTES
BORROW AREA RISK ASSESSMENT WORK PLAN
CLARK COUNTY, NEVADA

Chemical Group	Analytical Method	CAS Number	Compound List
Ions	**EPA 314.0**	14797-73-0	Perchlorate
Polychlorinated Dibenzodioxins/ Dibenzofurans	**EPA 8290**	39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran
		3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin
		67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran
		35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin
		55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran
		70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran
		39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin
		57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran
		57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin
		72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran
		19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin
		57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran
		40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin
		60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran
		57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran
		51207-31-9	2,3,7,8-Tetrachlorodibenzofuran
		1746-01-6	2,3,7,8-Tetrachlororodibenzo-p-dioxin
Asbestos	**ISO 10312 TEM**	1332-21-4	Asbestos
General Chemistry Parameters	**EPA 9010/9014**	57-12-5	Cyanide (Total)
	EPA 9045C	pH	pH in soil
Metals	**EPA 6020/6010B**	7429-90-5	Aluminum
		7440-36-0	Antimony
		7440-38-2	Arsenic
		7440-39-3	Barium
		7440-41-7	Beryllium
		7440-42-8	Boron
		7440-43-9	Cadmium
		7440-70-2	Calcium
		7440-47-3	Chromium
		7440-48-4	Cobalt
		7440-50-8	Copper
		7439-89-6	Iron
		7439-92-1	Lead
		1313-13-9	Lithium
		7439-95-4	Magnesium
		7439-96-5	Manganese
		7439-98-7	Molybdenum
		7440-02-0	Nickel
		7440-03-1	Niobium
		7440-05-3	Palladium
		7723-14-0	Phosphorus
		7440-06-4	Platinum
		7440-09-7	Potassium
		7782-49-2	Selenium
		7440-21-3	Silicon
		7440-22-4	Silver
		7440-23-5	Sodium

TABLE 2
2006 BORROW AREA INVESTIGATION PROJECT LIST OF ANALYTES
BORROW AREA RISK ASSESSMENT WORK PLAN
CLARK COUNTY, NEVADA

Chemical Group	Analytical Method	CAS Number	Compound List
Metals (continued)	**EPA 6020/6010B**	7440-24-6	Strontium
		7704-34-9	Sulfur
		7440-28-0	Thallium
		7440-31-5	Tin
		7440-32-6	Titanium
		7440-33-7	Tungsten
		7440-61-1	Uranium
		7440-62-2	Vanadium
		7440-66-6	Zinc
		7440-67-7	Zirconium
	EPA 7196A[1]	18540-29-9	Chromium (VI)
	EPA 7470/7471A	7439-97-6	Mercury
Organophosphorous Pesticides	**EPA 8141A**	264-27-19	Azinphos-ethyl
		86-50-0	Azinphos-methyl
		786-19-6	Carbophenothion
		2921-88-2	Chlorpyrifos
		56-72-4	Coumaphos
		298-03-3	Demeton-O
		126-75-0	Demeton-S
		333-41-5	Diazinon
		62-73-7	Dichlorvos
		60-51-5	Dimethoate
		298-04-4	Disulfoton
		2104-64-5	EPN
		13194-48-4	Ethoprop
		56-38-2	Ethyl parathion
		52-85-7	Fampphur
		55-38-9	Fenthion
		121-75-5	Malathion
		953-17-3	Methyl carbophenothion
		298-00-0	Methyl parathion
		7786-34-7	Mevinphos
		300-76-5	Naled
		297-97-2	O,O,O-Triethyl phosphorothioate (TEPP)
		298-02-2	Phorate
		732-11-6	Phosmet
		299-84-3	Ronnel
		22248-79-9	Stirophos (Tetrachlorovinphos)
		3689-24-5	Sulfotep
Chlorinated Herbicides	**EPA 8151A**	93-76-5	2,4,5-T
		93-72-1	2,4,5-TP (Silvex)
		94-75-7	2,4-D
		94-82-6	2,4-DB
		75-99-0	Dalapon
		1918-00-9	Dicamba

TABLE 2
2006 BORROW AREA INVESTIGATION PROJECT LIST OF ANALYTES
BORROW AREA RISK ASSESSMENT WORK PLAN
CLARK COUNTY, NEVADA

Chemical Group	Analytical Method	CAS Number	Compound List
Chlorinated Herbicides (continued)	**EPA 8151A**	120-36-5	Dichloroprop
		88-85-7	Dinoseb
		94-74-6	MCPA
		93-65-2	MCPP
Organochlorine Pesticides	**EPA 8081A**	53-19-0	2,4-DDD
		3424-82-6	2,4-DDE
		72-54-8	4,4-DDD
		72-55-9	4,4-DDE
		50-29-3	4,4-DDT
		309-00-2	Aldrin
		319-84-6	alpha-BHC
		5103-71-9	alpha-Chlordane
		319-85-7	beta-BHC
		57-74-9	Chlordane
		319-86-8	delta-BHC
		60-57-1	Dieldrin
		959-98-8	Endosulfan I
		33213-65-9	Endosulfan II
		1031-07-8	Endosulfan sulfate
		72-20-8	Endrin
		7421-93-4	Endrin aldehyde
		53494-70-5	Endrin ketone
		58-89-9	gamma-BHC (Lindane)
		5103-74-2	gamma-Chlordane
		76-44-8	Heptachlor
		1024-57-3	Heptachlor epoxide
		72-43-5	Methoxychlor
		8001-35-2	Toxaphene
Polychlorinated Biphenyls	**EPA 8082**	12674-11-2	Aroclor 1016
		11104-28-2	Aroclor 1221
		11141-16-5	Aroclor 1232
		53469-21-9	Aroclor 1242
		12672-29-6	Aroclor 1248
		11097-69-1	Aroclor 1254
		11096-82-5	Aroclor 1260
Polynuclear Aromatic Hydrocarbons	**EPA 8310**[2]	83-32-9	Acenaphthene
		208-96-8	Acenaphthylene
		120-12-7	Anthracene
		56-55-3	Benzo(a)anthracene
		50-32-8	Benzo(a)pyrene
		205-99-2	Benzo(b)fluoranthene
		191-24-2	Benzo(g,h,i)perylene
		207-08-9	Benzo(k)fluoranthene
		218-01-9	Chrysene
		53-70-3	Dibenzo(a,h)anthracene
		193-39-5	Indeno(1,2,3-cd)pyrene
		85-01-8	Phenanthrene
		129-00-0	Pyrene

TABLE 2
2006 BORROW AREA INVESTIGATION PROJECT LIST OF ANALYTES
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CLARK COUNTY, NEVADA

Chemical Group	Analytical Method	CAS Number	Compound List
Radiochemicals	**EPA 901.1/ HASL GA-01-R**	14331-83-0	Actinium-228
		14913-49-6	Bismuth-212
		14733-03-0	Bismuth-214
		13981-50-5	Cobalt-57
		10198-40-0	Cobalt-60
		14255-04-0	Lead-210
		015816-77-0	Lead-211
		15092-94-1	Lead-212
		15067-28-4	Lead-214
		13966-00-2	Potassium-40
		14913-50-9	Thallium-208
		15623-47-9	Thorium-227
		15065-10-8	Thorium-234 (from U-235)
	EPA 903.0	13982-63-3	Radium-226
	EPA 904.0	15262-20-1	Radium-228
	Quantitate from Parent or Daughter Radionuclide	14952-40-0	Actinium-227 (from Th-227)
		14331-79-4	Bismuth-210 (from Pb-210)
		15229-37-5	Bismuth-211 (from Pb-211)
		13981-52-7	Polonium-210 (from Pb-210)
		13981-52-7	Polonium-212 (from Bi-212)
		15735-67-8	Polonium-214 (from Bi-214)
		15756-58-8	Polonium-216 (from Pb-212)
		15422-74-9	Polonium-218 (from Pb-214)
		15100-28-4	Protactinium-234 (from Th-234)
		15623-45-7	Radium-223 (from Th-227)
		13233-32-4	Radium-224 (from Pb-212)
		14133-67-6	Thallium-207 (from Pb-211)
		14932-40-2	Thorium-231 (from U-235)
		7440-29-1	Thorium-232
		14274-82-9	Thorium-228
		14269-63-7	Thorium-230
		13966-29-5	Uranium-233/234
		15117-96-1	Uranium 235/236
		7440-61-1	Uranium-238(from Th-234)
Semivolatile Organic Compounds	**EPA 8270C[2]**	95-94-3	1,2,4,5-Tetrachlorobenzene
		122-66-7	1,2-Diphenylhydrazine
		123-91-1	1,4-Dioxane
		3457-46-3	2,2'-Dichlorobenzil
		95-95-4	2,4,5-Trichlorophenol
		88-06-2	2,4,6-Trichlorophenol
		120-83-2	2,4-Dichlorophenol
		105-67-9	2,4-Dimethylphenol
		51-28-5	2,4-Dinitrophenol
		121-14-2	2,4-Dinitrotoluene
		606-20-2	2,6-Dinitrotoluene
		91-58-7	2-Chloronaphthalene
		95-57-8	2-Chlorophenol
		91-57-6	2-Methylnaphthalene

TABLE 2
2006 BORROW AREA INVESTIGATION PROJECT LIST OF ANALYTES
BORROW AREA RISK ASSESSMENT WORK PLAN
CLARK COUNTY, NEVADA

Chemical Group	Analytical Method	CAS Number	Compound List
Semivolatile Organic Compounds (continued)	**EPA 8270C[3]**	88-74-4	2-Nitroaniline
		88-75-5	2-Nitrophenol
		91-94-1	3,3-Dichlorobenzidine
		99-09-2	3-Nitroaniline
		3457-46-3	4,4'-Dichlorobenzil (as 2,2'-dichlorobenzil)
		101-55-3	4-Bromophenyl phenyl ether
		59-50-7	4-Chloro-3-methylphenol
		7005-72-3	4-Chlorophenyl phenyl ether
		123-09-1	4-Chlorothioanisole
		106-54-7	4-Chlorothiophenol
		100-01-6	4-Nitroaniline
		100-02-7	4-Nitrophenol
		83-32-9	Acenaphthene
		208-96-8	Acenaphthylene
		98-86-2	Acetophenone
		62-53-3	Aniline
		120-12-7	Anthracene
		103-33-3	Azobenzene
		56-55-3	Benzo(a)anthracene
		50-32-8	Benzo(a)pyrene
		205-99-2	Benzo(b)fluoranthene
		191-24-2	Benzo(g,h,i)perylene
		207-08-9	Benzo(k)fluoranthene
		65-85-0	Benzoic acid
		100-51-6	Benzyl alcohol
		111-91-1	bis(2-Chloroethoxy)methane
		54-28-1	bis(2-Chloroethyl) ether
		108-60-1	bis(2-Chloroisopropyl) ether
		117-81-7	bis(2-Ethylhexyl) phthalate
		111-44-4	bis(Chloromethyl) ether
		80-07-9	bis(p-Chlorophenyl) sulfone
		1142-19-4	bis(p-Chlorophenyl)disulfide
		85-68-7	Butylbenzyl phthalate
		86-74-8	Carbazole
		218-01-9	Chrysene
		53-70-3	Dibenzo(a,h)anthracene
		132-64-9	Dibenzofuran
		542-88-1	Dichloromethyl ether
		84-66-2	Diethyl phthalate
		131-11-3	Dimethyl phthalate
		84-74-2	Di-n-butyl phthalate
		117-84-0	Di-n-octyl phthalate
		882-33-7	Diphenyl disulfide
		139-66-2	Diphenyl sulfide
		127-63-9	Diphenyl sulfone
		206-44-0	Fluoranthene
		86-73-7	Fluorene
		118-74-1	Hexachlorobenzene

TABLE 2
2006 BORROW AREA INVESTIGATION PROJECT LIST OF ANALYTES
BORROW AREA RISK ASSESSMENT WORK PLAN
CLARK COUNTY, NEVADA

Chemical Group	Analytical Method	CAS Number	Compound List
Semivolatile Organic Compounds (continued)	**EPA 8270C[3]**	87-68-3	Hexachlorobutadiene
		77-47-4	Hexachlorocyclopentadiene
		67-72-1	Hexachloroethane
		118-29-6	Hydroxymethyl phthalimide
		193-39-5	Indeno(1,2,3-cd)pyrene
		78-59-1	Isophorone
		106-44-5	m,p-Cresol
		91-20-3	Naphthalene
		98-95-3	Nitrobenzene
		621-64-7	N-nitrosodi-n-propylamine
		86-30-6	N-nitrosodiphenylamine
		95-48-7	o-Cresol
		29082-74-4	Octachlorostyrene
		106-47-8	p-Chloroaniline (4-Chloroaniline)
		106-54-7	p-Chlorobenzenethiol
		608-93-5	Pentachlorobenzene
		87-86-5	Pentachlorophenol
		85-01-8	Phenanthrene
		108-95-2	Phenol
		129-00-0	Pyrene
		110-86-1	Pyridine
		108-98-5	Thiophenol
			Tentatively Identified Compounds (TICs)
Volatile Organic Compounds	**EPA 8260B**	630-20-6	1,1,1,2-Tetrachloroethane
		71-55-6	1,1,1-Trichloroethane
		79-34-5	1,1,2,2-Tetrachloroethane
		79-00-5	1,1,2-Trichloroethane
		75-34-3	1,1-Dichloroethane
		75-35-4	1,1-Dichloroethene
		563-58-6	1,1-Dichloropropene
		87-61-6	1,2,3-Trichlorobenzene
		96-18-4	1,2,3-Trichloropropane
		120-82-1	1,2,4-Trichlorobenzene
		95-63-6	1,2,4-Trimethylbenzene
		95-50-1	1,2-Dichlorobenzene
		107-06-2	1,2-Dichloroethane
		540-59-0	1,2-Dichloroethene
		78-87-5	1,2-Dichloropropane
		108-70-3	1,3,5-Trichlorobenzene
		108-67-8	1,3,5-Trimethylbenzene
		541-73-1	1,3-Dichlorobenzene
		542-75-6	1,3-Dichloropropene
		142-28-9	1,3-Dichloropropane
		106-46-7	1,4-Dichlorobenzene
		594-20-7	2,2-Dichloropropane
		95-49-8	2-Chlorotoluene
		591-78-6	2-Hexanone
		79-46-9	2-Nitropropane

TABLE 2
2006 BORROW AREA INVESTIGATION PROJECT LIST OF ANALYTES
BORROW AREA RISK ASSESSMENT WORK PLAN
CLARK COUNTY, NEVADA

Chemical Group	Analytical Method	CAS Number	Compound List
Volatile Organic Compounds (continued)	**EPA 8260B**	108-90-7	4-Chlorobenzene
		106-43-4	4-Chlorotoluene
		108-10-1	4-Methyl-2-pentanone (MIBK)
		67-64-1	Acetone
		75-05-8	Acetonitrile
		71-43-2	Benzene
		108-86-1	Bromobenzene
		75-27-4	Bromodichloromethane
		75-25-2	Bromoform
		74-83-9	Bromomethane
		75-15-0	Carbon disulfide
		56-23-5	Carbon tetrachloride
		108-90-7	Chlorobenzene
		74-97-5	Chlorobromomethane
		124-48-1	Chlorodibromomethane
		75-00-3	Chloroethane
		67-66-3	Chloroform
		74-87-3	Chloromethane
		156-59-2	cis-1,2-Dichloroethene
		10061-01-5	cis-1,3-Dichloropropene
		99-87-6	Cymene (Isopropyltoluene)
		73506-94-2	Dibromochloroethane
		124-48-1	Dibromochloromethane
		96-12-8	Dibromochloropropane
		74-95-3	Dibromomethane
		25321-22-6	Dichlorobenzene
		75-09-2	Dichloromethane (Methylene chloride)
		624-92-0	Dimethyldisulfide
		64-17-5	Ethanol
		100-41-4	Ethylbenzene
		75-69-4	Freon-11(Trichlorofluoromethane)
		76-13-1	Freon-113(1,1,2-trichloro-1,2,2-trifluoroethane)
		75-71-8	Freon-12(Dichlorodifluoromethane)
		142-82-5	Heptane
		31394-54-4	Isoheptane
		98-82-8	Isopropylbenzene
		mp-XYL	m,p-Xylene
		78-93-3	Methyl ethyl ketone (2-Butanone)
		74-88-4	Methyl iodide
		1634-04-4	MTBE (Methyl tert-butyl ether)
		104-51-8	n-Butyl benzene
		103-65-1	n-Propylbenzene
		124-19-6	Nonanal
		95-47-6	o-Xylene
		135-98-8	sec-Butylbenzene
		100-42-5	Styrene
		98-06-6	tert-Butyl benzene
		127-18-4	Tetrachloroethene

TABLE 2
2006 BORROW AREA INVESTIGATION PROJECT LIST OF ANALYTES
BORROW AREA RISK ASSESSMENT WORK PLAN
CLARK COUNTY, NEVADA

Chemical Group	Analytical Method	CAS Number	Compound List
Volatile Organic Compounds (continued)	**EPA 8260B**	108-88-3	Toluene
		156-60-5	trans-1,2-Dichloroethene
		10061-02-6	trans-1,3-Dichloropropene
		71-55-6	Trichloroethane
		79-01-6	Trichloroethene
		108-05-4	Vinyl acetate
		75-01-4	Vinyl chloride
		1330-20-7	Xylenes (total)
			Tentatively Identified Compounds (TICs)

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 Methods 8260B and 8270C.

[1] = Hexavalent chromium analyses used an alkaline digestion procedure for extracting hexavalent chromium prior to analysis.

[2] = For SVOCs, Method 8270C is the primary analytical method, but for risk assessment purposes results from Method 8310 will be used.

[3] = Method 3540 for extraction and Method 3640 for cleanup are to be used as appropriate.

TABLE 3
FATE AND TRANSPORT MODEL INPUT VALUES FOR AIR EPCs
BORROW AREA RISK ASSESSMENT WORK PLAN
CLARK COUNTY, NEVADA

Parameter	Abbrev.	Value	Units	Reference
Outdoor Air Parameters				
Particulate emission factor[a]	PEF	1.36 E+9	m^3/kg	USEPA 2002d
Volatilization factor	VF	---chemical-specific---		USEPA 2002d
Dispersion factor for volatiles emitted from soil[b]	Q/C_{vol}	83.1	g/m^2-s per kg/m^3	USEPA 2002d
Construction Dust Parameters				
Fraction of vegetative cover	V	0	--	USEPA 2002d
Mean annual wind speed	U	4.0 (8.9 mph)	m/s	(1)
Equivalent threshold value of wind speed	U_t	11.3	m/s	USEPA 2002d
Function dependent on U/U_t	F(x)	0.194	--	USEPA 2002d
Wet soil bulk density	r_{soil}	1.74	Mg/m^3	(2)
Percent moisture in soil	M	17.7	%	site-specific[c]
Depth of site excavation	d_{excav}	11 (35 ft)	m	site-specific[c]
Number of times soil is dumped	N_A	2.0	--	USEPA 2002d
Percent weight of silt in soil	s	9.4	%	site-specific[c]
Mean vehicle speed	S_{doz}	11.4	km/hr	USEPA 2002d
Areal extent of site tilling	A_{till}	3.6	acre	(3)
Number of times soil is tilled	N_A	2.0	--	USEPA 2002d
Subchronic dispersion factor for area source-Constant A	A	2.454	--	USEPA 2002d
Subchronic dispersion factor for area source-Constant B	B	17.566	--	USEPA 2002d
Subchronic dispersion factor for area source-Constant C	C	189.043	--	USEPA 2002d
Width of road segment	W_R	6.1	m	USEPA 2002d
Mean vehicle weight	W	8.0	tonnes	USEPA 2002d
Number of days/year ≥ 0.01 inches	p	27.0	days	(1)
Subchronic dispersion factor for road segment-Constant A	A	12.935	--	USEPA 2002d
Subchronic dispersion factor for road segment-Constant B	B	5.738	--	USEPA 2002d
Subchronic dispersion factor for road segment-Constant C	C	71.771	--	USEPA 2002d
Areal extent of site surface contamination	A_{surf}	17.8	acres	site-specific[c]

[a]For non-construction worker exposures only. Construction worker dust exposures calculated from USEPA (2002d).

[b]Calculated from default parameters for Las Vegas, NV in Appendix D of USEPA (2002d) .

[c]Average of all available site-specific data collected from the Borrow Area.

(1) - Based on long-term weather data for the area of interest (WRCC 2006, On-line. http://www.wrcc.dri.edu/).

(2) - Based on data from vicinity investigations (from data collected in the BMI Common Areas in 2004 and Environ [2003]).

(3) - Assumed value of one fifth of the site based upon USEPA (2002d).

TABLE 4
DETERMINISTIC EXPOSURE FACTORS – CONSTRUCTION WORKERS
BORROW AREA RISK ASSESSMENT WORK PLAN
CLARK COUNTY, NEVADA

Parameter	Abbrev.	Value	Units	Reference
Construction worker dermal adherence factor	AF_{cw}	0.3	mg/cm^2	USEPA 2002d
Averaging time, carcinogenic	AT_c	70	years	USEPA 1991
Averaging time, non-carcinogenic	AT_{nc}	1	years	Based on ED_{cw}
Adult body weight	BW_a	70	kg	USEPA 1991
Construction worker exposure frequency	EF_{cw}	250	days/year	USEPA 1991
Exposure duration	ED_{cw}	1	years	(1)
Adult inhalation rate	$IR_{a'}$	20	m^3/day	USEPA 2002d
Construction worker exposed surface area	SA_{cw}	3,300	cm^2/day	USEPA 2002d
Construction worker soil ingestion rate	$IR_{s,cw}$	330	mg/day	USEPA 2002d
Radionuclide-specific factors				
Exposure time fraction, indoors	$ET_{cw,i}$	0	unitless	(2)
Exposure time fraction, outdoors	$ET_{cw,o}$	0.33	unitless	(2)
Area correction factor	ACF_{cw}	0.9	unitless	USEPA 2000b, 2006a
Gamma shielding factor	GSF	0.4	unitless	USEPA 2000b, 2006a

(1) Based on site data. A one-year exposure duration is appropriate for carcinogenic effects, because the methodology averages exposures over a lifetime (see USEPA 2002d).

(2) Assumes worker spends 100% of time outdoors, 8 hours a day.

TABLE 5

DETERMINISTIC EXPOSURE FACTORS – OUTDOOR MAINTENANCE WORKERS[a]
BORROW AREA RISK ASSESSMENT WORK PLAN
CLARK COUNTY, NEVADA

Parameter	Abbrev.	Value	Units	Reference
Maintenance worker dermal adherence factor	AF_{mw}	0.2	mg/cm^2	USEPA 2002d
Averaging time, carcinogenic	AT_c	70	years	USEPA 1991
Averaging time, non-carcinogenic	AT_{nc}	25	years	Based on ED_{mw}
Adult body weight	BW_a	70	kg	USEPA 1991
Maintenance worker exposure frequency	EF_{mw}	225	days/year	USEPA 2002d
Exposure duration	ED_{mw}	25	years	USEPA 2002d
Adult inhalation rate	$IR_{a'}$	20	m^3/day	USEPA 2002d
Maintenance worker exposed surface area	SA_{mw}	3,300	cm^2/day	USEPA 2002d
Maintenance worker soil ingestion rate	$IR_{s,mw}$	100	mg/day	USEPA 2002d
Radionuclide-specific factors				
Maintenance worker exposure fraction, indoors	$ET_{mw,i}$	0	unitless	(1)
Maintenance worker exposure fraction, outdoors	$ET_{mw,o}$	0.33	unitless	(1)
Maintenance worker area correction factor	ACF_{mw}	0.9	unitless	USEPA 2000b, 2006a
Maintenance worker gamma shielding factor	GSF	0.4	unitless	USEPA 2000b, 2006a

[a]Exposure parameters for maintenance workers are based on outdoor worker exposure factors, from USEPA (2002d).

(1) Assumes worker spends 100% of time outdoors, 8 hours a day.

TABLE 6
DETERMINISTIC EXPOSURE FACTORS – TRESPASSERS[a]
BORROW AREA RISK ASSESSMENT WORK PLAN
CLARK COUNTY, NEVADA

Parameter	Abbrev.	Value	Units	Reference
Trespasser dermal adherence factor	AF_t	0.2	mg/cm^2	USEPA 2002d
Averaging time, carcinogenic	AT_c	70	years	USEPA 1991
Averaging time, non-carcinogenic	AT_{nc}	6	years	Based on ED_t
Trespasser body weight	BW_t	60.2	kg	USEPA 1997
Trespasser exposure frequency	EF_t	50	days/year	Professional judgment
Trespasser exposure time	ET	4	hrs/day	Professional judgment
Exposure duration	ED_t	6	years	USEPA 1997
Trespasser inhalation rate	$IR_{t'}$	1.2	m^3/hr	USEPA 1997
Trespasser exposed surface area[b]	SA_t	4,400	cm^2/day	USEPA 1997, 2004b
Trespasser soil ingestion rate	$IR_{s,t}$	100	mg/day	USEPA 1997
Radionuclide-specific factors				
Trespasser exposure fraction, indoors	$ET_{t,i}$	0	unitless	(1)
Trespasser exposure fraction, outdoors	$ET_{t,o}$	0.17	unitless	(1)
Trespasser area correction factor	ACF_t	0.9	unitless	USEPA 2000b, 2006a
Trespasser gamma shielding factor	GSF	0.4	unitless	USEPA 2000b, 2006a

[a]Assumes a teenager from 13 to 19 years of age. Age-specific exposure factors reflect this age range (that is, body weight, inhalation rate, exposure surface area, and ingestion rate).

[b]Average from 13 to 19 years of age for head, forearms, hands, and lower legs.

(1) Assumes trespasser spends 100% of time outdoors, 4 hours a day.

APPENDIX A

NDEP COMMENTS ON THE BORROW AREA HUMAN HEALTH RISK ASSESSMENT WORK PLAN AND BRC RESPONSE TO COMMENTS

APPENDIX A-1
Response to NDEP Comments Dated August 25, 2006 on the July 2006 BRC Human Health Risk Assessment Work Plan, Revision 2

General Discussion: *BRC and NDEP have had several discussions after these comments were received. The following discussion is provided to give some context to the BRC responses below to specific NDEP comments. Most of NDEP's comments pertain to the use of the VLEACH model – specifically with regards to input parameters for this model.*

BRC now expects that most if not all of the Borrow materials will likely be usable in the BMI industrial complex itself, including during CAMU construction. Typically, and consistent with prior constraints agreed to with the NDEP, these materials will be used as road bed, in pads for industrial buildings, and for CAMU construction. In all cases, materials will be used with cover such that they are not directly exposed to the ambient air. It is also expected that, in most situations, the cover will also impede (or, in some cases completely block) infiltration. It should be noted, that as a general matter, the properties of soils in the BMI complex are not too different from that in the current Borrow Pit area, since they are part of the same alluvial fan. Also, the depths to groundwater in the complex range from roughly 35 feet bgs to around 60 or so feet bgs. Figure 2 has been added to the report which shows the locations of proposed Borrow material use sites.

BRC notes that the purpose of using VLEACH in this context is to predict, conservatively, impacts to groundwater. Even though VLEACH can also be used to determine impacts to air and distribution of contaminants in the soil column, that is not the intent here. It is being used simply to screen out potential impacts to groundwater.

The VLEACH manual (Model Version 2.2a, EPA, 1997) discusses the model structure (i.e., the soil matrix is divided into "polygons" for capturing lateral heterogeneity and "cells" which are vertical divisions within each polygon.) In the present case, only one polygon will be used since the purpose of the modeling is to determine whether Borrow materials placed at any location (with potential residual contamination) can leach to groundwater beneath the placement. This placement, after excavation, will not create lateral heterogeneity at a given placement location – hence multiple polygons are not required. Regarding the vertical dimension, Borrow Area materials will be placed on top of varying lengths of native (or extant) soil layers. Thus, vertically, after placement of Borrow materials, there will be two layers of materials above groundwater (disregarding any cap materials at the very top near the ground surface) – namely the Borrow materials and, beneath them, the extant native materials at the placement location, and finally groundwater. Thus, there will be, at a minimum, two stacked material "layers" in the vertical dimension. Of course, these layers can be further divided into smaller VLEACH cells which facilitate computational needs within each layer.

The VLEACH manual also discusses all of the inputs required to run the model – in general they include contaminant properties (such as diffusion coefficients, Henry Law's coefficients, organic partitioning coefficients, etc.); infiltration rate; and geophysical properties of the soil column. BRC does not plan to change model assumptions regarding contaminant properties. Regarding infiltration rate, the work plan discusses the input to be used. In order to understand the sen-

sitivity of this parameter, sensitivity runs covering a range of infiltration rates (the range will be similar to that used in the VLEACH manual) will be conducted The geophysical properties needed for running the model (namely bulk density, effective porosity, moisture content, and organic fraction in soil) can, in general, be different for each of these layers. In order to therefore determine these properties at a given potential placement location, BRC will do the following:

(a) Obtain these parameters from Borrow materials which have already been excavated – these will be representative of the Borrow materials portion of the as-placed layer in the placement location. In order to facilitate the development of the geophysical input parameters for the Borrow materials, BRC has developed and NDEP has approved a work plan for sampling Borrow materials that have been excavated from this area prior. This sampling will provide bulk density, effective porosity, moisture content, and soil organic fraction;

(b) Obtain these parameters from a potential placement location, once such a location is determined. These parameters will be representative of the native materials layer under the Borrow materials in the as-placed location. Or, demonstrate to NDEP that for a different potential placement location, why parameters obtained previously may be representative (such as if the two placement locations are nearby and of similar geology).

The VLEACH manual discusses the effects of the various geophysical parameters on the predicted groundwater concentrations (See Section 8 of the VLEACH manual). Parameters that have high sensitivity (for predicted groundwater impacts) include: contaminant organic carbon partition coefficient (not proposed to be changed in the model); infiltration rate (which will be varied to cover a conservative range of values); and the fraction organic carbon in soil (which will be obtained from field measurements). It should be noted that, in several proposed uses (such as base materials for a concrete building pad) there should be no infiltration at all. Parameters that have moderate sensitivity include bulk density (to be determined from field measurements) and moisture content (to be obtained from field measurements). Other parameters including soil porosity show low sensitivity (see Figure 8.1 of the VLEACH manual).

Because the model does not allow for the input of heterogeneous soils in the vertical directions, BRC proposes running the model in a 'stacked' fashion. That is, the model will be run twice, first with the Borrow materials soil properties, assuming contaminant concentrations throughout this first 'layer'. Outputs from this initial model run will then be used as contaminant inputs to the second model run, which will use the extant native materials soil properties. BRC consultants have had discussions with one of the USEPA developers of the model concerning this approach. EPA has indicated in these discussions that this is an appropriate way to use the model under vertically heterogeneous soil conditions. A discussion on this is provided in Section 2.1.1 of the work plan.

1. Section 2.1, Conceptual Site Model, pg. 4, 2nd paragraph. The intended use of the model is to predict "impacts to groundwater considering the use of Borrow Area soils as off-site fill material."

Response: *Comment noted. The text has been revised as suggested (see Section 2.1.1).*

a. The following comes from the VLEACH user manual which is downloaded with the program from the EPA Center for Subsurface Modeling Support. "In particular, VLEACH simulates vertical transport by advection in the liquid phase and by gaseous diffusion in the vapor phase…These processes are conceptualized as occurring in a number of distinct, user-defined polygons that are vertically divided into a series of user-defined cells. The polygons may differ in soil properties, recharge rate, and depth to water… However, within each polygon homogeneous conditions are assumed except for contaminant concentration, which can vary between layered cells…" Emphasis added.

Response: *Comment noted. Although homogeneous conditions are assumed in each polygon, please note that BRC will use two vertically stacked layers in the polygon to represent the Borrow materials and the underlying native materials, respectively. A discussion on this approach has been added to Section 2.1.1.*

b. The VLEACH model referenced in the Human Health Risk Assessment Work Plan for the Borrow Area used a combination of Site-specific soil, City of Henderson (CoH) WRF soil, and general reference soil input parameters when the borrow material will be transported to another location with presumably different soil properties between the borrow fill material and groundwater. Thus, it would seem that the model does not represent potential leaching conditions at the point of use and according to the user manual the model does not accommodate more than one soil type in a vertical polygon. Please provide the rationale for the proposed use of the VLEACH model and the application of model results.

Response: *BRC has revised its approach regarding inputs noted in this Comment. Please see the General Discussion above. Soil properties will be collected from Borrow materials as well as native materials at the placement location. Thus, these properties will be representative. Also see response to comment 1a above.*

c. It is not clear to the NDEP why BRC did not collect and analyze or utilize Borrow Site specific soil samples for the input parameters.

Response: *Please see the General Discussion above. BRC will obtain Borrow Site specific soil samples for input parameters.*

d. See additional comments below.

Response: *No response necessary.*

2. Table 1, the NDEP has the following comments:

   a. Soil porosity can be estimated from the bulk density.

$$n = 1 - \frac{\rho_b}{\rho_s}$$

where: ρb = 1.78 g/cm3 (Table 1), and
ρs = 2.65 g/cm3 (quartz).

This yields n = 0.33 for total porosity with the given information. Comparing the calculated value with the reported 0.35 for effective porosity, the value of 0.35 appears high. BRC should provide the rationale for all the soil input parameters used in the VLEACH model.

Response: *BRC notes (VLEACH Manual, Figure 8-14) that soil porosity is not a sensitive parameter with regards to groundwater impact prediction. In fact, the Figure shows that there was no appreciable change in groundwater impacts even though porosity was varied between 0.35 and 0.45. Thus, BRC does not believe that its previous suggested input value of 0.35 and NDEP's suggested value of 0.33 will make a material difference in the results. Finally, as discussed earlier, BRC is proposing to use laboratory data from field samples for porosity so this issue is now moot.*

b. Soil saturation percent can be calculated from the porosity and soil volumetric water content:

$$S_s = \frac{\theta}{n} \times 100$$

where: θ = volumetric water content = 0.18 (Table 1), and
n = porosity = 0.35 (Table 1).

Response: *As discussed earlier, BRC is proposing to collect and use actual field measurements.*

c. The proposed effective porosity for the sand and gravel mixture and the average volumetric moisture content gives a saturation of about 50%. If the calculated porosity of 0.33 is used, the soil saturation is estimated at 55%. The range of 50-55% seems to be high for a sand and gravel mixture given the local climate. Please provide rationale for the effective porosity value and moisture content for Borrow Area soils.

Response: *BRC notes that volumetric water content and porosity needed for the model will be obtained from field measurements.*

d. The mass balance should be checked to confirm that the timestep and number of cells provide a stable solution. It should be kept in mind that reducing the timestep can stabilize the solution.

Response: *Comment noted, this will be confirmed at the time of the modeling.*

e. BRC's comments regarding the recharge rate are technically sound but a sensitivity run (or runs) should be completed if the area is to be irrigated or otherwise have water added.

Response: *BRC agrees. A range of infiltration rates, similar to that used in the VLEACH manual (from example, from 2 to 6 inches per year) will be used in the model.*

f. The rationale for using the percent soil organic carbon content from the CoH WRF soils needs to be provided. Some of the areas evaluated in the CoH WRF were groundwater discharge areas where the soil presumably was either saturated for some time or is currently saturated. This may allow for the build up of organic matter in the soil horizons sampled due to past or present vegetation in the area. Given that the borrow material is described as a sand and gravel mixture the value of 0.33 appears high. BRC needs to explain the comparability between the two locations for this parameter (soil percent organic carbon).

Response: *This parameter will be obtained from field measurements.*

3. Table 3, the NDEP has the following comments:
   a. Please edit the title to Table 3 to read "Fate and Transport Model Input Values for Air EPCs".

Response: *The title has been changed as requested.*

b. An additional question for Table 3 relates to the areal extent of contamination. "Asurf" is defined as 17.8 acres. This is approximately the entire acreage of the north and south portions of the Borrow Area. It is assumed by BRC that one-fifth of the site is the areal extent of the tilling operation ("Atill"). Please provide rationale for this assumption and explain how this relates to the NDEP's understanding that "mass grading" will take place at the site.

Response: *The construction dust emissions assume excavation, soil dumping, dozing, grading, and tilling operations. Given the nature of the operations that will occur at the site regarding excavation and placement of soil off-site, it was considered unlikely that a large amount of tilling will occur. Given this, the tilling area value of 1/5th used in the particulate matter case example from USEPA 2002 (Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites; page E-26) was proposed. This is independent of the grading part of the equation, which assumes grading over the entire areal extent.*

4. Appendix A-1, Response-to-comment (RTC) 1, it is not evident that Revision 2 complies with SOP-0, which establishes specific quality assurance and quality control (QA/QC) procedures. QA/QC problems not corrected include, but are not limited to:
   c. The redline/strikeout version does not match the edited (edits accepted) version (e.g., table of contents);

Response: *The TOC in the main text doesn't match that in the redline/strikeout version because the redline/strikeout version text includes both additions and deletions, thus the page numbering is necessarily different.*

d. Text formatting/font jumbling in text and tables;

Response: *This is due to differences in the versions of Adobe Acrobat used. BRC regrets the text jumble and will take every measure to avoid this in the future.*

e. Lack of documentation that the QA/QC reviewer has independently confirmed that data and proposed parameter values are correct;

Response: *A QA/QC reviewer signature has been added to the report.*

f. Inconsistencies in response-to-comments.

Response: *Comment noted. BRC regrets the error and will avoid this in the future.*

5. Appendix A-1, RTC 6c, please delete the second and third sentences of the first full paragraph on page 4 of the redline/strikeout of Revision 2 (paragraph begins with "The potentially exposed…"). Please edit the fourth sentence as follows: "The VLEACH modeling will be conducted for the chemicals of potential concern…". Also, please edit Figure 2 (CSM), gray box regarding VLEACH as follows: "This pathway will be evaluated…".

Response: *Change to the redline/strikeout of Revision 2 have not been made because this version of the report includes the redline/strikeout for Revision 3. The change to the main text regarding VLEACH modeling has been made (see Section 2.1.1). Figure 2 (now Figure 3) has been changed as requested.*

6. Appendix A-1, RTC 6e, in order for NDEP to approve the soil input parameter values listed in Table 1, the laboratory reports for the data, sample locations, data validation, and data usability evaluation for those data, need to be provided to NDEP.

Response: *Please see General Discussion earlier. BRC will provide all lab data relating to soil parameters that will be used in the model.*

7. Appendix A-1, RTC 6.f.i., as previously requested, the methodology by which the VLEACH process will be completed should be presented in conjunction with the input parameters. Also, it should be noted which parameters are specific to the site where the material will be placed versus parameters that will be generated from the borrow material itself. Finally, NDEP prefers that the VLEACH modeling be specific to the HRA and not based on

"updates" from the previous modeling, which was not approved by NDEP (and will not be approved by the NDEP).

Response: *Please see Section 2.1.1 for an expanded discussion on the VLEACH process that will be used along with how the input parameters will be used. Please also see the General Discussion above. This addresses NDEP's concern regarding properties pertinent to the Borrow materials as well as native materials. NDEP's last sentence in this comment is noted. References to previous modeling have been removed.*

8. Appendix A-1, RTC 6.f.ii., please insure that the risk assessment report contains an RTC letter which contains all of the NDEP's comments on VLEACH from the NDEP's May 19, 2006 letter, July 10, 2006 letter, this letter and any additional comments generated between now and then. Failure to do so will result in rejection of the risk assessment report without review.

Response: *Comment noted. The risk assessment report will include the RTCs.*

9. Appendix A-1, RTC 6.f.iii., Figure 2, the CSM, indicates that construction workers are receptors for the off-site fill material scenario, which is a reasonable assumption. Accordingly, the construction dust model is applicable for construction workers involved with fill activities off-site.

Response: *Comment noted, a reference to this has been added to the text in Section 4.2. (Note: Figure 2 is now Figure 3).*

10. Appendix A-1, RTC 6.f.iv., either a worst-case soil type should be assumed for the off-site soils underlying where the fill will be placed or, if not, then site-specific information should be used and NDEP should approve that on a case-by-case basis. Applying "generic" assumptions that are not necessarily "worst-case" without site-specific information to document applicability does not necessarily meet HRA Reasonable Maximum Exposure criteria. Additionally, if BRC is proposing a "worst case" scenario, the assumptions made should be discussed and explained why these assumptions constitute a "worst case" scenario.

Response: *Please see General Discussion above as well as Section 2.1.1 describing the methodology that is proposed to be used. Since site specific data are proposed to be used along with model sensitivity runs, BRC believes that the model results will be conservative (i.e., over-predict impacts).*

11. Appendix A-2, NDEP has no comments on this Appendix as the comments were provided via the NDEP's July 10, 2006 letter to BRC.

Response: *Comment noted.*

APPENDIX A-2
Response to NDEP Comments Dated July 10, 2006 on the June 2006 BRC Human Health Risk Assessment Work Plan, Revision 1

1. General comment, please insure that the resubmittal of this document fully complies with SOP-0.

Response: *Comment noted.*

2. General comment, please be sure to provide a full annotated response-to-comments and a red-line mark up of the document when it is resubmitted.

Response: *BRC is providing both documents requested.*

3. General comment, please ensure that x, y and z coordinates are recorded in case an exploratory spatial analysis needs to be completed.

Response: *Comment noted.*

4. Section 2.1.2, first full paragraph, the second constraint placed on Borrow Area soil fill refers to ambient conditions. It appears that the word ambient is used here to refer to surface conditions. This usage is not appropriate and surface conditions should be defined in this context. The intent is to restrict the placement of soils so that there are no pathways for receptors. If this is the case, then it should be stated as such.

Response: *The text has been revised accordingly.*

5. Table 2, neither the text nor Table 2 indicate that some model parameters are pending.

Response: *BRC is confused by this comment. Table 2 states 'pending' for soil moisture and percent silt. All other parameters proposed for use are defined.*

6. Appendix A, response-to-comments (RTC) letter, the NDEP has the following comments:
   a. General comment, please note that that the responses below also results in changes to the remainder of the document. BRC should insure that these changes are completed throughout the document.

Response: *Comment noted. As necessary, BRC has revised the text in the document.*

   b. RTC 4, it is not apparent that BRC has responded to the NDEP's previous comment. This comment references back to an April 4, 2006 meeting between the NDEP and BRC and

notes that the previous version of this document did not respond to the NDEP's comments either.

Response: *BRC attempted to respond to the earlier comment via additional discussion in Section 1.2. New language has been added further in response to NDEP comments below.*

i. BRC attempts to define Type II materials by providing a table which lists sieve opening sizes, however, it is not explained how this table relates to the definition of Type II material. Does Type II material include all of these sieve sizes?

Response: *This is clarified in the text in Section 1.2.*

ii. Additionally, BRC does not explain if the material will be mass graded at the site (meaning site-wide excavation) or if the site will be sub-divided and then graded, etc. This type of information is important for completion of a representative risk assessment calculation.

Response: *Within each of the two portions (Northern and Southern) of the Borrow Area, the material is expected to be mass graded. This is clarified in the text.*

iii. Also, BRC has noted that the reject sand may be used in landscape applications. This is contrary to the restrictions placed on the use of the materials from the gravel pit. Please explain.

Response: *BRC has modified the text to indicate that reject sand will be stockpiled for use in CAMU construction or for offsite applications. Should BRC need to use reject sand for offsite uses, its use will be subject to the same constraints as Type II material.*

c. RTC 5c, the NDEP would like to note the following:
   i. As noted by the NDEP in the previous comment letter, "it is premature to model a select list of chemicals that may or may not be chemicals of potential concern". The text revisions that have been made to the document are incomplete. For example, Section 2.1, page 4, states that the evaluation has been completed. In addition, Appendix B includes modeling runs.

Response: *BRC respectfully disagrees with this comment. The document does not state that the evaluation has been completed. Its states that it has been evaluated, but that it will be "…updated based on the chemicals of potential concern (COPCs) identified in the HHRA." In any case, Appendix B as been removed.*

d. RTC 9, BRC's response seems to indicate that the borrow area is not viable habitat because it is in the CAMU boundary. The geographic location of the borrow area is

irrelevant with respect to the site's suitability as habitat. A more viable explanation is necessary for this issue.

Response: *The text has been changed to state that no viable habitat is present in the Borrow Area based on field observations. The area (except for the intervening portion of the Western Ditch) has already been graded in anticipation of gravel mining. The Western Ditch contains sparse vegetation and no discernable habitat.*

e. RTC 16, the NDEP has the following comments:
   i. BRC indicates that "site-specific values will be the average of all available data collected from the Borrow Area for a particular parameter." It is not clear that this is a representative method of calculating a parameter and it is not clear that this is conservative.

Response: *BRC has used this approach based on discussions with NDEP and its consultants. BRC believes that this is a reasonable approach. Should NDEP require a different approach, BRC will be happy to discuss it with the NDEP.*

   ii. Please explain if individual batches of borrow materials will be tested for soil moisture, silt content, etc. If so, please explain the volumes of each batch to be tested. If not, please explain how in-situ measurements will be representative of the reject sand and type II materials.

Response: *BRC does not expect to conduct individual batch testing. It will use values for these parameters that are representative and are conservative. If needed, BRC will occasionally sample some of the materials to confirm that the parameter values that are use are representative.*

   iii. Please note that the construction volatization factor will likely be needed for other areas of the project.

Response: *Comment noted.*

f. RTC 27, the NDEP would like to note the following:
   i. It is not clear to the NDEP why comment 27b cannot be addressed at this time. There are other NDEP comments which also could be addressed at this time. In addition, it is not clear why BRC has dismissed the NDEP's comments and is electing to defer completion of the identification of input parameters and the methodology by which the VLEACH process will be completed. If some model parameters will be site-specific they should be identified as such. The methodology by which these parameters will be derived should be discussed. In addition, it should be noted which parameters are specific to the site where the material will be placed versus parameters that will be generated from the borrow material itself.

Response: *BRC did not intend to dismiss NDEP's comments. BRC has attempted to present the VLEACH input parameters that were used, in Appendix B. However, per discussions with NDEP after receiving these comments, BRC is now providing a new Table 1 containing all of the input parameters from VLEACH as well as the source of these parameters.*

ii. BRC states that the "appendix was supplied at the request of the NDEP for the VLEACH model that was performed previously". This is not accurate. NDEP noted that the issue of model input parameters for the VLEACH model had never been resolved between NDEP and BRC. NDEP requested that BRC pull together all pertinent information and prepare a submittal with said input parameters and methodology that would be employed to evaluate the borrow materials. It was the goal of the NDEP to reach agreement on the methodology as part of the risk assessment work plan. BRC has not provided this information and it appears that BRC is deferring to present this information in the risk assessment report. The NDEP will review the proposed methodology when it is submitted. When this report is submitted it must respond to all previous NDEP comments on the VLEACH modeling as provided in the May 19, 2006 letter and any letters issued in the interim. Failure to do so will result in rejection of the risk assessment report without further review.

Response: *Please see the response to the Comment above. The new Table 1 containing the VLEACH input parameters should address NDEP's comments.*

iii. Table 2 of the current work plan appears to contain parameters that may relate to the VLEACH procedure and it is not clear how this relates to the remainder of the workplan. In addition, it is not clear which of these parameters may be site-specific to the locations that are identified to accept borrow materials. This issue should be clarified in the table and the text.

Response: *A comparison between Table 1 and Table 3 indicates that only one parameter, soil bulk density, is common between the two models (although soil moisture and volumetric water content are related). Also, for Table 3, these are for the construction dust model, which would apply to the Borrow Area soils, and not soils at the locations where the borrow material will be placed.*

iv. Appendix B should be removed from this document.

Response: *Appendix B has been removed. The new Table 1 contains the VLEACH input parameters.*
NOTE: Since the VLEACH modeling is applicable for where the borrow material will be placed, we will not have site-specific soil parameters. There are five soil parameters in the model: bulk density, effective porosity, volumetric air content, volumetric water content, and percent organic carbon. One or more 'generic' soil types will need to be identified and input parameters selected for this model depending on the location of the disposal site.

APPENDIX A-3
Response to NDEP Comments Dated May 19, 2006 on the April 2006 BRC Human Health Risk Assessment Work Plan, Revision 0

1. General comment, please provide a full, annotated response-to-comments letter as part of the response to this letter. In addition, a red-line mark up should be provided as well.

Response: *Comment noted. Consistent with other responses to comments, these will be included as Appendix A of the revised work plan report.*

2. General comment, apparent responses to previous NDEP comment #2 as discussed in the April 4, 2006 meeting, this comment discussed the need to discuss how to address asbestos and compositing issues, the NDEP would like to note the following:
   a. Discussion of guidance for how to handle asbestos has been augmented but issues related to compositing and the impacts on analytical sensitivity have not been addressed. At the April 4, 2006 meeting there was discussion about how the soil sample is fully re-suspended and then forced through an airway and filter. At that point it seemed that compositing was no longer considered necessary because we are already analyzing a 1 kg sample (roughly) which is a larger than the sub-sample used for almost any other form of chemical analysis. Coupled with the very low response (few detections), there is probably very limited value, if any, to compositing the samples before analyzing them. The NDEP is not categorically opposed to the idea of compositing, however, discussion on this matter should be included in the work plan.

Response: *The procedure used followed that in the Standard Operating Procedure for Surface Soil Sampling for Asbestos (SOP-12). This procedure was developed by D. Wayne Berman for BRC. The following text has been added to the end of the last paragraph in Section 5.3: "The method of sample preparation and analysis for asbestos involves collection of composite samples that are re-suspended and then forced through an airway and filter. Because of this, coupled with the very low response (few detections), there is probably very limited value, if any, to compositing the samples before analysis."*

3. General comment, apparent responses to previous NDEP comment #3 as discussed in the April 4, 2006 meeting, as discussed and documented in the April 4, 2006 Meeting Minutes, Item #5, background risk will not be evaluated. However, in Section 3.1 Evaluation of Site Concentrations Relative to Background Conditions, top of page 12, the revised Human Health Risk Assessment (HHRA) Work Plan states the following: "Also consistent with USEPA guidance (2002a), for chemicals that exceed their respective background levels, risks will be calculated considering both background and site-related risks. In addition, risks associated with background levels will also be presented for comparison purposes." Please remove this statement from the Work Plan.

Response: *The intent was to be consistent with the TRECO risk assessment and provide the background soil risks as a point of reference. However, as requested by NDEP, background risks will not be evaluated and this statement has been removed.*

4. General comment, apparent responses to previous NDEP comment #4 as discussed in the April 4, 2006 meeting, this comment discussed an expanded discussion of how the sand and gravel would be used and the processes by which the removal and segregation would take place.
   a. It is the belief of the NDEP that these issues have not been addressed in the current version of the document.

Response: *An expanded discussion on this has been included in Section 1.2 (Excavation and Processing of Borrow Area Material).*

   b. However, it is acknowledged that a sentence was added to Section 1.1, Site Description, page 2, last paragraph that stated "Once excavation begins, it is expected that Borrow Area soils will be excavated and screened on-site into a few grades of material (such as sands and gravel, etc.). These various grades then will be used off-site depending on customer needs." However, the Work Plan lacks details regarding the characteristics of these materials that may affect the transport modeling for inhalation exposures. For example, Table 2 of the HHRA Work Plan that contains the modeling assumptions for the re-suspension and dispersion of dust notes that soil property characteristics are pending. The text within the Work Plan under Section 2.1.1 Inter-Media Transfers (page 3) or Section 4.2 Outdoor Air (pages 16-17) does not discuss whether multiple modeling runs will be performed to assess potential risks associated with the different grades of material (sand, gravel, etc.) or how modeling assumptions will be documented. Additionally, the areal extent of the excavation will need to be accurate.

Response: *Separate model runs will not be performed for different grades of material. The only soil characteristic factored into the model is silt content. Sand and gravel content are not model input parameters. A uniform site-specific silt content will be used in the model. Silt is defined as soil particles smaller than 75 micrometers (µm) in diameter and can be measured as that proportion of soil passing a 200-mesh screen.*

5. General comment, apparent responses to previous NDEP comment #7 as discussed in the April 4, 2006 meeting, the NDEP has the following comments:
   a. Section 2 Conceptual Site Model and Summary of Data Usability Evaluation have been modified to better define the current and potential future receptors. This section also discusses the rationale behind eliminating potential ecological receptors from this HHRA Work Plan. Figure 2 has been modified accordingly. However, two issues have not been adequately addressed by BRC and are as follows:
      i. Although BRC clarified the current on-site and future off-site receptors, the HHRA Work Plan does not acknowledge the potential "nearby, off-site" receptors that may be impacted during mining and placement activities. Please include a discussion on how these receptors will be addressed in the HHRA. For example, will this be addressed qualitatively in the uncertainty analysis section based on the risk characterization for the onsite receptors?

Response: *The following text has been added to the end of the last paragraph in Section 2.1.2 and Figure 2: "Risks to potential nearby, off-site receptors that may be impacted during mining and placement activities will be addressed qualitatively in the uncertainty analysis section of the HHRA based on the risk characterization for the on-site receptors."*

ii. Page 2, 2nd paragraph, first sentence, please change "land use conditions" to "uses of Borrow Area soils". Please also add the word "future" between "potential and receptors" on line 4 of this same paragraph. In addition, please make a similar edit to Section 2.1.2 Potential Human Exposure Scenarios, first line, change "land use" to "Borrow Area soil exposures".

Response: *The text has been modified as requested.*

b. Page 4, bullet, Construction Workers (noted as associated with on-site soil), is there also a construction worker scenario for the placement of the soils as offsite fill?

Response: *This bullet has been revised to reflect construction worker exposures to both on-site soil and off-site fill material.*

c. The VLEACH modeling performed in 2005 is now an attachment to the HHRA Work Plan. This modeling was formerly a component to the Compilation Report for the Site. As previously stated, until the Borrow Area soil database is validated and a data usability evaluation is completed, it is premature to model a select list of chemicals that may or may not be chemicals of potential concern (COPCs) for the Site. At this time, we do not know if there could be other COPCs that were not modeled in 2005. We acknowledge that it will be the intent of the VLEACH modeling to determine the depth at which the Borrow Area soils can be placed so that future impacts to groundwater are avoided, thus making the groundwater pathway incomplete. Please revise the first paragraph found on page 3 of the HHRA Work Plan to state that the VLEACH modeling will be updated based on the COPCs identified in the HHRA. NDEP approval will be pending the results of the VLEACH modeling for the HHRA COPCs. Please also note a consistency comment. Within this same paragraph it was noticed that the term groundwater was spelled two different ways (ground water and groundwater). Please select the appropriate spelling and use consistently throughout the report. Additionally, detailed comments on the VLEACH model are provided below.

Response: *The text has been modified as requested. It is understood that additional VLEACH modeling will be conducted for the COPCs evaluated in the risk assessment or any other additional compounds that NDEP may request.*

6. General comment, apparent responses to previous NDEP comment #7 as discussed in the April 4, 2006 meeting, this comment discussed verb tense problems throughout the document, it is acknowledged that BRC has addressed most of these items, except for Section 2.2 Summary of Data Usability Evaluation, page 5, first paragraph, first sentence, please change "used" to "that will be used".

Response: *The text has been modified as requested.*

7. General comment, apparent responses to previous NDEP comment #10 as discussed in the April 4, 2006 meeting, this comment discussed apparent problems with the template used to develop the HHRA work plan, it is acknowledged that BRC has addressed most of these items, except for the following:
   a. Please correct a typographical error found in footnote #2, please change "nation" to "national";

Response: *The text has been modified as requested.*

   b. Section 6 Toxicity Assessment, page 21, first paragraph, please delete "(e.g., titanium)" within the sentence that states "Should COPCs be found which do not have established toxicity criteria (e.g., titanium), these…". Titanium has toxicity criteria;

Response: *The text has been modified as requested.*

   c. Page 23, second paragraph, please add a discussion similar to that for the TRECO HHRA that discusses the rationale for using pyrene as a surrogate for non-cancer effects associated with the carcinogenic PAHs.

Response: *The text has been modified as requested with a paragraph added to the end of Section 6 discussing this approach.*

8. General comment, apparent responses to previous NDEP comment #11 as discussed in the April 4, 2006 meeting, BRC has added a section that includes a site description (Section 1). Please include the investigation reports cited in Section 2.2.1 in the reference section of the document. As previously stated, NDEP assumes that a final validated site database, data usability, and data adequacy evaluation will be submitted to NDEP for approval prior to initiation of the HHRA. Please modify Section 2.2.1, page 6, accordingly.

Response: *The investigation reports cited in Section 2.2.1 have been added to the reference section. In addition, the last sentence in Section 2.2.1 has been modified to read: "The final soil database, data validation, and data usability evaluation will be submitted to NDEP for approval prior to initiation of the risk assessment."*

9. General comment, apparent responses to previous NDEP comment #12 as discussed in the April 4, 2006 meeting, while it is acknowledged that BRC discussed future ecological receptors in Section 2, current ecological receptors do not appear to be discussed. Please clarify.

Response: *The last sentence of the second paragraph of Section 2.1 has been modified to the following: "In addition, the Borrow Area is within the CAMU boundary and is not considered viable habitat; thus, current and future ecological impacts will not be assessed in the HHRA."*

10. General comment, apparent responses to previous NDEP comment #12 as discussed in the April 4, 2006 meeting, the NDEP could not locate a discussion on groundwater quality in the HHRA work plan.

Response: *The following text has been added to the last paragraph of Section 1.1: "As discussed in Section 2.1 below, exposure pathways associated with groundwater will not be evaluated in the HHRA. Excavations within the Borrow Area will stop prior to reaching groundwater. A full discussion on groundwater quality will be provided in the conceptual site model (CSM) being prepared for the CAMU. The objective of the various investigations and assessments within the Borrow Area were to demonstrate to NDEP that it is acceptable to use soil within this area as off-site fill material. Because locations for placement of Borrow Area soil as off-site fill material have not been determined, groundwater quality at these locations is unknown."*

11. General comment, apparent responses to previous NDEP comment #15 as discussed in the April 4, 2006 meeting, the NDEP has the following comments:
    a. Please verify the issue about the site being fenced and include in the HHRA Work Plan.

Response: *The CAMU boundary will be fully fenced to limit site access. Current access by individuals from the industrial facilities to the Stauffer/Pioneer/Montrose Ground Water Treatment System (GWTS), which used to be through the site, have been re-routed.*

    b. BRC states that the impacts to groundwater are evaluated in Appendix A. See other comments throughout this letter as the NDEP believes that this is not appropriate. This work plan does not evaluate all data associated with the site and the CSM for this site has not been completed.

Response: *This appendix was supplied at the request of NDEP for the VLEACH model that was performed previously, with input from NDEP at that time. The VLEACH modeling was provided as is for NDEP to review the input parameters that were used at that time to determine whether these were still appropriate. No additional VLEACH modeling and/or text edits were done to this appendix for the work plan. As stated in response to comment #5c above, additional VLEACH modeling will be conducted for the COPCs evaluated in the risk assessment or any other additional compounds that NDEP may request. The revised VLEACH modeling will be included in the risk assessment report.*

12. General comment, apparent responses to previous NDEP comment #16 as discussed in the April 4, 2006 meeting, the text in Section 2.2 does not appear to be logical. The QAPP and SOPs were not approved until after the data was collected and analyzed. BRC needs to revise this text.

Response: *The following footnote has been added to this section: "Both the QAPP and SOPs were under review and not yet approved by NDEP at the time of the 2006 Borrow Area sample collection."*

13. General comment, apparent responses to previous NDEP comment #17 as discussed in the April 4, 2006 meeting, the final database, data validation, data usability evaluation, and data adequacy evaluation must be submitted to NDEP for review and approval prior to initiating the HHRA.

Response: *See response to comment #8 above.*

14. General comment, apparent responses to previous NDEP comment #20 as discussed in the April 4, 2006 meeting, NDEP assumes that the comment will be fully addressed as a component of the data usability evaluation.

Response: *Comment noted.*

15. General comment, apparent responses to previous NDEP comment #25 as discussed in the April 4, 2006 meeting, footnote 3 of Table 1 should be edited as follows" For SVOCs, Method 8270C is the primary…".

Response: *The text of footnote 2 has been modified as requested.*

16. General comment, apparent responses to previous NDEP comment #26 as discussed in the April 4, 2006 meeting, the rationale for the "site-specific" parameters listed in Table 2 should be given. Additionally, Section 4.2 Outdoor Air, pages 16-17 should note that some of the site-specific data such as soil properties are pending (see also comment above). In addition, this section should include some discussion similar to that in the TRECO HRA regarding whether or not the volatilization factors (VFs) will be adjusted to account for construction activities or if this will be addressed in the uncertainty section.

Response: *The following footnote has been added to Table 2: "Site-specific values will be the average of all available data collected from the Borrow Area for a particular parameter."*

The following text has been added to Section 4.2: "The same volatilization factors will be used for all scenarios. The volatilization factors for the construction worker will not be adjusted to account for soil intrusion activities. Soil intrusion associated with construction activities could results in increased volatilization from the subsurface to outdoor. However, the volatilization factors to be used are conservative and are not likely to underestimate exposures."

17. Section 2.1.2, pages 4 and 5, the NDEP has the following comments;
    a. First full paragraph. The second constraint placed on Borrow Area soil fill refers to ambient conditions. This is a bit vague and needs to be clarified.

Response: *The text has been modified as requested with the following: "…they will not be exposed to ambient (surface) conditions".*

b. First full paragraph. The third constraint placed on Borrow Area soil fill refers to a minimum soil column height that will be maintained between where these soils are placed and the local groundwater such that impacts to groundwater demonstrated via the leaching evaluation are negligible. Have ground water fluctuations at the future, undetermined sites been adequately characterized such that this can reasonably be ensured?

Response: *Because locations for placement of Borrow Area soil as off-site fill material have not been determined, groundwater conditions at these locations are unknown. An evaluation of groundwater conditions at each location will be conducted to ensure that constraints on use of Borrow Area soil use are met.*

c. First full paragraph. The final constraint placed on Borrow Area soil fill is…" that it (Borrow Area fill) will not be placed in environmentally sensitive areas". The definition of environmentally sensitive areas needs to be clarified.

Response: *The following footnote has been added to this section: "These areas may include wetlands, National and State parks, critical habitats for endangered or threatened species, wilderness and natural resource areas, marine sanctuaries and estuarine reserves, conservation areas, preserves, wildlife areas, wildlife refuges, wild and scenic rivers, recreational areas, national forests, Federal and State lands that are research national areas, heritage program areas, land trust areas, and historical and archaeological sites and parks. These areas may also include unique habitats such as aquaculture sites and agricultural surface water intakes, bird nesting areas, critical biological resource areas, designated migratory routes, designated seasonal habitats, State designated Natural Areas, State designated areas for protection or maintenance of aquatic life, and particular areas, relatively small in size, important to maintenance of unique biotic communities."*

18. Section 2.2, page 5, it appears that this section only discusses the data collected in 2006. BRC needs to discuss all of the data that will be evaluated.

Response: *See response to comment #8 above.*

19. Section 3.1, page 12, third paragraph should be replaced with the following " The Wilcoxon Rank Sum test performs a test for a difference between two population measures of center. This is a non-parametric method that relies on the relative rankings of data values and the measure of center is quantified by the sum of the ranks in both Site and background data. Knowledge of the precise form of the population distributions is not necessary. The Wilcoxon Rank Sum test has less power than the two-sample t-test when the data are in fact normally distributed; however the assumptions are not as restrictive. The GISdT® version of the Wilcoxon Rank Sum test uses the Mantel approach which is equivalent to using the Gehan ranking system." Similar comments have been provided previously to BRC.

Response: *The text has been modified as requested.*

20. Section 3.1, page 13, the description of the Slippage test should be changed to "The Slippage test evaluates whether there are an unreasonable number of site data points that exceed the maximum background value."

Response: *The text has been modified as requested.*

21. Section 3.1, page 13, second paragraph should be replaced with "Typically an alpha = 0.05 is used to evaluate a statistically significant result. Since several tests will be conducted, a lower alpha is selected. As more tests are performed, it is more likely that a statistically significant result will be obtained purely by chance. Given the use of the multiple statistical tests, an alpha = 0.025 is selected as a reasonable significance level for the COPC selection. Any chemical that resulted in a p value less than 0.025 in one of the four tests will be retained as a COPC. Additionally, these tests are set up with one-sided hypotheses. Consequently, not only are differences between the two samples able to be detected, a directional determination can be made as well (e.g. Site is greater than background).

Response: *The text has been modified as requested.*

22. Section 4.1, page 16, third sentence should be replaced with "The UCL incorporates the uncertainty of the estimate of the mean and is the value that, with repeated sets of samples, will be greater than the true mean 95% of the time."

Response: *The text has been modified as requested.*

23. Section 4.1, page 16, 2nd paragraph: please provide additional explanation why a 95% UCL is appropriate for the soil scenarios and how the 95% UCL will be calculated for current on-site receptors (construction workers and trespassers) and future off-site receptors (construction workers and maintenance workers).

Response: *A description of how the 95 percent UCL will be calculated for each receptor is provided in the last paragraph in Section 4.1 ("Representative exposure concentrations for soil are typically based on the potential exposure depth for each of the receptors. However, given that the HHRA will assess exposures to soil following excavation and use as off-site fill material, it is proposed that a 95 percent UCL be generated for all data collected within the excavation extent and depth. This 95 percent UCL will be used for all potentially exposed receptors. For indirect exposures, this concentration will be used in fate and transport modeling.").*

The following text has been added to Section 4.1: "The 95 percent UCL of the arithmetic mean concentration is used as the average concentration, because it is not possible to know the true mean. The 95 percent UCL, therefore, accounts for uncertainties due to limited sampling data. An estimate of average concentration is used because: carcinogenic and chronic non-carcinogenic toxicity criteria are based on lifetime average exposures; and, average concentration is most representative of the concentration that would be contacted at a site, over time (USEPA 1992b)."

24. Section 5.2, page 20, third paragraph, paragraph under the formula should be changed. The estimate of the mean asbestos concentration is the number of asbestos fibers detected multiplied by the pooled analytical sensitivity. The upper bound estimate is the upper confidence bound of the mean number of asbestos fibers detected multiplied by the pooled analytical sensitivity.

Response: *This paragraph has been modified to the following: "Two estimates of the asbestos concentration will be evaluated. The estimate of the mean asbestos concentration is the number of asbestos fibers detected multiplied by the pooled analytical sensitivity. The upper bound estimate is the upper confidence bound of the mean of the assumed underlying Poisson distribution used to model the number of structures found multiplied by the pooled analytical sensitivity. The intent of the risk assessment methodology is to predict the amount of airborne asbestos which can be inhaled by a receptor. In addition, it will be assumed that asbestos only occurs at the soil surface (i.e., upper two inches)."*

25. Section 10, please add USEPA, 2004d to the reference list and cross check citations in the text with those in the reference list.

Response: *The text has been modified as requested.*

26. Table 1, please discuss and present an evaluation of how this table compares to the list of site-related chemicals and any site-related chemicals that were not addressed by this list of analytes.

Response: *The analyte list presented in Table 1 is that prepared by Daniel B. Stephens & Associates in their Revised Sampling and Analysis Plan to Conduct Soil Characterization of Borrow Areas, Henderson, Nevada. Any site-related chemicals not included on this table are:*

• those that are primarily for water samples or for which toxicity criteria are unavailable (ions [bromide, bromine, chlorate, chloride, chlorine, chlorite, fluoride, nitrate, nitrite, orthophosphate, sulfate, and sulfite], dissolved gases [ethane, ethylene, and methane], aldehydes [acetaldehyde, chloroacetaldehyde, dichloroacetaldehyde, trichloroacetaldehyde, formaldehyde], general chemistry [ammonia, iodine, ph in water, sulfide, total inorganic carbon, total kjeldahl nitrogen, total organic carbon], organic acids [4-chlorobenzene sulfonic acid, benzenesulfonic acid, O,O-diethylphosphorodithioic acid, and O,O-dimethylphosphorodithioic acid], nonhalogenated organics [ethylene glycol, ethylene glycol monobutyl ether, methanol, propylene glycol], and water quality parameters);

• those for which toxicity criteria are unavailable (flashpoint), or toxicity is evaluated using surrogate chemicals (total petroleum hydrocarbons; risks evaluated using, for example, benzene, toluene, ethylbenzene, xylenes, and polycyclic aromatic hydrocarbons);

• those for which analytical methods were still being determined (white phosphorus and methyl mercury); and

• those which were added to the site-related chemicals list after this investigation was conducted (PCB congeners [PCB-77, PCB-81, PCB-105, PCB-114, PCB-118, PCB-123, PCB-126, PCB-156, PCB-157, PCB-167, PCB-169, and PCB-189], 2,2-dimethylpentane, 2,2,3-trimethyl-butane, 2,3-dimethylpentane, 2,4-dimethylpentane, 2-methylhexane, 3,3-dimethylpentane, 3-ethylpentane, and 3-methylhexane).

The following text has been added to the last paragraph in Section 2.2.1: "These datasets do not include several chemicals that are on the project site-related chemicals list. A discussion of those chemicals that are on the site-related chemicals list but that were not analyzed for will be presented in the uncertainty section of the HHRA report."

27. Appendix A, the NDEP has the following comments:
    a. General comment, this section of the submittal is not of sufficient quality to warrant a detailed review. Several specific comments are provided below as examples. If BRC does not understand what is expected a clarification should be requested from the NDEP.
    b. General comment, throughout this Appendix, BRC discusses the 2003 and 2005 evaluations that were conducted. Neither of these were approved by the NDEP. BRC needs to instead discuss the process that will be completed to evaluate the entire dataset. This should include a detailed discussion of the input parameters and assumptions used to complete the evaluation.
    c. General comment, many of the comments below apply to other sections of the report. The NDEP will not spend the time or resources to identify these for BRC.
    d. Page 1, second paragraph, please discuss if the samples collected meet the requirements for use in a risk assessment. This is not covered under Section 2.2. above and needs to be.
    e. Attachment A-1, BRC includes the November 2003 evaluation that was not approved by the NDEP. It is not clear why this memorandum was included in this section of the work plan.
    f. Attachment A-1, Data Evaluation Section, this section has not been modified based on discussions with BRC regarding UCL calculations for the TRECO property. The NDEP will not reiterate those comments herein.
    g. Attachment A-1, VLEACH Section, since BRC has included this memorandum without modification, the statements regarding depth to groundwater are inaccurate.
    h. Attachment A-1, VLEACH Section, BRC needs to provide the reference for the four inch infiltration rate and any other parameters that are presented.
    i. Attachment A-1, VLEACH Section, BRC states that the site soils are similar to the City of Henderson (COH) WRF soils. This is a baseless statement that requires modification and supporting documentation.
    j. Attachment A-1, Table 1, as stated previously, this Table requires revision based on discussions provided by the NDEP previously.
    k. Attachment A-1, Table 4, this table presents data from the COH WRF soils, as stated above it has not been shown by BRC that this data is representative of the site and this is not acceptable. What is the relationship between the two sites that justifies this assumption? This is especially important as the parameter K(d) is directly proportional to the fraction of organic carbon content. For hydrophobic compounds this is probably the most significant factor in soil partitioning.

l. Figure 1, this Figure does not show the location of the groundwater well to the borrow areas. In addition, there is no scale or north arrow on this figure. The location of this measurement is inappropriate and the figure must be revised.
m. Attachment A-2, Table 3, the same comment provided above applies herein.

Response: *This appendix was supplied at the request of NDEP for the VLEACH model that was performed previously, with input from NDEP at that time. The VLEACH modeling was provided as is for NDEP to review the input parameters that were used at that time to determine whether these were still appropriate. No additional VLEACH modeling and/or text edits were done to this appendix for the work plan. As stated in response to comment #5c above, additional VLEACH modeling will be conducted for the COPCs evaluated in the risk assessment or any other additional compounds that NDEP may request. The revised VLEACH modeling will be included in the risk assessment report.*

APPENDIX A-4
Response to NDEP Comments Dated November 9, 2006 on the October 2006 BRC Human Health Risk Assessment Work Plan, Revision 3

1. General comment, please note that if BRC chooses to use sensitivity analysis to justify a conclusion, then the sensitivity analysis range must include the number being evaluated.

Response: *Comment noted. For sensitivity analysis, the analysis range will include the number being evaluated.*

2. Section 2.1.1, page 6, 2nd sentence. Please change "…this pathway has been evaluated elsewhere as a constraint to soil placement." To "…this pathway will be evaluated as…"

Response: *The sentence has been changed.*

3. Section 2.2.1, page 9, first paragraph, regarding completion and approval of all data validation reports. In addition to data validation, a data usability evaluation should be conducted prior to the completion of a health risk assessment (HRA).

Response: *A data usability evaluation, as discussed in Section 2.2 of the work plan, will be conducted prior to conducting the health risk assessment. This will be included in the human health risk assessment report to NDEP.*

4. Section 3.1, page 14, it is suggested that the results of all statistical tests, as well as observations regarding the plotted data, be considered when making decisions regarding chemical of potential concern (COPCs) based on background criteria. In other words, it is not necessary to conclude that chemical concentrations exceed background based on the results of one test; rather, a weight-of-evidence approach should be used.

Response: *Comment noted. A weight-of-evidence approach will be used in the evaluation of statistical tests for the selection of chemicals of potential concern.*

5. Section 4.1, page 18, BRC has previously stated that batch sampling will not be performed. The NDEP assumes that when 95% UCLs are used as the basis for soil exposure concentration, the input data will be documented as being representative.

Response: *An evaluation demonstrating the representativeness of the 95% UCLs will be included in the human health risk assessment report to the NDEP.*

6. Table 1, the NDEP has the following comments:
   a. Footnote e, BRC states "Values will be obtained from placement location materials tests or be representative of such locations. Initial model runs may use values shown below

from the VLEACH manual for a typical sand soil…" It is not clear why BRC would use default values if site-specific values are available. Please clarify what is intended.

Response: *Footnote e has been removed from Table 1. As indicated, site-specific values will be used in the VLEACH modeling.*

b. Footnote e, please note that the VLEACH user's manual values for effective porosity and percent organic carbon appear high for soils at the site.

Response: *Footnote e has been removed from Table 1. As indicated, site-specific values will be used in the VLEACH modeling.*

c. Please note that volumetric water content is not the same as irreducible water content. The number provided in Table 1 for volumetric water content (0.045) is listed in Appendix B of the VLEACH manual as the irreducible water content.

Response: *As indicated above, footnote e has been removed from Table 1. Site-specific values will be used in the VLEACH modeling. Specifically, field measurements of percent moisture have been collected. The percent moisture is the water content of a soil on a mass basis. However, the VLEACH model requires the water content in terms of volume rather than mass. Therefore, the percent moisture will be converted to the volumetric water content using the following equation: percent moisture × (bulk density / density of water); where the density of water is assumed to be 1.0 g/cm^3.*

7. Appendix A, Appendix A-1, general discussion, the NDEP has the following comments:
   a. BRC states that "most if not all of the Borrow materials will likely be usable in the BMI industrial complex itself". It is not clear to the NDEP what the purpose of this statement is. The same risk and groundwater protection criteria apply regardless of the location of placement of the material.

Response: *In the interest of providing additional helpful information, the discussion merely provided specific identification of where the Borrow Area soils will likely be placed. BRC agrees that the same risk and groundwater protection criteria will apply regardless of the location of placement of the materials. It is also possible that materials will be placed outside the BMI industrial complex.*

b. BRC states that "It is also expected that, in most situations, the cover will also impede (or, in some cases completely block) infiltration." BRC continues in a later portion of this discussion to state "It should be noted that, in several proposed uses (such as base materials for a concrete building pad) there should be no infiltration at all." These statements are incorrect. Infiltration does not typically occur in a fashion where water travels straight down. Typically, infiltration also occurs from a certain lateral distance and water flows vertically and laterally in the sub-surface. It is not clear to the NDEP why this statement is included.

Response: *Regardless of these discussions, BRC will run the VLEACH model assuming direct vertical infiltration with no impediments at the top.*

8. Appendix A, Appendix A-1, response-to-comment (RTC) #2a, NDEP notes that BRC uses the term "effective porosity" in reference to its work with VLEACH. NDEP also notes that the referenced VLEACH manual appears to use porosity and effective porosity somewhat interchangeably. The manual provides a definition for effective porosity but does not appear to use it in its equations. If one examines Section 3 Mathematical Discussion in the manual, one notes that they use "porosity" in the equations and do not mention use of "effective porosity".

The following calculations are provided for BRC's reference.

a. Total soil porosity can be estimated from the bulk density.

$$n = 1 - \frac{\rho_b}{\rho_s}$$

where: ρb = 1.78 g/cm3 (original Table 1), and
ρs= 2.65 g/cm3 (quartz).

This yields n = 0.33 for total porosity with the given information. Comparing the calculated total porosity value with the reported effective porosity of 0.35, the value is higher than the calculated total porosity.

b. Alternatively calculating total soil porosity from the density reported in the current Table 1 yields:

$$n = 1 - \frac{\rho_b}{\rho_s}$$

where: ρb = 1.65 g/cm3, and
ρs= 2.65 g/cm3 (quartz).

This yields n = 0.38 for total porosity with the given information. Comparing the calculated total porosity value with the reported effective porosity of 0.35 (current Table 1), the value is still too high.

c. Soil saturation percent calculated from the porosity and soil volumetric water content:

$$S_s = \frac{\theta}{n} \times 100$$

where: θ = volumetric water content = 0.18 (original Table 1), and
n = porosity = 0.35 (original Table 1).

BRC's proposed effective porosity (35%) for the sand and gravel mixture and the average volumetric moisture content gives a saturation of about 50%. If we use the calculated total

porosity of 0.33, the soil saturation is estimated at 55%. The range of 50-55% appears to be on the high side for a sand and gravel mixture given the local climate.

Soil saturation percentage was not calculated using the value reported in the current Table 1 because the number reported in the table is incorrect.

The NDEP provides the information above on total porosity versus effective porosity and volumetric water content versus irreducible water content because these relationships must be understood to properly interpret and use the physical property analysis of the soil samples.

Response: *Comment noted. BRC reiterates that according to the VLEACH manual (Figure 8-14), soil porosity is not a sensitive parameter with regards to groundwater impact prediction. Regardless, site-specific values of porosity will be used as intended in the VLEACH modeling.*

November 16, 2006

Mr. Mark Paris
Basic Remediation Company (BRC)
875 West Warm Springs
Henderson, NV 89011

Re.: Nevada Division of Environmental Protection Response to:
Errata Pages for the Human Health Risk Assessment Work Plan – Borrow Area
dated November 14, 2006
NDEP Facility ID# H-000688

Dear Mr. Paris:

The NDEP has received and reviewed BRC's correspondence identified above and provides comments below.

1. Table 1, footnote e, please correct this footnote to note that volumetric air content is *total porosity* minus volumetric water content. Please re-issue Table 1 with the corrected footnote.

Response: *Footnote e has been corrected in the table.*

2. Appendix A-4, RTC 8, please note that for a sensitivity analysis to be valid the parameter being tested (in this case porosity) must be within the range of values included in the sensitivity model runs. If the total porosity from tests on site soils is between 35% and 45% then the referenced sensitivity tests are appropriate. If total porosity is not in that range then the comparison is not valid. A response to this issue is not required, however, the NDEP comments should be included with the document.

Response: *Agreed. The accepted risk assessment work plan, including all comments and response to comments, will be included as an appendix to the risk assessment report.*

Should you have any questions or concerns, please do not hesitate to contact me at (702) 486-2850x247.

Sincerely,

Brian A. Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions

BAR:s

cc: Jim Najima, NDEP, BCA, Carson City
Barry Conaty, Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1333 New Hampshire Avenue, N.W., Washington, D.C. 20036
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Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
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Paul Hackenberry, Hackenberry Associates, 550 West Plumb Lane, B425, Reno, NV, 89509

November 17, 2006

Mr. Mark Paris
Basic Remediation Company (BRC)
875 West Warm Springs
Henderson, NV 89011

Re.: Nevada Division of Environmental Protection Response to:
Additional Errata Page for the Human Health Risk Assessment Work Plan – Borrow Area
dated November 16, 2006
NDEP Facility ID# H-000688

Dear Mr. Paris:

The NDEP has received and reviewed BRC's correspondence identified above and finds that the document is acceptable.

Should you have any questions or concerns, please do not hesitate to contact me at (702) 486-2850x247.

Sincerely,

Brian A. Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions

BAR:s

cc: Jim Najima, NDEP, BCA, Carson City
Barry Conaty, Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1333 New Hampshire Avenue, N.W., Washington, D.C. 20036
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Rob Mrowka, Clark County Comprehensive Planning, PO Box 551741, Las Vegas, NV, 89155-1741
Girard Page, Clark County Fire Department, 575 East Flamingo Road, Las Vegas, Nevada 89119
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Craig Wilkinson, TIMET, PO Box 2128, Henderson, Nevada, 89009-7003
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ATTACHMENT A-2

NDEP COMMENTS ON THE DECEMBER 2006 BORROW AREA HUMAN HEALTH RISK ASSESSMENT AND BRC RESPONSE TO COMMENTS

Attachment A-2-1
Response to NDEP Comments Dated March 4, 2007 on the December 2006 BRC Human Health Risk Assessment Report – Borrow Area, Revision 0

1. General comment, in addition to the written comments provided below the NDEP has provided additional documentation in the form of spreadsheets in the attached CD.

Response: *Comment noted.*

2. General comment, the human health risk assessment (HHRA) should be a stand-alone document. Accordingly, there should be some information provided regarding the Corrective Action Management Unit (CAMU) and its status. Additionally, a CD containing all laboratory reports and data validation tables should be included with the document.

Response: *Information on the CAMU has been provided. In addition, a DVD with all laboratory reports and Data Validation Summary Reports has been included with the report.*

3. General comment, the descriptors for the receptors evaluated are not always consistent in the HRA, for example, sometimes reference is made to onsite or offsite and sometimes reference is made to current or future. It is recommended that it be made very clear in all tables and the text that the receptors are as follows:
    a. Current/Future Trespasser Onsite
    b. Future Construction Worker Onsite
    c. Future Maintenance Worker Offsite
    d. Future Construction Worker Offsite

Response: *References to receptors have been changed to reflect the descriptions provided in this comment.*

4. Executive Summary, page ES-1, 2nd paragraph, please note that the Work Plan was not followed completely. The main text later acknowledges the difference is use of ProUCL for UCL calculations instead of GiSdT, which was approved in the Work Plan.

Response: *Comment noted. The revised report uses the GiSdT for UCL calculations, therefore this statement has been removed from the report.*

5. Executive Summary, page ES-1, 3rd paragraph, please note that the data are evaluated in Chapter 3 for many more reasons than ensuring DQOs are met. Ensuring that the DQOs are met is the domain of Section 3.2.8 only. The rest of Chapter 3 relates to data validation and data usability, both of which are not tied to the DQO process.

Response: *Additional text has been added reflective of Chapter 3.*

6. Executive Summary, page ES-2, Background, some of the presentation in this document is confusing regarding the scenarios that are to be evaluated. In the Executive Summary, in some places it looks like there are 4 scenarios, and in other paces it looks like 3. Once the report starts to present results, etc., then it becomes clearer that 3 scenarios have been considered. This comment is provided as an example of an area where additional clarity would be useful.

Response: *The text has been revised to make the scenarios evaluated clearer.*

7. Executive Summary, page ES-2, Selection of COPCs, please note that the objective does not really seem to be to identify those substances that contribute the greatest to the risk assessment. The process seems to be different than that. It seems that it is to identify substances that might contribute to the incremental risks.

Response: *Comment noted. The text has been revised.*

8. Executive Summary, page ES-2, First bullet, please note that chemicals cannot be below background. If, statistically, this is the case, then it simply means that background is not well characterized (or there are other comparability issues). Some care and thought should be taken regarding background comparisons – see additional comments below. Statistical methods alone are not sufficient. Also see Section 5.1.

Response: *Comment noted. The text has been revised.*

9. Executive Summary, page ES-3, several times in this document reference is made to EPA's "risk range". Much of this language should probably be removed. It is NDEP's prerogative how to regulate risk. Consequently, this document should not be suggesting that risks are acceptable because they are within this risk range. Also, it is not appropriate to call a range a benchmark. See also Page ES-5, Summary of Results. Conclusions are drawn that the risks are probably acceptable, but some risks are greater than 10-6. This is NDEP's decision.

Response: *BRC acknowledges that it is NDEP's prerogative how to regulate risk. As stated in the NCP "For known or suspected carcinogens,* ***acceptable*** *exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response." [emphasis added] Because of the foundational AOC III, BRC considers it appropriate and relevant to compare to this NCP acceptable risk range and place the results of the risk assessment in this context. BRC also believes that this is consistent with how risks have been discussed in other BRC documents.*

10. Executive Summary, page ES-4, section "Evaluation of Uncertainties", first paragraph, last sentence states, "Therefore, the environmental sampling and selection of COPCs should not introduce appreciable uncertainty in this assessment." This statement does not seem to follow

from the previous sentences. It seems that the intent is to say that it is unlikely that existing significant risks will be missed. However, this is somewhat different than uncertainty in the results of the assessment.

Response: *This sentence has been revised to read "Therefore, it is unlikely that significant risks were missed or underestimated"*

11. Executive Summary, page ES-4, reference is made to populations. While this is not incorrect, the risk assessments are aimed at a typical person from those populations. Perhaps in this section this should also be made clear.

Response: *Comment acknowledged. The text has been revised.*

12. Executive Summary, page ES-5, some further discussion of asbestos risk is warranted here, since the risk is driven by upper bound risk estimates.

Response: *Additional text has been added regarding asbestos risk.*

13. Executive Summary, page ES-5, and general comment, NDEP recommends that in Table ES-1, for the trespasser, significant figures for the hazard index are changed to match those reported in the risk calculations sheets (e.g.: change 0.018 to 0.02). In addition, for the asbestos risk values, the subtitles in Table ES-1 should not be listed as the "risk range". These are simply two estimates of the mean risk; it does not represent a risk range.

Response: *The text and tables have been revised to reflect this comment.*

14. Executive Summary, Table ES-1, the NDEP has the following comments:
    a. Footnote b – amphibole was detected in one 2nd run sample. See asbestos risk assessment comments. Please clarify.

Response: *See response to comments below (for example comments 42 and 79a).*

    b. Background risk results are presented for radionuclides. Tow comments are provided below on this issue. One is that the role of background risk in this report is not explained in the document. This seems to be the case in both the Executive Summary and the main text. If comparison is going to be made to background risks, then this should be described in the main text (risk assessment), and the calculation of background risk should be described. The second comment is that the results presented are only for radionuclides, yet background risks are presented for metals in Appendix F. Since they are presented in Appendix F, it is not clear why results for background risk are used for radionuclides but not for metals.

Response: *Additional text has been added regarding background risks, and background risks for metals have been added to the tables.*

15. Section 1.1, page 1-1, please note that the first sentence has a comma at the end not a period.

Response: *The text has been corrected.*

16. Section 1.0, page 1-1, third sentence states, "One of the constraints on the future use of Borrow Area soil is that such soils cannot be placed in environmentally sensitive areas, nor be exposed to ambient conditions." Some reference here should be made to ambient conditions and the reason that exposure to these conditions is not acceptable.

Response: *Text has been added to address this comment.*

17. Section 1.1, page 1-1, at the bottom of the page, please reword #1 regarding the acceptable non-cancer criterion as follows: "For non-carcinogenic compounds, the acceptable criterion is a cumulative hazard index or one or less". For #2, reword as follows: "For known or suspected carcinogens, the acceptable ceiling for a cumulative incremental lifetime cancer risk ranges from 10^{-6} to 10^{-4}. The risk goal established by the NDEP is 10^{-6}."

Response: *The text has been reworded as indicated in this comment.*

18. Section 1.1, pages 1-1 and 1-2, items 1, 2 and 3 do not appear to cover asbestos, and perhaps not lead or radon, since those compounds are often modeled differently for risk assessment.

Response: *The text has been modified to address this comment.*

19. Section 1.2., page 1-2, the NDEP has the following comments:
    a. Guidance is cited, but there appears to be no references pertaining to radionuclide risk, asbestos risk or possibly risk from lead. This section also indicates that the risk assessment conforms to the Work Plan, but this is not the case for estimation of Exposure Point Concentrations (EPCs). We note that the authors recognize this difference later in the document.

Response: *See response to comment #4 above.*

    b. The list of guidance documents presented in this section is limited to three documents, one of which is an outdated document. The "Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors". OSWER Directive 9285.6-03 (USEPA, 1991) has been for the most part updated with the 1997 "Exposure Factors Handbook (USEPA, 1997)"and the 2002 "Supplemental Guidance for Developing Soil Screening Levels for

Superfund Sites" (USEPA, 2002). As previously communicated, NDEP prefers that these documents be relied upon for exposure factors. It appears that the only time the 1991 document is cited is as the reference for some of the general exposure factors listed in Tables 7, 8, and 9. USEPA 1997 or USEPA 2002 should be cited in those instances.

Response: *Comment noted. The text has been revised to include additional guidance.*

20. Section 1.3, page 1-2 bottom, please note that Chapter 4 also describes some relevant fate and transport processes, according to the Executive Summary, please rectify this discrepancy.

Response: *The text has been corrected.*

21. Section 2.1, page 2-1, bottom, the discussion provided here should be included in the Conceptual Site Model (CSM) (Section 4), which contains little or no information regarding primary sources.

Response: *Text has been added to Section 4 regarding primary sources.*

22. Section 2.2, general comment, the excavated material will be separated into 2 piles. Is there any consideration in the risk assessment that the concentrations of potential contaminants might be different in the two piles? It can be the case that concentrations are greater in more fine grained materials. In addition the dust loading might be different between the two piles. If this is not going to be considered BRC should discuss why.

Response: *See response to comment 23 below.*

23. Section 2.2, page 2-2, as discussed with BRC during the various iterations of the HHRA work plan for the Borrow Area, the reject sand is confined to the same usage restrictions as the remaining materials from the Borrow Area. Reject sand shall not be used as pipeline bedding or for landscape applications. It is the understanding of the NDEP that the reject sand may be used in the construction of the CAMU. If this is the case, this should be discussed. Some potential issues are as follows:
    a. If the reject sand is used as bedding material for the CAMU it will be in very close proximity to groundwater and the VLEACH calculations would need to address this matter.

Response: *Based on current disposal options, it is likely that all of the material will be disposed as "pit run" – thereby not requiring separation into two piles However, even if the material were screened into two piles, it is BRC's professional judgment that, given the other conservative assumptions being made in estimating potential risks, that these risks will not underestimate any actual risk. Please note also with regards to differences in concentration between coarse and fine grained materials, it is BRC's belief that the sample preparation step prior to analysis*

involves grinding the material – making this difference moot. Dust loading will be moot since sorting into different piles is not now contemplated, but please note that typical dust mitigation measures such as watering will be used, minimizing any dust generation.

BRC will not use and sand generated for landscape applications or for pipeline bedding. If any material is used in the CAMU construction, it will be used in the "ops" layer and not in the cover or in the leachate collection layer.

b. If reject sand was proposed for use in landscape applications this would violate the NDEP's requirement that the Borrow Area materials not be used at the surface.

Response: *BRC will not use reject sand in such applications.*

24. Section 2.3, pages 2-3 through 2-5, the NDEP has the following comments:
    a. Please provide references for site-specific information and data presented.

Response: *References have been added.*

b. It appears that the first full paragraph on p. 2-4, which describes the Las Vegas Wash, would be better located under a heading of "Surface Water" rather then under the "Climate" section.

Response: *The text has been modified to reflect this comment.*

c. Page 2-5, Section 2.3.4 – Groundwater – this is the only instance in the document where mention is made of the seven soil placement sites. It would be helpful to explain more about why those areas were selected as recipients of Borrow Area soil.

Response: *The placement sites are first identified in Section 2.1.*

25. Section 2.3.1, pages 2-3 and 2-4, rainfall is highest in January and February, however, the months with the highest evaporation coincide with those months with the highest intensity of rainfall. These are not necessarily contradictory statements, but perhaps some clarification can be provided.

Response: *Text has been added to reflect this comment.*

26. Section 2.3.4, page 2-5, depth to groundwater is 34-53 feet, however, in 2.4.1 depth to groundwater is 38-58 feet. BRC should resolve this inconsistency.

Response: *The most recent depth to groundwater measured in the vicinity is now referred to in the text.*

27. Section 2.4.3, page 2-7, it is not clear why all the metals evaluated are itemized in this section, but not in any previous sections. Please make the descriptions consistent or explain the inconsistencies.

Response: *The text has been revised to be consistent with other sections of the report.*

28. Section 2.4.4, page 2-7, this is a very brief description of the previous investigation. Reference of the sample locations to a Figure would be helpful for this Section and in all future reporting.

Response: *Reference to Figure 2 has been added to this section.*

29. Section 2.4.5, page 2-8, BRC indicates that the radionuclide analyses were completed by STL – Saint Louis. Please clarify if this is correct. It was the understanding of the NDEP that these analyses were completed by STL- Hanford.

Response: *The text has been corrected to reflect which analyses were performed at other laboratories.*

30. Section 3.0, general comment, most of the comments regarding Chapter 3 still stand, despite the improvement made in the revised Chapter 3 that has been submitted. These comments are, however, based on the original version.

Response: *Comment noted.*

31. Section 3.0, general comment, Guidance for Data Usability in Risk Assessment (Part B) (USEPA, 1992a) should be followed for purposes of evaluating radionuclide data. It is not apparent that Part B was applied.

Response: *This guidance was used and a reference to it has been added.*

32. Section 3.0, page 3-1, the HHRA states that samples used in the HHRA were collected prior to preparation of the approved Field Sampling and Standard Operating Procedures (FSSOP) project manual, but that "established industry standards for sample collection were followed. Please explain if there were differences in the methods employed and the FSSOP methods and if those differences result in any data quality issues.

Response: *As stated in the text, industry standard were followed. The standard operating procedures in the FSSOP are consistent with these industry standards; therefore, there should be no differences that would result in any data quality issues.*

33. Section 3.1 seems out of place. This section is mostly about the background data, although at the end it refers to data usability for the background data. Also the title of the section seems strange. Why "Determination of"? It is simply a matter of using the background data from the background investigations that have been performed. Perhaps the issue is that the idea of using background in this risk assessment has not been described prior to this section. Perhaps the information in this section belongs in another Section as another source of relevant data for the risk assessment, with the specific roles of the background data described there as well.

Response: *Section 3.1 has been moved into Section 2.*

34. Section 3.2.1, page 3-2, footnote, please provide the sample identifications and the results for the two locations mentioned. The omission of these data, and rationale, should be discussed in the data usability evaluation.

Response: *The sample identifications and results have been added.*

35. Section 3.2.1, top of page 3-3, the text states that the most recent boundary definition is presented in the CSM for the CAMU. Please include that information within the HHRA, and any other relevant information contained in the CAMU CSM.

Response: *Comment noted. The boundary is presented in Figure 2.*

36. Section 3.2.3, the minimum requirement of Criterion II is that sample results have been confirmed to a specific geographic location and that chain-of-custody records are provided and are complete. Please confirm in the text, Table 1, and Appendix C, Table C2-1 that both of these requirements were met for all data used in the HHRA.

Response: *Sample results have been confirmed to a specific geographic location and chain-of-custody records have been verified. This information has been added to the report.*

37. Section 3.2.4 and Table C2-1 Data Sources, Criterion III, the minimum requirements for Criterion III are that analytical sample data results are produced for each medium within an exposure area and that broad spectrum analyses have been used. Please confirm in the text, Table 1, and Appendix C, Table C2-1 that both of these requirements were met for all data used in the HHRA.

Response: *This information has been added to the report.*

38. Section 3.2.5, page 3-5, detection limits, it is not exactly clear from this description exactly what the detection limits are that are used in the risk assessment. For example, are they reporting limits or some form of sample specific method detection limit or sample quantitation limit. If the latter, then some more description is needed in this section. It would also be helpful if the substitution methods used for non-detects were also described. Most of the data plots seem to have used the actual detection limits, but summary statistics and statistical tests might have used ½ detection limit instead. We did not find any explanations of how detection limits were defined and used.

Response: *This information has been added to the report.*

39. Section 3.2.5, Table 1 and Table C2-1, Data Usability Evaluation, Criterion IV, samples and analytes for which reporting limits exceed risk benchmark concentrations and represent data carried into the HHRA, should be identified and discussed in the data usability evaluation and uncertainty analysis. For example, the reporting limit for 2,3,7,8-TCDD in sample BP-09 was 61 pg/g (ppt). Due to this elevated reporting limit, a TCDD TEQ concentration of 32.1 pg/g was calculated. This means that the TEQ for this sample lies somewhere between 0.35 pg/g (based on detected congeners only) and approximately 63 pg/g (based on full reporting limits for the non-detected congeners), a value which exceeds the ATSDR screening target level of 50 pg/g that is used in the HHRA as the basis for decisions regarding dioxin-related risks.

Response: *TCDD TEQs have been carried into the risk assessment as COPCs. Additional discussion has been added to Section 5.2 and the tables.*

40. Section 3.2.5, pages 3-5 through 3-7, the use of the elutriator method is mentioned again, but no further discussion of data validation or data usability is presented. On Page 3-7 there is a short discussion of detection limits for asbestos, but this seems off target considering the similar issue for asbestos is analytical sensitivity. There should be some discussion of analytical sensitivity for asbestos, some discussion of the duplicate, some discussion of the "2nd runs", and some discussion of any other data quality issues for the asbestos concentration data.

Response: *Discussions addressing these issues have been added to the report.*

41. Section 3.2.5, page 3-7, fourth sentence states, "For lead-210, the frequency and range of detected concentrations are very similar between the site and background, as was considered comparable in statistical comparisons with background." It appears that there might be a word or two missing from this sentence.

Response: *The sentence has been modified.*

42. Section 3.2.5, end, amphibole was detected in one of the 2nd run samples. It is not correct to say that amphibole was not detected.

Response: *Reference to the 2nd run detection of amphibole has been added to the text.*

43. Sections 3.2.6 and 3.2.7, Table 1 and Table C2-1, Data Usability Evaluation, Criteria V and VI, the NDEP has the following comments:
    a. Section 3.2.6.1, page 3-8, second sentence states, "Furthermore, based on a review of the laboratory narratives (provided in the laboratory reports in each of the DVSRs), the laboratories do not believe that the observed exceedances of laboratory criteria represent a concern." If the laboratory fails to ensure that certain QC standards (e.g. allowable PR and RPD), it doesn't seem sufficient to accept the assurance of that same laboratory that the data are useable. Perhaps reference should instead be made to the subsections that follow and the data usability tables that explain what the data issues are and how they are handled.

Response: *Reference to the appropriate section and table has been added to the text.*

    b. Page 3-8, section 3.2.6.2, last two sentences on the page state, "All RPD's were below 50 percent except for the following: delta-BHC at location EB-8 with an RPD of 144%; barium at location EB-3 with an RPD of 57.1%; lead at location PEB-13 with an RPD of 71.5%; chromium at location PEB-17 with an RPD of 57%; 2,3,7,8-tetrachlorodibenzofuran and sodium at location BP-06 with RPDs of 138% and 84%, respectively; and phosphorus (as P) and ronnel at location BP-09 with RPD's of 55% and 93%, respectively. While there are differences that are rather large, they do not appear to be consistent with a widespread issue with the data." It is not clear that these RPDs for field duplicates are acceptable. Perhaps reference should instead be made to the data usability tables that explain what the data issues are and how they are handled, and hence why the data are considered usable. The data usability evaluation is conducted on a sample-by-sample basis. It is not appropriate to make a conclusion that all data are usable based on the quality control data for a subset of the data. Each data point has its own laboratory control data, and those data should be used to make decisions regarding the usability of that data point in the HRA.

Response: *Reference to the appropriate section and table has been added to the text.*

    c. Section 3.2.6.2 – Field duplicates. In the Data Usability table, field duplicates are instead described as splits. Some clarification is needed here. Also, we did not find any description of how duplicates/splits were handled in the statistical analysis. Also, the asbestos duplicate and 2nd runs are not described anywhere.

Response: *Discussions of these issues have been added to the text.*

d. Page 3-1, BRC states ""RPDs were generally within the laboratory' acceptance criteria…" See NDEP comment above.

Response: *See response to comment 43b above.*

e. As discussed via email and teleconference, NDEP requests that each set of data points (identifying the sample ID and specific analytes) for which laboratory QC limits were exceeded, be identified in table format and the specific QC issues be discussed in light of documenting whether the data point meets USEPA HHRA usability criteria or not.

Response: *Data usability tables, as approved by NDEP subsequent to submittal of the Draft risk assessment deliverable of December 2006, have been added to the revised report.*

f. Page 3-11, near top. Precision and accuracy should refer to individual sample results, rather than of samples. The same observation applies to the lab control sample text.

Response: *Please see response in (e) above.*

g. Page 3-11, BRC states "MS/MSD analyses alone cannot be used to evaluate the precision and accuracy of individual samples and the presence of RPD exceedances in individual samples does not necessarily indicate a lack of precision or accuracy." Statements such as these do not add to the understanding of potential uncertainty regarding COPC selection and EPC characterization (the purpose of the DU evaluation), nor are they correct. For example, USEPA 1992b identifies duplicate data (i.e., RPD) as the basis for measurement of laboratory precision (p.102) and spiked sample data as the basis for measurement of laboratory accuracy (p. 102, p.109). USEPA guidance states that "Factors affecting the accuracy of identification and the precision and accuracy of quantitation of individual chemicals, such as calibration and recoveries, must be examined analyte-by-analyte" (p.105).

Response: *Please see response in (e) above.*

h. Page 3-12, Holding times main paragraph, the last sentence does not seem to be quite right.

Response: *The sentence has been revised.*

i. Section 3.2.7.3 Representativeness – This section does not discuss holding time, sample preservation, extraction procedures, or spatial coverage of sampling in regard to potential sources.

Response: *Discussions addressing these issues have been added to the report.*

j. Section 3.2.7.3. Representativeness is not a direct function of accuracy and precision – those terms should be deleted from the opening sentence. Samples need to be of the intended media with respect to the risk assessments that will be performed. Possibly there are particle size issues to deal with. Accuracy is an issue potentially only in terms of the random sampling scheme that should be used to the extent possible.

Response: *USEPA guidance defines representativeness as "the measure of the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition" (Page B-6. USEPA 2002, Guidance for Quality Assurance Project Plans. EPA QA/G-5). Comment noted. Discussions addressing these issues have been added to the report. As discussed in the response to Comment 23 above, particle size is not expected to be an issue.*

k. Page 3-15. Suggest delete "MWH believes that surrogate spike recovery evaluations meet the requirements of the accuracy parameter". There are no requirements of the accuracy parameter, and please note that there is no accuracy parameter (perhaps there are many, but there really isn't one). There is intent, which is something along the lines of lack of bias, which usually means presenting bias concerns. The latter has been done, and biases undoubtedly exist, in which case it is not clear what can be meant by meeting the requirement of the accuracy parameter.

Response: *The sentence has been removed.*

l. Page 3-15 – Blanks. This section might need to be revisited based on the recently developed data usability table. Some further explanation of the rules that have been applied to reject or otherwise qualify data suffering from blank contamination issues would be helpful. Also, see Section 3.2.7.4. It is not clear that it is so appropriate to interpret these results as non-detects.

Response: *Please see response in (e) above.*

m. Section 3.2.7.5 Comparability – Comparability of reporting limits (for site data sets and for site data versus background data) should be discussed in this section. Additionally, comparability of the geology of site versus background soil samples should be discussed.

Response: *A more detailed discussion of reporting limits and geological conditions has been added to the revised report.*

n. Section 3.2.7.5. There are two primary comparability issues for this risk assessment. One is comparability of site and background data, and the other is comparability of the different sets of site data. Important issues are analytical methods and similar environmental conditions. Like representativeness this is a qualitative measure. Consequently, the last sentence of the first paragraph can be deleted. In addition, some discussion of comparability re background data is needed.

Response: *Comment noted. A more detailed discussion of comparability has been added to the revised report.*

44. Section 3.2.8, general comment, the NDEP would like to note that there appear to be plenty of data. It would be a major surprise to discount data adequacy issues in this sense. However, we also note that data adequacy has not been demonstrated for the background comparisons, but only for the final risk assessment. This might be considered adequate, but perhaps some discussion should be provided along these lines.

Response: *A discussion of the data adequacy for the background comparisons has been added.*

45. Section 3.2.8.1, the NDEP has the following comments:

a. Page 3-17, second paragraph, second sentence states, "Qualitatively, sample sizes could be considered adequate for radium-226 given the similarity to background concentrations." The relative qualitative comparability of two datasets is not a justification for adequacy of sample size. This statement should be modified or removed. If background is to be described here, it is not clear why the discussion is limited to radium-226.

Response: *This sentence has been removed.*

b. Page 3-17, second paragraph, third sentence states, "Furthermore, hot spots do not seem to be evident based on the data, and were not considered likely." There does not appear to have been a spatial analysis that would validate this statement. This sentence should be modified or removed.

Response: *This sentence has been removed.*

c. Page 3-17, third paragraph, first sentence states "In addition, hot spots do not seem to be prevalent at the Site based on the data,…." Some analyses should be presented to support this assertion. Otherwise, this sentence should be removed.

Response: *This sentence has been removed.*

46. Section 3.2.8.2. Its not clear why the maintenance worker was chosen for this analysis, or why it was not applied to all 3 scenarios. If the maintenance worker was chosen because this scenario exhibits the greatest cancer risks, then this should be made clear.

Response: *Clarification of this issue has been added to the text.*

47. Section 3.2.8.2 and Appendix C. It is not clear that the probabilistic methods that were not run need to be described in this document.

Response: *These discussions have been removed.*

48. Section 4.0, general comment, key information presented in this section should be carried into the DU evaluation. The distinction between primary sources (e.g., surface runoff and transport of dust emitted from adjacent contaminated soil) and secondary sources should be made.

Response: *Additional text has been added to the representativeness discussion to address how the sampling design addresses migration pathways.*

49. Section 4.0, page 4-1, second paragraph, fifth sentence has a typo. The word "are" should be changed to area.

Response: *The sentence has been corrected.*

50. Section 4.0, page 4-1, 2nd paragraph, reference is made to the "human health CSM for the Site is presented in Figure 4". The words "the Site" should be removed from that sentence. The Figure shows the exposure pathways that are considered important for this risk assessment, but the bullets on Page 4-1 present more pathways, some of which do not appear to be used. The text and the figure should be more consistent, or some explanation should be given for the pathways that are not included in the risk calculations.

Response: *The sentence has been revised. Discussions regarding pathways not evaluated have been added to the text.*

51. Section 4.1. It is not clear exactly what is meant by "Samples relative to Site baseline conditions have been collected at the Site for soil". Please rewrite and clarify.

Response: *The sentence has been removed.*

52. Section 4.2, general comment, primary transfers are described, but this begs the question of what secondary transfers might be. Please clarify.

Response: *The text has been revised.*

53. Section 4.2, page 4-2, please use the USEPA terminology "migration pathways" instead of "inter-media transfers".

Response: *The term has been replaced.*

54. Section 4.3, page 4-3, 2nd paragraph, item "(2)", please revise this statement to be "the placement of soils will be such that there are limited exposure pathways for receptors".

Response: *The sentence has been revised.*

55. Section 4.3.1, page 4-3, please change the title of this section to "Identification of Exposure Pathways and Receptors"

Response: *The title has been changed.*

56. Section 4.3.1, page 4-4, it is not so much that the inhalation pathway includes asbestos that is important; what is more important is that asbestos will be evaluated separately.

Response: *The section has been modified to address this comment.*

57. Section 5.0, last paragraph, please discuss if there are examples of chemicals that were included in the risk assessment even if there is historical evidence that they should be included?

Response: *It is unclear as to the intent of this comment.*

58. Section 5.1, the NDEP has the following comments:
    a. First paragraph, are there examples of chemicals of chemicals that would have been deleted based on a weight of evidence approach (rather than exceedance of a single test) that are identified in Chapter 7?

Response: *The background comparison has been revised based on NDEP comments. This section has been updated to reflect the approach recommended by NDEP.*

    b. Page 5-2, first paragraph, last sentence states, "An alpha = 0.025 is adequate to identify differences between the two datasets since multiple statistical tests are proposed (Black 2006)." This sentence should probably be deleted. The reference is unnecessary and the content is repeated below.

Response: *The sentence has been removed.*

c. Page 5-2, last paragraph, second sentence states, "Since several tests were conducted, a lower alpha was selected." The word "correlated" should be inserted between the words several and correlated in the above sentence.

Response: *The sentence has been revised.*

d. Page 5-3, first paragraph, The parenthetical "e.g." should be changed to "i.e." since this is the only directional difference that makes sense conceptually. In addition, "below" should be removed from the succeeding sentence.

Response: *The sentence has been revised.*

e. Page 5-3. The plots that are referenced appear to use the detection limit as opposed to ½ detection limit. This needs to be explained. Otherwise there are apparent mismatches between the plots and the statistical results. Also, different summary statistics are provided on separate tables – it would be more helpful if they were consolidated.

Response: *The plots have been revised to be consistent with the tables and statistical results.*

59. Section 5.2, the NDEP has the following comments:

a. Page 5-3, section 5.2, first bullet states, "Including chemicals positively identified in at least one sample, including: (1) chemicals with no qualifiers attached (excluding non-detect results with unusually high detection limits, if warranted), and (2) chemicals with qualifiers attached that indicate known identities but estimated concentrations (*e.g.*, J-qualified data)…" The exclusions of exclusion of non-detect results with unusually high detection limits, if warranted should be approved by NDEP. Also, it is not clear what is meant by the phrase "known identities but estimated concentrations". Please revise the text accordingly. Also, the use of "estimated values" and "J-qualified" is not complete. J-qualification is used for many different reasons. Note also, that all sample results are estimated, even thought J-qualification is used associated with the team "estimated concentrations" when J-qualification is used for reported values below the reporting limit (but above the sample quantitation limit).

Response: *The text has been modified to address this comment.*

b. Page 5-4, first full paragraph, third sentence states, "The maximum TCCD Equivalents for all samples were less than the screening level of 50 ppt." This is a typo and TCCD should be replaced by TCDD. Also, it does not appear that there is a discussion in Chapter 7 as indicated.

Response: *The sentence has been corrected. In addition text has been added to Chapter 7 to address this issue.*

c. Page 5-4, second paragraph, second sentence states, "Although included as COPCs, these chemicals were not quantitative evaluated in the risk assessment." The word quantitative should be replaced by quantitatively.

Response: *The sentence has been corrected.*

d. 59) Page 5-4, third paragraph, fifth sentence states, "Prior to eliminating a COPC based on the frequency of detection criteria, (1) any elevated detection limits are addressed, and (2) data distributions within the Site are considered." It should be stated here how the data distributions within the site are used to inform COPC selection.

Response: *The text has been revised.*

e. Page 5-4, please reference Table C-1 here to support the conclusion regarding TCDD TEQ concentrations.

Response: *The text has been revised.*

60. Section 6.1, the NDEP has the following comments:

a. General comment, this section describes methods for estimating exposure point concentrations, but asbestos is not included. Please expand the discussion in this Section to include asbestos.

Response: *Additional discussion regarding asbestos has been added.*

b. The term "conservative assumptions" is used in association with the deterministic risk assessment. Not all of the exposure parameters are conservative, and supposed conservative assumptions are not always as conservative as they first appear. We agree that this risk assessment probably overestimates risk for a variety of reasons, but believe that the language here should be softened so that not all parameters are defined as conservative.

Response: *The text has been revised to address this comment*

61. Section 6.1.1, the NDEP has the following comments;

a. The 95% UCL that has been calculated using ProUCL is rarely of the "arithmetic mean". When normality is assumed this is perhaps the case, but otherwise it is

not, because it is the distribution mean rather than the arithmetic mean that is being estimated. These are not the same usually.

Response: *Comment noted. GISdT was used to calculate 95 percent UCL's in the revised risk assessment.*

b. Explanation is offered for how non-detects are handled, but not for how duplicates are handled. This also needs to be explained.

Response: *The primary sample has been used unless rejected. The duplicate is then used if it is not rejected. The text has been revised.*

c. Formulas for UCL calculations are referenced to EPA 1992 and 2002. Given the use of ProUCL, the UCL formulas are not all contained in these documents (for example, UCLs based on the gamma distribution are not included).

Response: *Comment noted. GISdT was used to calculate 95 percent UCL's in the revised risk assessment.*

d. Page 6-2, first paragraph, seventh sentence to the end of the paragraph states, "Although the Work Plan stated that the 95 percent UCL statistical calculations would be performed using the computer statistical software program GISdT® (Neptune and Company 2006), these calculations were not completed using GISdT®, rather, USEPA's ProUCL (version 3.00.02) was utilized. Although GISdT® calculates and presents a number of suitable UCL values, the program provides no recommendations which value is most appropriate. As ProUCL provides consistent recommendations based upon published decision criteria, the ProUCL program was utilized for UCL calculations." If the use of GISdT® was an issue it should have been addressed in one of the three rounds of revisions in the workplan. Although ProUCL is capable of generating a number of different UCLs, the decision logic for the recommended UCL is flawed for a number of cases. Whether GISdT® or ProUCL is used, the determination of an appropriate UCL needs input from a qualified statistician. The reason GISdT® was recommended over ProUCL is that recommendations are not made, and this forces the user to understand the data in order to determine which UCL is most appropriate. See attached commentary and observations on ProUCL in Attachment B.

Response: *Comment noted. GISdT was used to calculate 95 percent UCL's in the revised risk assessment.*

e. Page 6-3 section 6.1.1.1, second paragraph, first sentence states, "In order to demonstrate that the 95 percent UCLs used in the risk assessment are representative and realistic, six chemicals were selected for the calculation of

confidence intervals." It is not clear how computing confidence intervals using an assumption of normality demonstrates that the UCLs are representative or realistic.

Response: *See response to comment 61h below.*

f. Please discuss if any maximum values were used for EPCs in this risk assessment. If so, it would be helpful if they were identified. If not, perhaps these sentences should be deleted.

Response: *The table has been revised to show the basis for the exposure point concentrations, including identifying where maximum values were used.*

g. The confidence intervals presented are not 95% confidence intervals – they are 90% confidence intervals. Confidence intervals are 2-sided. UCLs' are 1-sided. Hence, the upper side of the 90% CI matches a 1-sided 95% UCL. The language should be changed.

Response: *The text has been revised to address this comment.*

h. In addition, it is not clear exactly why this analysis is presented. What it demonstrates is that UCLs when normality is not assumed (and the assumed distribution is positively-skewed) are greater than the UCL that would be seen if normality was assumed. This is a given. It is not clear how this demonstrates that the UCLs used are "representative and realistic". If this is the goal, this can be achieved instead by comparing the UCLs to the summary statistics. Since UCLs are estimates of means, with the number of data points there are for many chemicals, it would make sense that the UCLs are not much greater than the means.

Response: *The analysis has been modified to address this comment.*

62. Section 6.2, general comment, since leaching modeling falls under the definition of fate and transport modeling, but is not contained in this section, please change the title of this section to "Air Exposure Point Concentrations" and incorporate Section 6.1.2 (Outdoor Air) into this section. Also, see Comment #20 regarding Appendix E.

Response: *The section title has been changed.*

63. Section 6.2, general comment, a comment is appropriate for asbestos in this section as well, since only the inhalation pathway is relevant. Potentially the issue of Exposure Time for asbestos could be discussed in this section.

Response: *The text has been revised to address this comment.*

64. Section 6.2, first paragraph, last sentence. There is not always a time-dependent reduction of chemical concentrations in these media. Sometimes there can be concentration instead. This sentence can be reworded or deleted.

Response: *The sentence has been revised.*

65. Section 6.3.1. Note that the Exposure Time parameter (8 hours) used in the asbestos risk assessment is not described in the text or the tables.

Response: *See response to comment 63 above.*

66. Section 6.3.1. Transparency issue. Some further explanation of the exposure parameters (justification) would be helpful. Much of the justification is removed to footnotes in a table.

Response: *Further discussion of site specific parameters has been added to the text.*

67. Section 6.3.2. An equation is provided. However, there are no similar equations for radionuclides or asbestos. Also, is lead considered in the same way? This again is a transparency issue.

Response: *Additional equations and discussions have been added to the report.*

68. Section 6.3.3. Radionuclide decay is included, but no other fate and transport mechanisms are included. Perhaps other mechanisms should be applied as well. Please discuss.

Response: *Additional discussions have been added to the report.*

69. Section 6.3.3, first bullet, since these are activities, they are not concentrations, hence, the sentence should be changed.

Response: *The sentence has been revised to reflect activity.*

70. Section 6.3.4, pages 6-8 and 6-9, the NDEP has the following comments:
    a. General, since the formulation for asbestos risk calculations is so different than those for chemical risks, the underlying equations should be presented in full, with supporting explanation.

Response: *Additional equations and discussions have been added to the report.*

b. General, the implication is that amphibole was not detected in site samples. This is incorrect. One short amphibole fiber was detected and is reported in the data set. Please clarify.

Response: *The text has been revised.*

c. General, it seems that the modified elutriator method should be described in Chapter 3, along with other factors relevant to the asbestos measurements (data quality issues).

Response: *A description of the modified elutriator method has been provided in Chapter 3.*

d. Page 6-8, 1st paragraph, exposure pathways, equations and parameters are not completely defined in EPA 2003. For example, exposure duration, frequency and time are not defined in that guidance. The guidance provides sufficient information to obtain URFs, but does not complete the equations necessary to calculate site-specific asbestos risk. Some clarification is needed. Also, note again, that Exposure Time for asbestos calculations has not been defined.

Response: *See response to comments 63 and 70a above.*

e. Page 6-8, 2nd paragraph, the pooled analytical sensitivity is not the best estimate of risk. The pooled analytical sensitivity is multiplied by the number of fibers detected, to obtain the best estimate of risk. Similarly the upper bound is not "calculated as the 95% UCL on the mean of the assumed underlying Poisson distribution. The Poisson assumes the total number of fibers detected as its mean, from which an upper bound estimate is calculated, which is then multiplied by the analytical sensitivity. Some clarification/correction is needed.

Response: *Comment noted. The text has been revised.*

f. Page 6-8, 3rd paragraph, the sentence "the intent of the risk assessment methodology was to predict the amount of airborne asbestos which can be inhaled by a receptor" is awkward. It is suggested that the intent is clarified. It is the NDEP's understanding that the intent is to estimate risk.

Response: *The sentence has been revised to address this comment.*

g. Page 6-8, 3rd paragraph, the decision to use Table 8.2 of EPA 2003 requires some discussion. The decision is not even placed in context of the alternatives, or in the context of what "Optimum Risk Coefficient" means. This would aid transparency of the document.

Response: *Additional discussions have been added to the report.*

h. Page 6-8, 4th paragraph, the equation for "population averaged risk" is cited. It would be more helpful if it was presented and explained. Beyond that, its role in the risk assessment is not described.

Response: *Additional discussions have been added to the report.*

71. Section 6.4.4. Were any of the decay products out of equilibrium? If so, what was done about it? The decay products are in general very short-lived, in which case equilibrium should not be a problem. A larger problem could be the quality of the radionuclide data (e.g., gamma spec data). Please note that it would still be beneficial to compare gamma spec data to results that would be expected based on equilibrium (from alpha or beta analyses).

Response: *BRC acknowledges this comment. Equilibrium has been assumed in the calculations. Separately, BRC will compare gamma spec data to corresponding alpha or beta analysis data.*

72. Section 6.4.4. Since toxicity factors for radionuclides included effects from daughter products, it would seem that there has been double counting in the radionuclide risk assessment. This seems unnecessary.

Response: *BRC agrees with this comment; however, use of radionuclide toxicity factors that include the effects from daughter products were used based on previous NDEP comments on this issue. If BRC misunderstands NDEP position, please advise.*

73. Section 6.4.5, page 6-12, this section warrants more explanation given the differences between chemical risk assessment and asbestos risk assessment.

Response: *Discussion on this issue has been added to the report.*

74. Section 6.5.3, pages 6-14 and 6-15, as written, the reference to asbestos risk tables is followed by reference to ILCRs. The asbestos risks are not ILCRs in the usual sense, and this term should probably be left for the chemical risk assessment. The next sentence says that all calculation spreadsheets are included in Appendix B. This is confusing. There is a CD in Appendix B, but copies of some of the spreadsheets are also found in Appendices E and F.

Response: *It will be made clear that hardcopies of tables are found in Appendices E and F, while electronic spreadsheets are found in Appendix B.*

75. Section 7.0, the NDEP has the following comments:

a. The use of the term "Relative degree" implies a quantitative assessment. It is requested that the wording be changed.

Response: *The sentence has been revised to address this comment.*

b. 2nd paragraph. It is not clear that to say "estimating risks is impossible" is reasonable. Mention is made of PRA in this risk assessment. Arguably for PRA estimating risks is what is happening. For deterministic risk assessment, perhaps it is a matter of over-estimating risks. We agree that risks are estimated, but they are estimated with a view to decision analysis and protection of human health rather than prediction. Perhaps some clarification can be made.

Response: *The sentence states that estimating* ***actual*** *risks is impossible, not estimating risks. Discussion on this issue has been added to the report.*

c. 2nd paragraph, 3rd sentence. Hazard index endpoints are not associated so directly with the probability of an adverse health effect. Some clarification should be made.

Response: *Discussion on this issue has been added to the report.*

d. Last paragraph. 10,000 is not an upper limit as implied in the relevant sentence. Suggest rewording. Perhaps use "e.g., 10,000 times".

Response: *This paragraph has been removed.*

e. Last paragraph. There is something missing in transition from the 3rd last sentence about PRA and the last two sentences that are about uncertainty analysis for this risk assessment.

Response: *This paragraph has been removed.*

76. Section 7.1. UCL estimation should also be included as a source of uncertainty, since the purpose is to overestimate the mean concentrations.

Response: *Discussion on this issue has been added to the report in Section 7.1.4.*

77. Section 7.1.1, page 7-2, BRC discusses two sample locations with elevated beta-BHC concentrations that were excluded from the risk assessment. The justification provided is that the data were not validated. It is the understanding of the NDEP that hypothetical inclusion of this data does not materially affect the quantitative results of the risk assessment. This issue should be discussed further in the uncertainty analysis.

Response: *Further discussion on this issue has been added to the report.*

78. Section 7.1.2, the NDEP has the following comments:
    a. This section should be compared to the recently completed data usability tables, and consequently edited if necessary.

Response: *This section has been updated.*

    b. Page 7-3, fourth sentence has a subject-verb agreement typo.

Response: *The sentence has been corrected.*

    c. Page 7-3, fifth sentence contains the phrase "is suggestive that the data is" should be changed to "suggests that the data are".

Response: *The sentence has been corrected.*

79. Section 7.1.3, page 7-4, the NDEP has the following comments:
    a. BRC states that amphibole was not detected. This is not the case. Amphibole was detected once (reported as one short fiber) on site. Some clarification is needed, since this could be considered sufficient evidence itself to justify using the UCL for amphibole risk.

Response: *It was incorrectly stated that amphibole was not detected. A short structure was detected during a 2nd run of a sample. The sample was rerun because an unidentifiable structure was found in the initial run. Asbestos risk calculations are performed for long fibers only. Short fibers are considered to be non-protocol structures. Thus, the asbestos risk estimates did not change. The text has been revised to present this explanation.*

    b. Exceedence of the 10-6 risk goal for asbestos (amphibole UCL) implies that the analytical sensitivity for asbestos risk has not been achieved. There should be some discussion of this. Perhaps some discussion of how this is set up is needed in Chapter 3, and of how or why the targets were not achieved should be in the uncertainty analysis.

Response: *Further discussion on this issue has been added to the report.*

    c. Section 7.1.3, page 7-4 top, it is not appropriate to say that the risk assessment is "adequate". This sentence should focus only on over- or under-estimation of risk.

Response: *Further discussion on this issue has been added to the report.*

80. Section 7.2, please note that the PEF translation from soil to air concentrations should be included in this section.

Response: *Further discussion on this issue has been added to the report.*

81. Section 7.2.1, third sentence has a subject-verb agreement typographic error.

Response: *The sentence has been corrected.*

82. Section 7.3.1.2 first paragraph, last word should be changed from "appropriate" to "sufficient".

Response: *The sentence has been revised.*

83. Section 7.3.1.2, page 7-5, third paragraph, first sentence states "Although a weight of evidence approach to COPC selection was described in the Work Plan (MWH 2006), if a chemical failed a single background comparison test it was included as a COPC." Although this may been seen as conservative, this approach fails to develop an understanding of the data on a per chemical basis. This understanding is critical for an informed decision regarding not only COPC selection but also the identification of data issues. For example, There are several chemicals for which the maximum value is a non-detect. Additionally, there are some chemicals for which less than 5% of the data were detected, however, the results of statistical hypothesis tests are presented nonetheless. These data issues in conjunction with the blind application of statistical testing procedures without sufficient thought are unacceptable. We again recommend that the weight of evidence approach be used.

Response: *The background comparison analysis has been revised. This paragraph has been removed.*

84. Section 7.3.1.2, last paragraph, a new subsection or additional clarification is needed here, since this paragraph refers to background comparisons rather than points of human exposure.

Response: *This paragraph has been removed.*

85. Section 7.3.1.3, arsenic is discussed here, but cadmium is not. Given the use of a gastrointestinal absorption factor for cadmium, it too should be discussed here.

Response: *Specifically addressed in this section are the oral bioavailability values utilized to estimate oral absorption of COPCs for receptors exposed to Borrow Area soils. The only chemical for which an oral bioavailability is employed is arsenic (Table 11, 'ORAL BIO';*

arsenic bioavailability is assumed to be 30%), hence, only the discussion of arsenic is presented here. As shown in Table 11, cadmium is assumed to be 100% bioavailable in Borrow Area soils. The gastrointestinal absorption value referred to in the comment is employed only to adjust the results of study utilized to develop the oral RfD for cadmium in order to produce a dermal RfD, as per USEPA guidance (USEPA 2004f). This is discussed further in section 7.3.2.2. The gastrointestinal absorption value is not utilized to adjust oral intakes of cadmium in soils at the Borrow Area.

86. Section 7.3.2.2, page 7-8, the discussion regarding cadmium and arsenic is a little confusing. The text does not seem to quite match Table 11 (for example), since arsenic seems to have a dermal factor as well.

Response: *The text has been revised to clarify the two separate discussions presented in this section: the application of a gastrointestinal absorption value to adjust the study results utilized to develop the oral RfD for cadmium to produce a dermal RfD as per USEPA guidance (USEPA 2004f); and application of an oral bioavailability for arsenic to estimate the absorbed dose from the intake of Borrow Area soils. The discussion of arsenic in this section specifically relates to the fact that the arsenic oral RfD does not require adjustment to produce a dermal RfD (as supported by the Wester 1993 data as presented in* USEPA 2001c*), and that the uncertainty associated with not adjusting the arsenic RfD to produce a dermal RfD is low.*

Furthermore, additional text has been added to Section 7.3.1.3 to address the intake factor referred to in the comment, which is the dermal absorption of COPCs.

87. Section 7.3.2.6, page 7-10, there are far more uncertainties associated with the asbestos risk assessment than noted here. Some discussion of the URFs, the uncertainties in the asbestos studies, the use of Table 8.2 over 8.3 (EPA 2003), and what this means, etc. is needed. There should be a far greater discussion of the uncertainties associated with the asbestos risk assessment than described here.

Response: *Additional discussions have been added to the report.*

88. Section 7.3.3, the last sentence states that the resulting risk estimate is above the 90th or 95th percentile, etc. This is a curious statement and depends on how the risk has been calculated. Since here we have deterministic risk assessment aimed at a reasonable maximum exposure estimate that is based on mean risk, then the reference should be to mean risk. NDEP suggests either deleting the end of the sentence (stop at compounded) because of the complexities, or at least recognizing that the percentiles referred to are for the distribution of mean risk.

Response: *The sentence has been revised.*

89. Section 8, the NDEP has the following comments:

a. General comment, reference is made again to ILCR for asbestos. The terminology should perhaps be clarified, since the derivation of asbestos risk is different. Perhaps the terminology from EPA 2003 should be used (estimated additional deaths from lung cancer or mesothelioma, etc.).

Response: *The terminology used to identify asbestos cancer risks has been revised.*

b. General comment, the upper bound estimate for amphibole does not assume that there are 3 amphibole structures present at the site, as stated several times in Chapter 8. The upper bound estimate assumes that the mean amphibole concentration is 3 fibers per cm^3. Please clarify this issue.

Response: *Discussion on this issue has been added to the report.*

c. This appears to be the first reference to background risk calculations. They should be described earlier since they are used to support the decision making process.

Response: *Reference to background risks has been added to Section 6 of the report.*

90. Section 8.1, page 8-1, the text again says that amphibole fibers were not detected, but one short fiber was detected, and that could be considered sufficient evidence that amphibole fibers exist onsite.

Response: *The text has been revised.*

91. Section 8.1, page 8.2, bullet at the top of the page, the previous asbestos risk assessment performed by BRC used exactly the same exposure time factors for construction workers, and this approach was approved and authored by the industry expert, Wayne Berman. In addition, language in Appendix E of the EPA 2003 guidance suggests that this is a reasonable approach. The risk tables (e.g., Table 8.2 in EPA 2003) refer to constant lifetime exposure, not to constant low-level exposure. The language should be clarified.

Response: *From Appendix E of the 2003 guidance. - "When used to estimate risk from continuous exposure (24 hours/day, 7 days/week), KL and KM were adjusted upward by multiplying by 365/240 (to adjust from an assumed occupational exposure of 240 days/year to 365 days/year) and by 2.0 (to adjust from an assumed exposure during work hours to 24 hours/day, assuming that the amount of air breathed during 24 hours is roughly double the amount breathed during a single work shift." (pg E-3) Therefore the URFs are adjusted upward from an occupational exposure to get to a 24 hr/d, 365 d/yr continuous exposure. So application of a hour per day exposure time factor is appropriate.*

92. Section 9.1, page 9-1, 1st paragraph of section, please explain if the sample results used were from the stock pile area material or the soil samples collected from the Borrow Area.

Response: *The text has been revised.*

93. Section 9.1, page 9-2, BRC indicates that the COPC 95% UCL concentrations are used. This differs from the derivation of the exposure point concentrations where, in some cases, the maximum values was used. Please explain.

Response: *The text has been revised to refer to exposure point concentrations.*

94. Section 9.3, page 9-4, 3rd paragraph, BRC states "Also, according to the VLEACH manual (Figure 8-14), soil porosity is not a sensitive parameter with regards to groundwater impact prediction. For this evaluation, site-specific values of porosity were used in the VLEACH modeling." This is a detail and likely does not impact the outcome, but for a sensitivity analysis to be valid the range of values in the sensitivity analysis must encompass the range of measured field values; otherwise the comparison is invalid. The VLEACH manual analyzed model sensitivity for a range of values from 35% to 45%. The site specific vales from Table G-3 ranged from 24% to 37%. There appears to be a small overlap in values between the ranges but average values for the two data sets are not comparable. If BRC intends to make a reference in regards to porosity then they should perform a sensitivity analysis with site specific data.

Response: *Although the range site specific porosity (24% to 37%) is outside the range of porosity (35% to 45%) included in the sensitivity analysis presented in the VLEACH manual, the point is that porosity is not a sensitive parameter for the model. In addition, use of site-specific values of porosity should add to the applicability of the VLEACH modeling for the site.*

95. Section 9.3, page 9-4, penultimate bullet on page, BRC states "Inadequate and/or inconsistent field sampling data…" Please explain (expand upon) this comment, *e.g.*, why is the data inadequate and how is the data inconsistent?

Response: *This sentence has been revised.*

96. Figure 3, location 3 does not appear to coincide with the criteria outlined by the NDEP for use of the borrow materials. If the borrow materials were used to cap the CAMU they would be exposed to the ambient air and would be subjected to exposure to rainfall (leaching) as well as windblown dispersion. This is not acceptable unless BRC can provide additional clarification and justification.

Response: *Materials will not be used to cap the CAMU.*

97. Table 1, third comment under field sampling states "Field equipment blank and soil duplicate samples were collected during all field sampling activities as specified in the QAPP. QC sample results were within the acceptable range specified in the QAPP, and further QC samples did not result in data that was rejected as unusable." Page 3-8, Section 3.2.6.2 states that there were a handful of field duplicate samples with RPDs greater than 50%. Some clarification is needed.

Response: *Table 1 has been revised.*

98. Table 1, page 1, second comment under analytical techniques states, "Yes, in general the soils analyses met the detection limits required for risk assessment purposes." There are several analytes (Sb, Be, Tl) for which the maximum value is a non-detect.

Response: *Detection limits were reviewed and compared to USEPA Region IX PRGs and were not found to be an issue.*

99. Table 1, page 1, third comment under analytical techniques does not address the activity and is identical to the first comment under analytical techniques.

Response: *The statement has been revised to better answer the question.*

100. Table 1. Items under Data Quality Objectives have nothing to do with DQOs. These are Data Quality Indicators, as defined by EPA. Please rename table section.

Response: *The table section has been revised.*

101. Table 1, first and second items under DQOs. Use of the highest of 2 split samples is not recommended by EPA. Other options include, averaging and using the first sample, since the second one was for QC purposes only. Note also that in Chapter 3, these samples are referred to as field duplicates. Some clarification is needed, perhaps with some explanation of how split samples were collected.

Response: *The duplicates were incorrectly identified as splits, but they were not analyzed by a separate laboratory. The data selection process has been revised to: (a) select the primary sample result unless it has been rejected; and (b) then select the duplicate sample unless it has been rejected. The statement in Table 1 has been revised.*

102. Table 1. Comparability should be considered for the background data as well.

Response: *Table 1 has been revised to include comparability of background data.*

103. Table 1, page 2, fourth activity states, "Were the DQOs specified in the QAPP satisfied?" The response presented is "Yes, DQIs for soils (equipment rinseate blanks, split sample results) were adequate for use in the risk assessment." This does not address the activity.

Response: *This response has been revised.*

104. Table 1, last item. What does it mean that "detection limits were raised"?

Response: *This response has been revised to provide more detail on the reporting limits used for blank qualified data.*

105. Table 3. A more comprehensive set of summary statistics (e.g. 1st quantile, mean, median, 3rd quantile) should be presented. Additionally, the presentation of summary statistics for each analyte should be partitioned by detection status. These summary statistics are provided in Table 5, but it would be more helpful if the summary statistics were presented separately, and both for site and background data.

Response: *These summary statistics have been provided in the revised risk assessment.*

106. Table 3. There appears to be an issue with the presentation of significant figures for the max detects. For example, for cadmium, the minimum detect is presented as 0.034 and the maximum detect is presented as 0.

Response: *The table has been corrected.*

107. Table 3. Decisions regarding COPC selection need to be made on a per analyte basis using the weight of evidence approach outlined in the workplan. There are a number of issues. The primary one is that statistical test results have been applied to decision making with limited thought. For example, the statistical test results have been used for hexavalent chromium, but there are no detects in the background data and only 2 detects in the site data. We agree that hexavalent chromium should be carried into the risk assessment, but not for reasons of background comparison tests that have been performed. The t-test and Wilcoxon test that have been run for hexavalent chromium make no sense given the data. This is one of many examples of questionable results. Others include (but are not limited to), all slippage test results that have p-values of 1, beryllium, mercury, platinum, thallium, titanium, tungsten, bismuth-210. Summary statistics are reported as 0, when that is not possible, Slippage test results are given as a p-value of 1, when what that actually means is that the highest concentration data point is in the background data set. The problem with this is that for several chemicals this is confounded by the highest value being a non-detect, in which case the test itself should not be run. The Bismuth-210 issue is one of decay and ingrowth relationships. How is it possible that Bismuth-210 is greater than background, but Bismuth-214 is not? This comes down to the quality of the data again. Bismuth-214 has better data, the two isotopes are in equilibrium, in which case, Bismuth-210 is probably also at a background. Again, the issue is apparent blind reliance on statistical tests instead of

interpretation and understanding of what the data have to say. In addition to these problems, which stem from a lack of thought being given to the data and the statistical methods/results, some t-test results have p-values close to 1, implying that the site data are less than background. Some consideration should be given to why this is happening, and why (data comparability issues perhaps), the geology or analytical methods (or other reason) has occurred. Finally, it is not clear why the Wilcoxon results come with test statistic, p-value and a determination of LT or GT, when the same level of detail is not provided for the t-test or the other tests. A significant amount of work is needed on this table and on interpretation of the results.

Response: *Additional interpretation of the results has been conducted to ensure that constituents at background concentrations are not unnecessarily selected as COPCs. Rationale has been provided for the interpretation of results to ensure transparency and consistency of the background comparisons.*

108. Table 4, the application of the rationale codes seem unusual in places. For example, As is carried forward because it is detected in greater than 5% of the samples. Presumably it is because the concentrations are greater than background. More generally, the rationale codes should be revisited to make sure that appropriate ones are chosen.

Response: *The application of rationale codes has been reviewed and corrected. In addition, rationale code has been added to indicate when concentrations were found to be greater than background.*

109. Table 4 page 1 states that numerous dioxins and furan congeners were not carried forward and the rationale given (12) is that "The maximum TCDD Equivalents were less than the screening level of 50 ppt." However, since TCDD is a class A carcinogen, this is in contradiction to the first full sentence of page 5-4, which states, "Thus, Class A carcinogens (*e.g.*,benzene) were retained as COPCs."

Response: *Dioxins/furans have been included as COPCs.*

110. Table 4, page 9, rationale 11 and 12. The text "TCCD" should be changed to "TCDD"

Response: *The text has been changed.*

111. Table 5, the NDEP has the following comments:
    a. It appears that the footnote "Maximum detected concentration is used as exposure point concentration." is missing the footnote number in the notes field and throughout the table.

Response: *The table has been corrected.*

b. Again, some of the numbers in this table do not make sense. There are average concentrations given as 0. Sometimes the 95% UCL is the same as the average. Some explanation is needed, since the UCL should be greater than the average.

Response: *The table has been corrected. The formatting changes demonstrate that the 95 percent UCLs are indeed greater than the average.*

c. Radium-228 is not included in the results pages. Was radium-228 not part of the analysis suites?

Response: *Radium-228 was not selected as a COPC and therefore does not appear in this table.*

d. One of the footnotes says that NA means that the statistic was not evaluated because the number of samples was less than 2. However, NA was used for Cyclic octaatomic sulfur, which was detected 3 times.

Response: *The footnotes have been revised to indicate that distributional statistics are not evaluated when there are three or less results.*

112. Table 6 does not report exposure point concentrations for radionuclides. It is not clear why they are omitted from this table.

Response: *Exposure point concentrations have been added for radionuclides.*

113. Tables 7-9. Exposure Time needs to be included in all of these tables for the asbestos risk assessment.

Response: *The table has been modified to clarify that exposure times provided for radionuclides apply to asbestos as well.*

114. Table 19. This table is not sufficiently explanatory, since the URF is not described elsewhere in the text or in this table.

Response: *The table has been modified to provide an explanation of the URF.*

115. Table 21. Why are background results for other chemicals not also presented? They are included in Appendix F.

Response: *Background risks for metals have been added to the table.*

116. Table 22, the NDEP has the following comments:

a. This table should include USEPA Region IX PRGs for tap water for compounds that do not have an MCL.

Response: *The table has been modified as suggested.*

b. Footnotes should be included to explain the appropriateness of the MCLs presented. For example, BRC presents the MCL for total trihalomethanes for chloroform. This is not conservative.

Response: *As appropriate rationale has been provided for presentation of MCLs. For example, chloroform is the only trihalomethane evaluated and as such would also represent the total trihalomethanes of the evaluation.*

117. Appendices, review of spreadsheets,

a. General comment, the spreadsheets have some hidden rows. Obviously these can be opened. However, because the calculations are not always obvious, it is frustrating to find hidden rows that support the calculations. Presumably this was done to simplify printing to the Appendix tables, but it would have been more helpful if the rows had not been hidden in the supplied spreadsheets or if notes had been provided to the NDEP to explain this methodology.

Response: *Hidden rows have been removed from spreadsheets provided for review.*

b. In general, the calculations appear to have been carried out properly with appropriate unit conversions. The use of cell references to spreadsheets (and worksheets therein) that are not archived in the repository, nor have they "traveled" with the reviewed spreadsheets, is a chronic problem with the spreadsheets reviewed. Due to this lack, the review of calculations was unavoidably incomplete. The lack of well-considered names for worksheets and the lack of extensive annotation and/or documentation made the review of the spreadsheets unnecessarily arduous. Thought and consideration of reviews and documentation of calculations and source materials is paramount for a lasting affirmation of valid risk-based conclusions derived from spreadsheet (or other) calculations. Consistent and up-front notation of spreadsheets (and worksheets) that must "travel" together to maintain the linked integrity of the calculations from one worksheet or spreadsheet to another is necessitated.

Response: *Link integrity will be maintained in the worksheets provided for review.*

c. The main issues are transparency and lack of traceability through the spreadsheets because of broken links (sometimes to spreadsheets that appear to be misnamed, and sometimes to spreadsheets that were not provided with the submittal). No risk assessment equations are presented for radionuclides and very little annotation is provided. In addition, the main text is very brief, and does also not

contain a lot of description or explanation of the radionuclide risk calculations. It becomes incumbent upon the reviewer to work through the spreadsheets with little supporting information, which makes the review more onerous, costly, and time consuming than necessary.

Response: *Comment noted. BRC will strive to maintain clarity and transparency in all subsequent risk assessment deliverables.*

d. Please note that it is not imperative (however it would be helpful) to address many of the comments below, however, the NDEP has provided these comments to demonstrate to BRC what is expected in future deliverables.

Response: *Comment noted. BRC will strive to maintain clarity and transparency in all subsequent risk assessment deliverables.*

e. Specific comments on Worksheet "CW_Chem Calculations_Bkg"
   i. Comments 18, 19, and 20 are in reference to the first two tables in the worksheet. Comments 22, 23 and 23 are in reference to the third table in the worksheet. As for the fourth table in the worksheet, there is no comment.
   ii. Columns C and F refer to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 10" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   iii. Columns D and E refer to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 7" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   iv. Column G refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 11" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   v. Columns E and F refer to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 7" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   vi. Column G refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Appendix E Calculations.xls]Table E-10" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

vii. Column H refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Appendix E Calculations.xls]Table E-11" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

f. Specific comments on Worksheet "MW_Chem Calculations_Bkg"
   i. Comments 24, 25, and 26 are in reference to the first two tables in the worksheet. Comments 27, 28 and 29 are in reference to the third table in the worksheet. As for the fourth table in the worksheet, there is no comment.
   ii. Columns C and F refer to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 10" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   iii. Columns D and E refer to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 8" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   iv. Column G refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 11" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   v. Columns E and F refer to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 8" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   vi. Column G refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 10" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   vii. Column H refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 11" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

g. Specific comments on Worksheet "TP_Chem Calculations_Bkg"
   i. Comments 31, 32, and 33 are in reference to the first two tables in the worksheet. Comments 34, 35, and 36 are in reference to the third table in the worksheet. As for the fourth table in the worksheet, there is no comment.

ii. Columns C and F refer to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 10" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

iii. Columns D and E refer to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 9" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

iv. Column G refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 11" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

v. Columns E and F refer to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 9" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

vi. Column G refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 10" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

vii. Column H refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 11" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

h. Specific comments on Worksheet "CW_Rad_Bkg"

i. The following comments apply to all tables on the worksheet.

ii. Column C refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Decay Constants" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

iii. Column D refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 7" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

iv. Column E refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 12"

but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

i. Specific comments on Worksheet "MW_Rad_Bkg"
   i. The following comments apply to all tables on the worksheet.
   ii. Column C refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Decay Constants" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   iii. Column D refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 8" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   iv. Column E refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 12" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

j. Specific comments on Worksheet "TP_Rad_Bkg"
   i. The following comments apply to all tables on the worksheet.
   ii. Column C refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Decay Constants" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   iii. Column D refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 9" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
   iv. Column E refers to a spreadsheet and worksheet therein, in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\[Borrow Area Risk Calculation_3.xls]Table 12" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.

k. Specific comments on Worksheet "Table 2"
   i. Non-descriptive worksheet name; perhaps "Chemicals and CAS#s."

l. Specific comments on Worksheet "Table 3"
   i. This table is identical to "D-1 Summary" in "Appendix D Calculations.xls." Relevant comments are identical to Comments #1 through #7, and pertain directly to the "Appendix D Calculations.xls" spreadsheet.
   ii. Non-descriptive worksheet name; perhaps "Site v. Bkgd Comparison."

m. Specific comments on Worksheet "Table 4 COPC Selection"

i. Columns C, D, F, and G refer to a spreadsheet and worksheet therein, in the path "C:\ToxRiskProjects\BMI-Henderson\Borrow Area\2006 Borrow Area Risk Calculations\Data\20061206_Update\[Risk Data Summary Stats_20061208.xls]Risk_Data_Summary_Stats" but is missing from the repository. The spreadsheet requires addition in full to the repository.

n. Specific comments on Worksheet "Table 5_EPCs"
   i. Columns F and G refer to a spreadsheet and worksheet therein, in the path "C:\ToxRiskProjects\BMI-Henderson\Borrow Area\2006 Borrow Area Risk Calculations\Data\20061206_Update\[Risk Data Summary Stats_20061208.xls]Risk_Data_Summary_Stats" but is missing from the repository. The spreadsheet requires addition in full to the repository.
   ii. Columns J, M, N, and O refer to a spreadsheet and worksheet therein, in the path "C:\ToxRiskProjects\BMI-Henderson\Borrow Area\2006 Borrow Area Risk Calculations\Data\20061206_Update\ProUCL_Output\[ProUCL_Summary.xls]Sheet2" but is missing from the repository. The spreadsheet requires addition in full to the repository.
   iii. Columns K and L are hidden and contain no information – delete.
o. Specific comments on Worksheet "Table 7"
   i. Non-descriptive worksheet name; perhaps "CW Exposure Factors."
   ii. Requires more descriptive annotation.
p. Specific comments on Worksheet "Table 8"
   i. Non-descriptive worksheet name; perhaps "MW Exposure Factors."
   ii. Requires more descriptive annotation.
q. Specific comments on Worksheet "Table 9"
   i. Non-descriptive worksheet name; perhaps "TP Exposure Factors."
   ii. Requires more descriptive annotation.
r. Specific comments on Worksheet "Table 10"
   i. Columns E, H, L, O, and P are obscured or hidden, and each are blank – remove.
   ii. Non-descriptive worksheet name; perhaps "Exposure Thresholds."
   iii. Requires more descriptive annotation.
s. Specific comments on Worksheet "Table 11"
   i. Columns E is hidden and blank – remove.
   ii. Column K is the factor "K_p^b" and is hidden – unhide.
   iii. Non-descriptive worksheet name; perhaps "Exposure Thresholds."
   iv. Requires more descriptive annotation.
t. Specific comments on Worksheet "Table 12"
   i. Non-descriptive worksheet name; perhaps "Rad PRGs."
   ii. Requires more descriptive annotation.
u. Specific comments on Worksheet "Table 13 ChemSummary_CW"
   i. Poorly descriptive worksheet name; perhaps "Table 13 Chem Increm Risk Sum_CW."
   ii. Requires more descriptive annotation.
v. Specific comments on Worksheet "Table 14 ChemSummary_MW"

i. Poorly descriptive worksheet name; perhaps "Table 14 Chem Increm Risk Sum_CW."
ii. Requires more descriptive annotation.

w. Specific comments on Worksheet "Table 15 ChemSummary_TP"
i. Poorly descriptive worksheet name; perhaps "Table 15 Chem Increm Risk Sum_MW."
ii. Requires more descriptive annotation.

x. Specific comments on Worksheet "Table 16 RadSummary_CW"
i. Poorly descriptive worksheet name; perhaps "Table 16 Rad Increm Risk Sum_CW."
ii. Requires more descriptive annotation.

y. Specific comments on Worksheet "Table 17 RadSummary_MW"
i. Poorly descriptive worksheet name; perhaps "Table 17 Rad Increm Risk Sum_MW."
ii. Requires more descriptive annotation.

z. Specific comments on Worksheet "Table 18 ChemSummary_TP"
i. Poorly descriptive worksheet name; perhaps "Table 18 Rad Increm Risk Sum_TP."
ii. Requires more descriptive annotation.

aa. Specific comments on Worksheet "Table19 Asbestos risk summary"
i. Requires more descriptive annotation.

bb. Specific comments on Worksheet "Table 21 Risk Summary"
i. The Chemical HI and ILCR and Radiation ILCR are totals, and should be noted as such in the table.
ii. Requires more descriptive annotation.

cc. Specific comments on Worksheet "CW_Chem Calculations"
i. Poorly descriptive worksheet name; perhaps "CW_Chem Exposure Calcs."

dd. Specific comments on Worksheet "MW_Chem Calculations"
i. Poorly descriptive worksheet name; perhaps "MW_Chem Exposure Calcs.

ee. Specific comments on Worksheet "TP_Chem Calculations"
i. Poorly descriptive worksheet name; perhaps "TP_Chem Exposure Calcs."

ff. Specific comments on Worksheet "Decay Constants"
i. Requires appropriate references for values.

gg. Specific comments on Worksheet "CW_Rad"
i. Poorly descriptive worksheet name; perhaps "CW_Rad Exposure Calcs."

hh. Specific comments on Worksheet "MW_Rad"
i. Poorly descriptive worksheet name; perhaps "MW_Rad Exposure Calcs."

ii. Specific comments on Worksheet "TP_Rad"
i. Poorly descriptive worksheet name; perhaps "TP_Rad Exposure Calcs."

Response: *Link integrity will be maintained in the worksheets provided for review. Hidden rows and columns have been removed and annotation added as necessary. Worksheet names will be revised in subsequent risk assessments.*

118. Appendix C, the NDEP has the following comments:

a. Page C3-4, it is not clear why the maintenance worker results were used in the data adequacy evaluation. Some clarification is needed.

Response: *Discussion clarifying this evaluation has been added to the report.*

b. Table C-4, arsenic data, the 3 data points associated with blank contamination for arsenic need to be revisited based on the latest data usability tables that have been prepared. Similar comments, regarding data usability, might apply to other chemicals.

Response: *Data usability tables, as approved by NDEP have been added to the revised report.*

c. Attachment C-3, since the probabilistic approach was not undertaken here, it is not clear that it needs to be mentioned at all.

Response: *This discussion has been removed from the report.*

119. Appendix D, the NDEP has the following comments:

a. General comment, the plots use the detection limits directly it seems, and non-detects are not differentiated from detected values. For several chemicals, to understand differences between plots and statistical test results, it would be much more helpful if different symbols were used for detects and non-detects, and it would be much more helpful if the statistical results were interpreted with these plots in mind. For example, several of the Slippage test results are impacted because the highest values are non-detects, and because the highest detected results are in the background data set.

Response: *The plots have been revised to be consistent with the statistical tests results. Further review of the background comparisons have been provided.*

b. Table D-1 seems to be a copy of Table 3 and is unnecessary if it is a duplicate.

Response: *Comment noted. Table D-1 (now Table E-1) has been retained to provide a summary of the Appendix D (now E) results within Appendix D (now E).*

120. Appendix D, comments on the live spreadsheets as follows:

a. Specific Comments on the Appendix D Calculations.xls – Worksheet "D-1 Summary"

i. Columns B, C, E, and F refer to an internal worksheet entitled "Data_Summ," which is not in the spreadsheet. This issue and many other identical to it (each of which are commented on below) appears to be due to a spreadsheet alteration (deletion of the worksheet). This form of problem does not allow for proper verification of calculations and causes

object errors in the initiation of the spreadsheet when opening. A restored spreadsheet is required.

ii. Columns G, H, J, and K refer to an external spreadsheet in the path and with the title "C:\ToxRiskProjects\BMI-Henderson\Borrow Area\2006 Borrow Area Risk Calculations\Data\20061206_Update\[Risk Data Summary Stats_20061208.xls]" and to the worksheet entitled "Risk_Data_Summary_Stats." The path is incorrect, as it is workstation-specific, and the spreadsheet "Risk Data Summary Stats_20061208.xls" is not included in the submittal. This spreadsheet, with all internal worksheets, is required for adequate verification of calculations and to avoid difficulties with object errors. The latter issue likely requires that the worksheet be added to "Appendix D Calculations.xls" in order to avoid problems associated with workstation-specific path references.

iii. Column L refers to an internal worksheet entitled "t test," which is not in the spreadsheet.

iv. Column N refers to an internal worksheet entitled "Quantile," which is not in the spreadsheet.

v. Column L refers to an internal worksheet entitled "Slippage," which is not in the spreadsheet.

vi. Columns R and S refer to an internal worksheet entitled "WRS," which is not in the spreadsheet.

vii. These lookups are not absolutely critical because the worksheets contain the end point of the lookups, but it makes traceability difficult to impossible.

viii. Columns O, Q, T, and V are hidden. These columns indicate intermediate values or results. While it's reasonable that these columns are hidden, some annotation to the effect of their function would aid the NDEP in understanding the full functionality of the worksheet. Indeed, the worksheet and spreadsheet in general suffer from a general lack of annotation that would help explain the calculational or determinative process.

Response: *Link integrity will be maintained in the worksheets provided for review. Hidden rows and columns have been removed and annotation added as necessary.*

b. Specific Comments on the Appendix D Calculations.xls – Worksheet "D-2 Quantile_BorrowvsBkg"

i. Column A is hidden and has no evident utility.

ii. The spreadsheet is propagated with values only and the contents of cells does not refer to calculations performed elsewhere. This is problematic for review. At the very least, annotation should be provided to direct a reviewer or reader to the spreadsheet or database in/from which calculations were made.

Response: *Format changes and annotation have been added as necessary.*

c. Specific Comments on the Appendix D Calculations.xls – Worksheet "D-3 Slippage_BorrowvsBkg"
    i. Columns D through K refer to an internal worksheet entitled "Slippage," which is missing from the spreadsheet.
    ii. Column H: entitled "NDs Greater than the Sample 1 Max Detect," is a good example of material requiring annotation/explanation.

Response: *Link integrity will be maintained in the worksheets provided for review. Explanatory annotation has been added as necessary.*

d. Specific Comments on the Appendix D Calculations.xls – Worksheet "D-4 WRS_BorrowVsBkg"
    i. Columns D through L refer to an internal worksheet entitled "Slippage," which is missing from the spreadsheet.

Response: *Link integrity will be maintained in the worksheets provided for review.*

e. Specific Comments on the Appendix D Calculations.xls – Worksheet "D-5 ttest_BorrowVsBkg"
    i. Columns D through L refer to an internal worksheet entitled "Slippage," which is missing from the spreadsheet.

Response: *Link integrity will be maintained in the worksheets provided for review.*

121. Appendix E – PEF/VF calculations:
    a. General comment, entrainment of dust from wind and the construction activities of excavating, dozing, grading, and tilling are considered pertinent to, and their contributions are incorporated into, the calculation of total ambient air dust concentration, as are time-averaged emissions and fractions of PM_{10} dispersion. These calculations are performed in the Appendix E spreadsheet. Some more annotation to connect the spreadsheets would be helpful. Also, the dust calculations for the construction worker are very involved, but again are not annotated well in either the spreadsheets or the main report.

Response: *Explanatory annotation has been added as recommended.*

b. Table E-1 contains values, for example, for wet soil bulk density, percent moisture in soil, percent weight of silt in soil. The references cited for these values are footnoted in the table as "Based on data from vicinity investigations (from data collected by GES 2006)…" and "Average of site data from BRC (2006) dataset." The NDEP is not able to verify these values given the apparent confusion over sample labeling; the lack of the summary tables requested below under the NDEP's comments for Appendix G; and very non-specific references to

Table E-1. A revised Table E-1 must reference one of the three tables requested above.

Response: *References have been revised as requested.*

c. Please correct typos in Table E-1 footnote #6. Please change 0.035 to 0.35 and Um/2 to Um/2.2 per USEPA guidance (2002d) page E-23.

Response: *The table has been revised accordingly.*

d. Table E-2, please add to footnote #3 that the USEPA 2002 reference is USEPA 2002d.

Response: *The table has been revised accordingly.*

e. Table E-4 likewise does not reference the source of the data.

Response: *The table has been revised accordingly.*

122. Appendix F, the NDEP has the following comments:

a. This appendix is confusing initially because it contains asbestos risk calculations and background risk. It is not clear why these very different sets of analyses were paired in the same Appendix.

Response: *These risk calculations have been separated into Appendices G and H.*

b. The calculations in the Appendix F asbestos spreadsheet appear to be carried out correctly. However, the purpose of the table and the ensuing calculations are not annotated, which causes the NDEP some difficulty when assessing the intent or inclusiveness of the calculations. The same basic comments apply to the Appendix E spreadsheet and the links between the spreadsheets. In general the spreadsheets suffer from a lack of documentation, traceability and transparency.

Response: *Explanatory annotation has been added as necessary.*

123. Appendix F, live worksheets provided on CD, the NDEP has the following comments:

a. General comment, the worksheets for this Appendix should have been linked to the spreadsheets developed for Appendix E. This would increase transparency, traceability and would shorten review times. To explain further, the spreadsheets are difficult to follow because the inputs used are entered as numbers instead of references (algebra), meaning the NDEP has to recognize the inputs for what they are and then track them back to a source somewhere else in the document (which

is not defined). It would be far easier to track the calculations if the front page of the asbestos spreadsheet contained a list of all the input parameters and their values. We have made this comment previously on other asbestos risk assessments. In addition, the presentation could be simplified and annotated to make the review easier. The NDEP has spent a considerable amount of time trying to understand what has been done; the review would be streamlined if the BRC provided more explanation, annotation and information. We take the position that the document should be reasonably easy to follow for any potential reader. Currently, it does not achieve this goal.

Response: *Link integrity will be maintained in the worksheets provided for review. Explanatory annotation has been added as necessary.*

b. In Worksheet F-1 the dimensions of interest are not listed. That is, fibers that are at least 10 um long and at most 0.4 um wide are of concern (defined as long fibers following the 2003 EPA draft final guidance). The only dimension listed at the top of the columns is the length, presumably. The measurements provided for the detects show a smaller value first and a longer one second, suggesting that they are presented as width x length, although no indication of this is given. With this interpretation it would also seem that the one amphibole detect should be considered a long fiber. Its length seems to be greater than 10 um (63.52 um) and its width seems to be less than 0.4 um (0.22 um). It is not clear why this is not included as a detected long fiber in the remainder of the asbestos risk assessment. In the hidden rows it seems that this is used as a short fiber, rather than a long fiber. Some explanation is needed.

Response: *There was a typographical error regarding the length of the fiber presented on Worksheet F-1. The laboratory report states that the amphibole structure is 0.22 µm x 6.52 µm. Worksheet F-1 (now G-1) has been corrected. Therefore, there were no long fibers of amphibole detected.*

c. The analytical sensitivity *(AS)* of the TEM (transmission electron microscopy) test is provided for each of 22 samples of filtered dust. The pooled *AS* is calculated as the reciprocal of the summed reciprocals of the individual sample *AS*. The *AS* calculation is basically correct, however, it is not clear why only 22 sample results have been included. There are 24 sample results in total. One of the two that have not been included in the *AS* calculation contains the only detection of an amphibole fiber. But, this sample result is not included in the *AS* calculation. Perhaps its exclusion is because it is a 2nd run of a sample, but if that is the case, it is not clear why the one duplicate result is included. At the very least some explanation is required. This could be explained, for example, in Chapter 3 on Data Validation, but there is very little relevant information in that Chapter regarding QA/QC for the asbestos analysis. There is also no explanation in the spreadsheets.

Response: *The AS was calculated based on the total number of individual samples, 22, analyzed for TEM asbestos tests. The excluded results are because those results were the 2nd run of a sample. In both cases, the first run identified a Chrysotile fibers and the second run was conducted to identify amphibole fibers. The duplicate sample result for "BEC-01-Sa(Dup)" is included because the primary analysis, "BEC-01-Sa", for that sample is not included due to blank contamination. Explanatory annotation has been added as necessary.*

d. There appears to be an error in Worksheet F-1 in rows 43-45, which are initially hidden. The error does not appear to affect the overall risk calculation results. The rows in question read as follows:

22 samples	**Long**	**short**	**TOTAL**
4 Chrysotile fibers short	3	1	4
0 Amphibole fibers short	0	1	1

The error appears in the leftmost column of this table. A corrected table would appear as:

Of 22 samples for:	**Long**	**short**	**TOTAL**
Chrysotile fibers	3	1	4
Amphibole fibers	0	1	1

That is, the text table entries are incorrect (because of the inclusion of the word “short”), and the total associated with the text (on the left hand side) is incorrect for amphibole.

Response: *The table has been corrected.*

e. Columns F and G also contain minor errors, this time with the potential to change the risk results, but not the conclusions (the error is minor, but should be fixed). In rows 22 and 28 the concentration has been rounded to 1 decimal place. But, this has not also occurred in rows 10 and 12. This inconsistency should be rectified.

Response: *The table has been corrected.*

f. We note also that none of the samples observed more than 1 asbestos fiber. We assume this is a correct interpretation.

Response: *Correct.*

g. It would help if the dust factors and equations were better presented and explained, and if the reason for the difference was explained. The dust factor is similar to the one used for the TRECO risk assessment (0.00134 ug/cm^3), but it would be helpful to understand the derivation of this number.

Response: *The table has been corrected.*

h. Only the number of observations of long fibers of each mineral are carried through subsequent calculations. This concentration using long fibers is in accordance with EPA (2003)[1]. It might be better to make this more obvious in Worksheet F-1, and hence not perform any calculations even at this stage on total or short fibers. This comment applies to Worksheet F-2 as well.

Response: *The table has been corrected.*

i. The soil concentration of long fibers is calculated in this worksheet utilizing the relationship of the *AS* to the number of total and long structures observed in the sample. Only the relationship of long structures is relevant to subsequent calculations. In the table presented in Tab F-2, Column E presents the "Best Estimate Concentrations Total" for observed structures (fibers) from the pooled samples. This column appears to be in error, as it only calculates what is found in the next column, Column F, which is the "Best Estimate Concentrations Long" structures. If Column E were to be correctly calculated, it would multiply Tab F-1 cell H44 and H45 (for Chrysotile and Amphibole, respectively) by Tab F-2 cell D10 and D11, respectively, for the correct result. However, since this is an unnecessary calculation, this column should be eliminated from the table, as it only adds confusion. This also raises the issue again of transparency. Column F results derive from results on this Worksheet, whereas Column E results point back to Worksheet F-1. There is no apparent reason to perform the calculation in this manner, and it just obfuscates the process.

Response: *The table has been corrected.*

j. The second calculation made in the Tab F-2 worksheet is the 95% UCL (upper confidence limit) of the Poisson distribution for the observation of events (observation of structures from the sub-sample observations made on the TEM of filter surfaces). The use of the inverse Chi-square calculation is applied correctly for the proper calculation of this quantity, but it is not explained anywhere in the document. This is a somewhat obscure use of the Chi-square distribution that should be explained somewhere in the presentation.

Response: *Explanatory annotation has been added as necessary.*

[1] EPA (United States Environmental Protection Agency). 2003. *Final Draft: Technical Support Documentation for a Protocol to Assess Asbestos-Related Risk.* Office of Solid Waste and Emergency Response. EPA # 9345.4-06. Washington, DC. October, 2003.

k. Calculation of the airborne dust concentrations of the two target minerals (chrysotile and amphibole) is performed in worksheet labeled "Tab F-3" for both of the Worker and the Trespasser scenarios. The airborne dust concentration is calculated from the product of the estimated bulk concentrations (10^6 s/g, PM_{10}, where s=structures) of each of the target minerals in soil, and the estimated dust levels ($\mu g/cm^3$). The cancellation of units for the final product, measured in s/cm^3, is not clear in the calculations, but appear to be mathematically correct. Limited attending annotations are found in the worksheet. Note also that the dust level is calculated in this worksheet for these scenarios, but not for the construction scenario, which, instead, is referenced to the Appendix E Calculations spreadsheet. It would be more consistent for them to behave the same way, and this would make review easier.

Response: *Explanatory annotation has been added as necessary.*

l. The calculations of "Estimated Dust Levels" for the Construction worker scenario are carried out in a separate spreadsheet (Appendix E Calculations.xls). It would be more helpful if these calculations were repeated in the "Appendix F Asbestos Calculations.xls" spreadsheet, even if they are carried out on another worksheet therein. Annotations (as mentioned) should be applied to the dust level calculations for the Construction Worker.

Response: *Explanatory annotation has been added as necessary.*

m. As a note, the terms "Best Estimate" and "Upper Bound" are different than those used in standard risk assessment. The terms come from the Asbestos Risk draft final guidance, but perhaps it would be helpful somewhere in the document to associate these terms with Central Tendency Estimate and Reasonable Maximum Estimate that are used in risk assessment more generally.

Response: *The table has been corrected accordingly.*

n. In worksheet F-4 the calculations are again performed correctly, but with very little annotation. Asbestos risk assessments are performed differently than other risk assessments, and the differences warrant some annotation. For example, the asbestos risk guidance Table 8.2 title is "Estimated Additional Deaths from Lung Cancer or Mesothelioma per 100,000 Persons from Constant Lifetime Exposure to 0.0001 TEM f/cc Longer than 10 um and Thinner than 0.4 um…". That is, this is not an excess cancers per lifetime risk, it is a risk of death from cancer calculation. The URF also warrants some explanation and reference to Equation 8.1 in the EPA 2003 guidance. Some explanation of the distinction between short and long fibers would be appropriate as well, especially since the only detect of amphibole is a short fiber.

Response: *Explanatory annotation has been added as necessary.*

o. In addition, there is no attending explanation for the use of 250 days and 8 hours, or 225 days and 8 hours, or 50 days and 4 hours, for the *EF* of the three risk scenarios. An explanation is needed, especially since the chemical risk assessment does not include similar Exposure Time factors. These factors require explanation, and inclusion in the Appendix E spreadsheet tables and in Tables 7-9 of the main text.

Response: *Explanatory annotation has been added as necessary.*

p. Again, some annotation in Worksheet F-5 would be helpful to any reviewer or reader. In general the presentation is not sufficiently transparent. This makes traceability difficult, and hence makes the review difficult and overly time consuming.

Response: *Explanatory annotation has been added as necessary.*

q. Specific comments on "Appendix F Background Calculations.xls Worksheet "Table F-6 Data Eval Metals_Bkg"
    i. Columns B, C, E, and F refer to the a spreadsheet entitled "Borrow Area Risk Calculation_3.xls" and to a worksheet in that spreadsheet entitled "Table 3." The spreadsheet is missing from the directory.
    ii. Columns G, H, I, and J refer to a spreadsheet and worksheet therein, in the path "C:\ToxRiskProjects\BMI-Henderson\Borrow Area\2006 Borrow Area Risk Calculations\Data\20061206_Update\[Background_ProUCL_Summary_20061208.xls]Sheet2" This path, spreadsheet and worksheet were not provided with the submittal.

r. Specific comments on "Appendix F Background Calculations.xls Worksheet "Table F-7 Data Eval Rad_Bkg"
    i. Columns B, C, E, and F refer to the a spreadsheet entitled "Borrow Area Risk Calculation_3.xls" and to a worksheet in that spreadsheet entitled "Table 3." The spreadsheet is reportedly in the path "C:\Repository\NDEP\projects\Borrow Pit - CAMU\documents\BRC documents\Appendix B\" but is missing from the directory/repository. The spreadsheet requires addition in full to the repository.
    ii. Columns G, H, I, and J refer to a spreadsheet and worksheet therein, in the path "C:\ToxRiskProjects\BMI-Henderson\Borrow Area\2006 Borrow Area Risk Calculations\Data\20061206_Update\[Background_ProUCL_Summary_20061208.xls]Sheet2" This path, spreadsheet and worksheet are not found in the repository. The file requires addition in full to the repository.

Response: *Link integrity will be maintained in the worksheets provided for review.*

124. Appendix G, the NDEP has the following comments:
    a. All input to the VLEACH model runs must be traceable to the original data set. The following comments illustrate issues with data traceability and are based on the GES facsimile reproduced in Appendix G and dated 12/14/06:
        i. Pg 002/070: Table titled – BRC Stockpiles Moisture Content & Sieve Analysis. The samples are labeled "SS"; there are 12 samples.
        ii. Pp 004/070 through 013/070: shows calculations and results for samples numbered SS-1 through SS-8. Are the second set of samples identified as "SS" a subset of the samples identified on pg 002/070 with samples labeled "SS"? If they are not then there is inconsistent sample labeling.
        iii. Pg 017/070: Table without title; samples are labeled "SP" with six results listed (SP-1, SP-3, SP-5, SP-7, SP-9, and SP-11) and "SS" with eight results listed (SS-1, SS-2, SS-3, SS-4, SS-5, SS-6, SS-7, and SS-8).
        iv. Pg 023/070: Table without title; samples are labeled SP-1 through SP-12.

Response: *Further clarification of data has been provided.*

    b. It appears from the report that samples were collected at three locations: Stockpile Area; Borrow Pit Area, and User Sites. The NDEP requests three separate summary tables, one for each area sampled with a consistent sample numbering (labeling) system. Typically a FSP requires that a sample designation system be established (EPA, 1988). This sample designation system must be unique for each specific sample area and must be followed throughout the sampling program. The NDEP believes that not following the system is a data quality issue.

Response: *Further clarification of data has been provided.*

125. Appendix G, review of VLEACH calculations, the NDEP has the following comments and statements. Please note that many of the statements that are provided below are meant to provide insight into the NDEP's review and to explain the NDEP's understanding of what BRC is presenting. If any of these statements appear to be in error, please advise.
    a. Statement, based on our review of the VLEACH input files provided, it is our understanding that the "BRC Borrow 1 COC" and "BRC Borrow 2 COC Revised" project sets were used to simulate leaching from borrow area soils and, more specifically, to calculate pore water concentrations. It is also our understanding that these pore water concentrations were then used as input (via the recharge concentration input term) for the remaining project sets (*i.e.*, the 'Site' project sets). The maximum pore water concentrations from the "Site" simulations are then compared to MCLs (Table G-6) and, possibly, the input

recharge concentration (Table G-4). Please confirm that this is the correct assumption and elucidate this issue in the text.

Response: *The maximum leaching pore water concentration from Borrow Fill 1 and Borrow Fill 2 evaluations were used as the recharge concentration for each of the Site project sets. Only Site project sets 1, 4, and 5 were ultimately evaluated using site concentrations for the full set of COPCs that were included in the VLEACH evaluation.*

b. There are 34 chemicals of potential concern (COPCs) for Sites 1, 2, 4, and 5. There are 11 COPCs for Sites 6, 7, and 8. Please explain this difference.

Response: *An initial subset of 11 COPCs were evaluated for each Site project set as part of a sensitivity analysis. The results of the sensitivity analysis indicated that the evaluation of Sites 1, 4, and 5 provide the worst case analyses for the range of COPCs evaluated; metals, organochlorine pesticides, semi-volatile organic chemicals, and volatile organic chemicals. Therefore, the analyses at Sites 1, 4, and 5 of the full set of 34 COPCs evaluated were used.*

c. The only difference between the BRC Site 1, 2, 4, and 5 simulations are associated with the soil parameters (*i.e.*, dry bulk density, effective porosity, moisture, and fraction organic carbon) – all other inputs for these simulations are identical.

Response: *Correct. Also, it should be noted the based on the sensitivity analyses the full evaluation was not completed for Site 2 beyond the sensitivity analyses phase.*

d. Similarly, the only difference between the BRC Site 6, 7, and 8 simulations are associated with the soil parameters (*i.e.*, dry bulk density, effective porosity, moisture, and fraction organic carbon) – all other inputs for these simulations are identical.

Response: *Correct. Also, the evaluations of Site 6, 7, and 8 were not carried forward beyond the sensitivity analyses phase.*

e. In addition to the number of COPCs and the soil parameters, the BRC Site 1, 2, 4, and 5 simulations differ from the BRC Site 6, 7, and 8 simulations in that simulation times for the former are 100 years while for the latter, they are 30 years. Please explain this difference.

Response: *The sensitivity analysis conducted on the Sites was conducted for only 30 years. Based on the results of the sensitivity analysis, only the analyses at Sites 1, 4, and 5 were carried through for the full 100 year model run duration.*

f. A summary of selected input parameters for the simulations reviewed is included as Table 1 in Attachment C. The initial soil matrix concentrations were not confirmed in this review.

Response: *Comment noted.*

g. The bulk density, effective porosity, moisture content, and fraction organic carbon values listed in Table G-3 match those used in the simulations.

Response: *Comment noted.*

h. The recharge rate used in the simulations reviewed is 4 inches per year. This value would be conservative provided the area is not to be irrigated/landscaped (*i.e.*, additional water is not added to the site).

Response: *Comment noted. Appropriate discussion has been added to the Uncertainty Section.*

i. The use of recharge concentration for the 'Site' simulations is conservative in that it simulates a constant source as correctly noted on Table G-6, Footnote "a".

Response: *Comment noted.*

j. It is not clear which output terms from the "Borrow" simulations were used to establish the recharge concentrations that serve as input for the "Site" simulations. A table listing the output parameter and time (*e.g.*, "C_{liq} at 27 years") used to establish the recharge concentration for each simulation would be helpful. Similarly, it is not clear which "Borrow" simulations were used to establish the recharge concentrations that serve as input for the "Site" simulations.

Response: *The maximum leaching pore water concentration from Borrow Fill 1 and Borrow Fill 2 evaluations for each COPC were used as the recharge concentration for each of the Site project sets.*

k. If leaching to ground water is the primary concern, the upper boundary should be set as an impermeable boundary to provide a conservative analysis. If surface emissions are the primary concern, the lower boundary should be set as an impermeable boundary to provide a conservative analysis. (It is our understanding that the upper boundary of the "Site" simulations is not the atmosphere but rather the interface between the Borrow soils and the native soil at each site.)

Response: *Setting the upper boundary as an impermeable boundary would increase the conservatism of the analyses.*

l. The maximum simulation time for the "Borrow" simulations (used to generate recharge concentrations for the final ["Site"] simulations at Site 1, Site 2, Site 4, Site 5, Site 6, Site 7, and Site 8) were as follows:
    i. Borrow Area 1 – 30 years
    ii. Borrow Area 2 – 30 years

b. The maximum simulation time for the "Site" simulations were as follows:
    i. Site 1 – 100 years
    ii. Site 2 – 100 years
    iii. Site 4 – 100 years
    iv. Site 5 – 100 years
    v. Site 6 – 30 years
    vi. Site 7 – 30 years
    vii. Site 8 – 30 years.

Response: *Correct. As noted above only the results from Sites 1, 4, and 5 were used in the final assessment.*

b. The NDEP could not find 100-year "Site" simulations for Areas 6, 7, and 8.

Response: *The sensitivity analysis conducted on the Sites was conducted for 30 years. Based on the results of the sensitivity analysis, only the analyses at Sites 1, 4, and 5 used the full 100 year duration.*

c. It is not clear how the values listed in Table G-4 were calculated. Please explain.

Response: *The ratios were calculated by dividing each leaching pore water concentration for each analyte and scenario by the maximum leaching pore water concentration for each analyte amongst all the sensitivity analyses scenarios.*

d. The profile thickness of the native soil in the "Site" simulations for Sites 6, 7, and 8 is 5 feet. The profile thickness of the native soil in the "Site" simulations for Areas 1, 2, 4, 5 (revised) is 25 feet. The number of cells and respective cell thicknesses for these simulations suggest the simulated thickness is 5 feet so the profile thickness appears to be in error. Confirmation is requested to ensure that the simulated thickness is 5 feet (not 25 feet).

Response: *An initial thickness of 5 feet was evaluated for each Site project set as part of a sensitivity analysis. As noted the only analyses at Sites 1, 4, and 5 evaluated were used for the final evaluations. For the final analyses a thickness of 25 feet was used based on depth to groundwater.*

e. A spot-check of the chemical input parameters revealed that the product of the 'organic carbon partition coefficient' (Koc) and 'fraction organic carbon' (foc),

which is the soil-water partition coefficient (Kd), for arsenic in the BRC Borrow 1 COC simulation is calculated to be 31 ml/g (consistent with the value listed in Table G-2) whereas for the BRC Site 5 COC (revised) simulation it is calculated to be 159 ml/g. The Kd calculation appears to be correct for the Site 4 simulation suggesting that the Koc value was not decreased appropriately to compensate for the higher foc value at Site 5. While it is anticipated that this is primarily an issue for the metals because of the manner in which VLEACH is coded (VLEACH uses Koc values, which are not applicable to metals), the chemical parameters should be confirmed for all COPCs and all simulations. A table listing the adjusted "Koc values for metals" based on site-specific foc values is requested.

Response: *A table listing the adjusted "Koc values for metals" based on site-specific foc values has been provided.*

f. The recharge concentration for 1,2-DCB exceeds its solubility. If the value is correct, a model other than VLEACH capable of assessing free-phase liquid would be more appropriate.

Response: *The results of 1,2-DCB were not used.*

g. Any 'Project Sets' not listed above that were used in the risk assessment should be provided or identified. Similarly, it would be appreciated if extraneous and/or superseded files (*e.g.*, 'BRC Site 3 COC') be excluded in future submittals. To this end and in the interest of time, it would be appreciated if a flowchart, table, or figure be provided that lists the function of each file.

Response: *Comment noted.*

h. See also Excel Table in Attachment C.

Response: *Comment noted.*

Attachment A-2-2
Response to NDEP Supplemental VLEACH Comments Dated March 13, 2007 on the December 2006 BRC Human Health Risk Assessment Report – Borrow Area, Revision 0

This draft technical memorandum includes our comments based on our review of Excel files listing input and a summary printout (in Word) of VLEACH input parameters generated by Waterloo Hydrogeologic, Inc. (WHI) "UnSat Suite" modeling environment.

Scope of Review

The files reviewed are as follows:

- BRC VLEACH SOIL INPUTS.xls (user-generated Excel file containing five worksheets listing the parameters used by MWH as input to VLEACH); and
- WHI VLEACH Inputs-Borrow Soils 1.doc (model-generated Word file the reports the VLEACH parameter values input by the user).

No supporting text describing what was done is provided; therefore, this review is limited to checking that the values in the Excel file match those in the Word file.

Understanding of the Problem and Overview of Simulation

Based on our review of the files provided, it is our understanding that the Excel file contains soil input parameter values (*i.e.*, values for bulk density, effective porosity, volumetric water content, and fraction organic carbon) for:

- Two types of soil for the Borrow Area ("Type II" and "Reject Sand"); and
- Seven types of soil for the Placement Sites (Sites 1, 2, and 4 through 8).

Based on a comparison of the Excel and Word files, the only simulation performed was for the Borrow Area (VLEACH Project 'BRC Borrow 1'). That is, the soil input parameter values (bulk density, effective porosity, volumetric water content, and fraction organic carbon) reported in both files are 1.96 g/cm^3, 0.26 cm^3/cm^3, 0.053 cm^3/cm^3, and 0.0079, respectively. Specifically, it appears that this simulation was based on the Type II Borrow Area soils reported in the Excel file assuming 95% compaction. There are 34 chemicals of potential concern (COPCs) for the Type II soils in the Borrow Area.[1] Chemical parameters for these COPCs (K_{oc}, solubility, Henry's constant, and diffusion coefficient), as well as input concentrations, are also provided in the Excel file.

Other characteristics of the simulation are as follows:

[1] The COPCs are as follows: Arsenic, Chromium VI, DDT, ˜BHÇ ˜BHÇ ˜BHÇHCB, 123TCB, Benzene, Beryllium, Cadmium, Chromium, Iron, Mercury, Nickel, Selenium, Silver, Thallium, Vanadium, DDD, DDE, ˜BHÇDieldrin, Chlordane, Benzoic acid, MEK, Acetone, Carbon Disulfide, Chloroethane, Chloroform, Ethylbenzene, Methylene Chloride, *m,p*-Xylene, and Toluene.

- The runtime is 30 years with 1-year timesteps.
- The simulation grid consists of a single 20-foot thick cell.
- The cell contains initial soil matrix concentrations (input concentrations) for each COPC as listed in Table 1.
- Recharge concentration for all COPCs is 0 mg/L.
- Boundary conditions are set such that COPCs can migrate freely upwards towards the ground surface and downward toward the water table.
- The recharge rate is 4 inches per year.

Comments

- The reviewer appreciates that BRC color-coded the Excel tables – it expedited the review process.

Response: *Comment noted.*

- The laboratory report for the soil input parameters was not provided. These values should be checked against the laboratory report.

Response: *Laboratory reports have been provided.*

- Please note that the statistical calculations summarized in Table 5 of the Excel file have not been checked by a qualified statistician as part of this review.

Response: *Comment noted.*

- It is unusual to use a single cell for a numerical simulation. The NDEP suggests that sensitivity simulations be performed for each class of COPCs (*e.g.*, VOCs, SVOCs, metals, and pesticides) using twenty 1-foot thick cells. For example, perform simulations using the suggested 20-cell grid for benzene, benzoic acid, arsenic, and chlordane and compare the results to those obtained using the single-celled grid.

Response: *An additional sensitivity analysis was conducted which demonstrated that the use of 1-foot thick cells has no impact on the results of the evaluation. The maximum leaching pore water concentration from Borrow Fill 1 and Borrow Fill 2 evaluations for each COPCs were used as the recharge concentration for each of the Site project sets. The use of the 1-foot thick cells did not change the maximum concentrations between the Borrow Fill evaluations.*

- No simulation results were provided. Based on the review conducted in February 2007, it is the understanding of the NDEP that these simulations are used to calculate the 'Concentration in Recharge Water' value used as input for the simulations involving the application of the Borrow Area soils over native soils in other areas of the site.

Response: *Correct. The maximum leaching pore water concentration from Borrow Fill 1 and Borrow Fill 2 evaluations for each COPC were used as the recharge concentration for each of the Site project sets.*

- The chemical parameters reported in the model-generated Word file were checked against Table G-2 and USEPA (2002). It is assumed that this reference is Exhibit C-1, C-2, and C-4 of the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*. A brief discussion regarding the soil pH used to select the K_d values for metals is warranted. Discrepancies and other comments are noted in Table 1 (attached).

Response: *Additional discussion has been provided regarding the pH of soil used for selecting Kds. Discrepancies and other comments are noted in Table 1.*

Attachment A-2-3
Response to NDEP Comments Emailed March 18, 2007 on Revised Background Comparisons for the December 2006 BRC Human Health Risk Assessment Report – Borrow Area, Revision 0

General Comments

The background comparisons appear to have been performed correctly, and reasonable decisions have been made in most cases. There are occasions for which the explanation offered should probably be changed, but otherwise, the COPC selection is reasonable. We recommend that the conclusions are revisited to ensure that they are appropriately descriptive. The specific comments below provide those few instances for which a different decision could be made. Note, in particular, that the comments pertain to radionuclides.

Note that the plots in Appendix D were helpful for verifying conclusions, but, as noted in the full set of comments provided before, it would be more helpful if different symbols were used for detects and non-detects on the plots. This would make it easier to see the effect of the non-detects for some chemicals (e.g., antimony, cadmium, lead-210).

Response: *Comment noted. Revisions to the background comparison have been made based on the comments below. In addition, all plots and summary statistics have been revised as appropriate.*

Specific Comments

1) Beryllium is carried forward based on one very marginal statistical result (for the Slippage test). The greater concentration values that cause this marginal significance are not much greater than the bulk of the background and site data. We note that sample size has a direct effect on classical statistical tests, resulting, in general, in smaller p-values than would occur with smaller sample sizes. This can be considered when making these background comparison decisions. The lines of evidence here seem sufficient to justify not carrying beryllium forward, but we will not argue again with carrying forward beryllium if that is BRC's preference.

Response: *Comment noted. For the purposes of expediting the completion of the report, beryllium has been carried forward in the risk assessment.*

2) For cadmium the detection limits (DLs) appear similar between the two datasets, however, the proportion of detects is much greater for the site data. Given this fact and the results of the statistical tests, we request that cadmium be retained as a COPC.

Response: *Cadmium has been retained as a COPC.*

3) We note that hexavalent chromium is not included in the background comparisons, and does not appear to have been retained as a COPC. The plots in Appendix D suggest that hexavalent chromium should be retained as a COPC.

Response: *Hexavalent chromium was not detected in any of the samples collected at the site, and detection limits are sufficiently low (from 0.4 to 1.3 mg/kg) to have detected concentrations of potential interest; hexavalent chromium is therefore not recommended for retention as a COPC.*

4) For lithium and magnesium, it is not clear why there is no result for the Quantile test.

Response: *There is a result for the Quantile test for magnesium. For lithium, a result was not because the maximum non-detect result exceeded the maximum detected result.*

5) The conclusion for niobium should not be based on ”multiple tests” so much as a lack of detected data, and a higher proportion of detects in the site data.

Response: *The rationale for including Niobium has been modified: Chemical not detected in background samples and was detected in almost 30% of the site samples. Furthermore, statistical analysis of the two datasets does not support the conclusion that the two datasets are comparable.*

6) The results for palladium and strontium show marginal significance. On both cases it is probably reasonable to conclude that these metals have site concentrations that are not different from background. The sample size arguments made on Specific Comment 1 above apply here as well. Please note that we will not argue again with carrying forward these two if that is BRC’s preference.

Response: *Comment noted. For the purposes of expediting the completion of the report, palladium and strontium have been carried forward in the risk assessment.*

7) The decision for thallium should not be based on “multiple tests”. The problem with the analysis is the lack of detected values in the site data. Although the site data contains a few higher DLs for the non-detects, the plot in Appendix D suggests that most of the site DLs for non-detects are lower than those for the background data set. It might be worth exploring why the few higher DLs exist, otherwise it is probably reasonable to conclude that thallium does not need to be retained as a COPC.

Response: *Additional rationale has been added: Not considered a COPC because chemical was detected in very few site related samples (1%) compared to background (35%), and the plots in Appendix D suggest that most of the site sample DLs for non-detects are lower than those for the background data set. Furthermore, statistical analysis supports the conclusion that the two datasets are comparable.*

8) Although the statistical tests for tin indicate a difference between background and site data, the plots in Appendix D indicate that the differences are small. The t-test results might be affected by using ½ DL for the background non-detects (NDs). The sample size arguments made

on Specific Comment 1 above apply here as well. There may be sufficient justification to not carry tin forward, but again we will not argue with carrying forward tin if that is BRC's preference.

Response: *Comment noted. For the purposes of expediting the completion of the report, tin has been carried forward in the risk assessment.*

9) The decision for tungsten should be based primarily on the problems with detection limits. The DLs overlap to the point that statistical decisions cannot be defended. Tungsten should be carried forward because it is not possible to defend an alternative decision.

Response: *Additional rationale has been added: Chemical not detected in background samples and was detected in 25% of the site samples. Furthermore, elevated site detection limits coupled with significant range overlap of the detection limits for non-detected results renders meaningful statistical comparisons to background difficult. The chemical is therefore selected as a COPC.*

10) Vanadium is carried forward based on one statistical result (for the Slippage test). The greater concentration values that cause this marginal significance are not much greater than the bulk of the background and site data. The sample size arguments made on Specific Comment 1 above apply here as well. The lines of evidence here seem sufficient to justify not carrying vanadium forward, but we will not argue again with carrying forward vanadium if that is BRC's preference.

Response: *Comment noted. For the purposes of expediting the completion of the report, vanadium has been carried forward in the risk assessment.*

11) Many radionuclides should be expected to be in secular equilibrium, in which case, if one radionuclide is greater than background then those that are in secular equilibrium should also be greater than background. This should be considered when evaluating the radionuclides.

For example, it does not seem reasonable that U-238 and Pr-234 are greater than background, but Th-234 is not. In the case of Th-234 the data issue is that the DLs are different between site and background datasets. Th-234 should be retained as a COPC.

Response: *Additional rationale has been added: U-238 and Pr-234 are greater than background; if secular equilibrium is assumed, then Th-234 must also subsequently be above background. The detection limits for the site and background datasets are sufficiently different (higher for site samples) such that elevated but non-detected Th-234 concentrations may be masked. Th-234 is selected as a COPC.*

Similarly the daughters of Ra-226 and Rn-222 should be in equilibrium. These include Po-218, Pb-214, Po-214, all of which are greater than background, and Bi-214, which is not greater than background. It seems that Bi-214 should be greater than background as well.

Response: *Additional rationale has been added: Po-218, Pb-214, Po-214 are greater than background; if secular equilibrium is assumed, then Bi-214 must also be above background. Bi-214 is selected as a COPC.*

Also, the daughters of Pb-210 should be in equilibrium. Pb-210, Bi-210 and Po-210 are fraught with detection limit problems, and should be in equilibrium.

Response: *Comment noted.*

Note also that the range of activities for all of the radionuclides in this chain are similar. It is probably reasonable to conclude that all of the radionuclides in the U-238 chain are greater than background and should all be retained as COPCs. This is the recommendation of the NDEP.

Response: *Additional rationale has been added: U-238 was determined to be above background, and the range of activities for all of the radionuclides in this decay chain are similar. If secular equilibrium is assumed, it is reasonable to conclude the radionuclides in the U-238 chain (Th-234, Pa-234, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210) are greater than background and are selected as COPCs.*

The top-level radionuclides in the Th-232 chain are Ra-228 and Th-228. Ra-228 is consistent with background, and the results for Th-228 are consistent with background with the exception of the slippage test. Plots of the data suggest similarity with background is a reasonable conclusion for Th-228. For many of the other radioncludes in this chain there are data issues related to non-detects. An exception is Ra-224, but the Ra-224 data have been questioned in the past, and often appear to be about twice as large as they should be. At this time, and perhaps pending further investigation of the Ra-224 data, it seems reasonable to conclude, for all of these radionuclides that they are consistent with background.

Response: *Additional rationale has been added: (20) Th-232 and Ra-228 were determined to be consistent with background, as was Th-228 with the exception of the slippage test. Plots of the data suggest the conclusion Th-228 is similar to background. Therefore, if secular equilibrium is assumed, it may also be concluded the radionuclides in the Th-232 decay chain (Ac-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Po-212, Tl-208) are similar to background and should not be retained as COPCs.*

Attachment A-2-4
Response to NDEP Comments Emailed March 18, 2007 on Revised Exposure Point Concentrations for the December 2006 BRC Human Health Risk Assessment Report – Borrow Area, Revision 0

General Comments

There are several aspects of this revision that address previous concerns. In particular, ProUCL has not been used to estimate UCLs. We note that Neptune and Company, Inc.'s GiSdT program has been used instead. While we believe this is preferable for the reasons described in our previous review comments (other software could also be used), we still believe that UCL estimation requires consideration of the data before decisions are made on the appropriateness of any method. There are examples in the revised spreadsheet that, in our opinion, do not adequately consider the entirety of the data for a given chemical. It is very difficult to create rules that can easily be applied to all the different types of cases, or data, that arise in environmental work. Some of the more challenging issues to deal with include data that are dominated by non-detects, data for which the non-detects are the greatest values, and data that indicate highly skewed distributions.

We have attempted in this review to provide some rules that can perhaps be followed most of the time. However, we also find that creation of rules usually leads to more conservative risk assessments, and we would prefer that more time is spent justifying the choice of UCL and EPC for each chemical. **Rules have been provided to expedite completion of this specific risk assessment. BRC should not use these rules uniformly in the future without additional discussion.**

The basic method used by BRC was to calculate UCLs using the variety of methods available in GiSdT, and choosing one of those UCLs unless the UCL is greater than the maximum reported detected value, in which case the maximum reported detected value is used instead. The UCL estimation methods are reasonable, however, some consideration needs to be given to use of ½ the detection limit (DL) for the non-detects. We think there are two approaches that are better for UCL estimation. The first is to use the DL directly, and the second is to impute a random number between 0 and the DL for each non-detect. Both of these methods will, most often, generate greater UCLs than are currently generated using ½ DL. The reason we think this is more appropriate is that it is reasonable to argue that the use of ½ DL could underestimate the UCL, whereas both of these other methods would not. We think this approach will also work in cases for which the maximum reported values are non-detects. There are a number of such cases in this data set. **We do recognize that the use of ½ the DL is considered "industry standard" in risk assessments and in general this will be acceptable. However, scenarios such as those for which the maximum reported values are non-detects should consider using the guidance discussed above.** In addition, it is not clear that use of 1/2 the DL is appropriate for UCL calculations.

Environmental data often present challenges. We are currently working on a different package for UCLs that better incorporates the underlying conceptual model, and deals with non-detects through survival analysis algorithms that also use a bootstrapping algorithm. The challenge in the short term is using existing methods and technology on environmental data that contain non-

detects or are highly skewed. We believe that the most defensible path forward is to use the DL or the random imputation approaches described above.

To automate this some more, an option is to run the set of GiSdT UCLs for each of the 3 possible substitution methods. If the normal option is chosen, then choose the max UCL from the 3 that are generated. For the non-normal (bootstrap) cases, the maximum would essentially be chosen across 9 UCLs (3x3 – 3 bootstrap estimates by 3 substitution methods). We expect that the result of doing this would be defensible. We recognize that does require running the GiSdT options for 3 different data sets (DL, ½ DL, and random imputation), but this is not difficult or overly time consuming.

Once the "most appropriate" UCL is chosen, if the UCL is greater than the maximum reported value (detect or non-detect), then the maximum reported value can be used instead of the UCL. This logic should not be limited to detects. That is, in these cases, if the maximum reported value is a non-detect, then its value (detection limit) should be used in lieu of the maximum reported detected value. The challenge, again, is defending the final choice of EPC, and any method that can reasonably be argued as non-conservative should be avoided, especially since the EPCs' are supporting a deterministic risk assessment.

We would also accept use of the random imputation method only. Note we do not see the benefit of the lognormal method (see specific comments below).

If this basic approach is taken, we would be able to turnaround a review, if necessary, in a matter of a few hours.

Response: *To expedite completion of this specific risk assessment, the process outlined above was implemented. UCLs were calculated using three options; use of the DL, use of ½ the DL, and a random number between 0 and the DL for each non-detect. This was done for non-radionuclides. For non-detect radionuclides, the use of laboratory reported value for quantitative statistics was continued. For normally distributed data the max of the three normal UCLs was selected. For non-normal data the max of the nine bootstrap UCLs was selected. If the selected UCLs did not exceed the maximum value (including detects and DLs) it was selected as the EPC, otherwise the maximum value was used as an EPC. For future risk assessments, calculation of UCLs will be conducted using a random number between 0 and the DL for each non-detect, and greater consideration of the entirety of the data for a given chemical will be considered prior to selecting an adequate UCL.*

Note: *In applying the three methods to the Borrow Area risk assessment database, differences in the three methods were only observed in non-normal data, likely due to the high detection frequency of normal data, which ranged from 98 to 100% for non-radionuclides. For data sets with greater than 60% detection frequency, the estimated UCLs using of the DL were on average 3.7% higher than the use of a random number and the estimated UCLs using ½ the DL were on average 0.3% lower than the use of a random number. For data sets with less than 60% detection frequency, the estimated UCLs using of the DL were on average 79% higher than the use of a random number and the estimated UCLs using ½ the DL were on average 2.4% higher*

than the use of a random number. BRC believes it would be fruitful to discuss these results further with NDEP after the present Risk Assessment is finalized and approved.

Specific Comments

1) We attempted to reproduce the results in the EPC spreadsheet, but were unable to do so. The differences were very small, and probably occurred because we do not have a copy of the data set that was used to support the calculations. It would help our review if the data that were used were also provided. This is a comment that can be carried forward into all future Deliverables.

Response: *A copy of the data set that was used in the calculations has been provided.*

2) Although we could not reproduce any of the results (including summary statistics), our best guess is that the lognormal calculations are based on an inappropriate method. Since GiSdT does not provide lognormal UCLs, we guess that the data were log-transformed, a UCL calculated in the log-space, and the result exponentiated. This, at best, provides a UCL of the geometric mean rather than the mean of the lognormal distribution, and should not be used. We request that the lognormal method not be used. It is fraught with difficulties, and usually does not match the underlying conceptual model of human exposure. We would prefer that the normal or bootstrap methods be used.

Response: *The lognormal method was not used.*

3) In light of the above, there is not much utility in testing for lognormality. We do not object from the point of view of exploring the data to gain a better understanding, but we just note that the lognormal test results are not needed for the recommended UCL calculations.

Response: *Comment noted.*

4) It would have helped our review if some more of the summary statistics had been provided. In some cases the maximum detected value is less than the mean (e.g., Pb-210, benzene). This implies that the UCL is driven by non-detects more so than by detects. It would have been helpful to see some more of the summary statistics to get a better idea of what the data look like.

Response: *More summary statistics have been provided.*

APPENDIX B

CALCULATION SPREADSHEETS AND ELECTRONIC DATA
(on DVD)

APPENDIX C

DATA VALIDATION SUMMARY REPORTS (INCLUDING LABORATORY REPORTS) (on DVD)

APPENDIX D

DATASET USED IN THE RISK ASSESSMENT, DATA USABILITY SUMMARY, AND DATA ADEQUACY EVALUATION

ATTACHMENT D-1

DATASET USED IN THE RISK ASSESSMENT

TABLE D1-1
DIOXINS/FURANS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 2)

DVSR	Location	Depth (ft bgs)	1,2,3,4,6,7,8-Heptachlorodibenzofu	1,2,3,4,6,7,8-Heptachlorodibenzo-p	1,2,3,4,7,8,9-Heptachlorodibenzofu	1,2,3,4,7,8-Hexachlorodibenzofuran	1,2,3,4,7,8-Hexachlorodibenzo-p-di	1,2,3,6,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	1,2,3,7,8,9-Hexachlorodibenzofuran	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin
36	BP-01	0	25	11	8.6	19	< 0.44 U	7.8	< 1.2 U	< 1.1 U	< 1.1 U
		10	4.1	< 1.1 U	< 1.5 U	4.6	< 0.13 U	< 1.7 U	< 0.29 U	< 0.3 U	< 0.4 U
		30	< 1.6 U	< 0.57 U	< 0.26 U	< 0.6 U	< 0.19 U	< 0.17 U	< 0.17 U	< 0.19 U	< 0.34 U
	BP-02	0	51	7.5	21	34	< 0.59 U	18	< 1.4 U	3	< 1.2 U
		10	< 0.43 U	< 0.21 U	< 0.14 U	< 0.18 U	< 0.14 U	< 0.11 U	< 0.12 U	< 0.17 U	< 0.21 U
		30	< 0.59 U	< 0.35 U	< 0.22 U	< 0.24 U	< 0.26 U	< 0.22 U	< 0.24 U	< 0.24 U	< 0.31 U
		40	< 0.52 U	< 0.25 U	< 0.16 U	< 0.19 U	< 0.19 U	< 0.18 U	< 0.21 U	< 0.19 U	< 0.27 U
	BP-03	0	41	56	20	25	< 0.84 U	15	4.2	< 2.2 U	< 2.5 U
		10	< 0.39 U	< 1.1 U	< 0.53 U	< 0.43 U	< 0.41 U	< 0.37 U	< 0.34 U	< 0.47 U	< 0.35 U
		30	< 0.87 U	< 2 U	< 1.2 U	< 0.82 U	< 0.65 U	< 0.71 U	< 0.54 U	< 0.89 U	< 0.56 U
	BP-04	0	73	21	32	44	< 0.96 U	24	< 2.4 U	4.1	< 1.6 U
		10	< 0.77 U	< 1.3 U	< 1.1 U	< 0.49 U	< 0.5 U	< 0.41 U	< 0.41 U	< 0.53 U	< 0.42 U
		30	< 0.95 U	< 2.3 U	< 1.3 U	< 0.69 U	< 0.84 U	< 0.59 U	< 0.69 U	< 0.76 U	< 0.71 U
	BP-05	0	< 1.4 UJ-	< 2.7 UJ-	< 1.9 UJ-	< 1.1 U	< 0.76 U	< 0.66 U	< 0.63 U	< 0.83 U	< 0.64 U
		10	< 0.54 U	< 1.2 U	< 0.73 U	< 0.37 U	< 0.5 U	< 0.31 U	< 0.41 U	< 0.4 U	< 0.42 U
		30	25	< 1.5 U	< 1.5 U	6.7	< 0.8 U	< 0.62 U	< 0.66 U	< 0.78 U	< 0.68 U
		40	< 1.2 U	< 2.4 U	< 1.7 U	< 0.92 U	< 0.94 U	< 0.8 U	< 0.77 U	< 0.99 U	< 0.8 U
	BP-06	0	< 0.65 U	< 0.37 U	< 0.34 U	< 0.66 U	< 0.26 U	< 0.37 U	< 0.24 U	< 0.22 U	< 0.23 U
		10	< 1.1 U	< 2.3 U	< 1.5 U	< 0.78 U	< 1.1 U	< 0.67 U	< 0.91 U	< 0.85 U	< 0.94 U
		30	< 0.46 U	< 0.89 U	< 0.62 U	< 0.48 U	< 0.56 U	< 0.42 U	< 0.46 U	< 0.52 U	< 0.85 U
		40	< 1.2 U	< 2.4 U	< 1.6 U	< 1 U	< 1.2 U	< 0.91 U	< 1 U	< 1.1 U	< 1 U
	BP-07	0	6.6	< 1.6 U	3.3	6.9	< 0.97 U	5.1	< 0.79 U	< 0.95 U	< 0.81 U
		10	< 0.42 U	< 0.89 U	< 0.58 U	< 0.4 U	< 0.49 U	< 0.35 U	< 0.4 U	< 0.45 U	< 0.41 U
		30	< 1.1 U	< 2.4 U	< 1.5 U	< 0.93 U	< 1.2 U	< 0.79 U	< 0.94 U	< 1 U	< 0.96 U
		40	< 0.28 U	< 0.28 U	< 0.32 UJ	< 0.34 U	< 0.36 U	< 0.3 U	< 0.33 U	< 0.36 U	< 0.32 U
	BP-08	0	24	5.6	13	18	< 0.39 U	12	< 1.7 U	< 2.4 U	< 1.5 U
		10	< 0.25 U	< 0.22 U	< 0.28 U	< 0.3 U	< 0.34 U	< 0.27 U	< 0.31 U	< 0.32 U	< 0.37 U
		30	< 0.76 UJ-	< 0.78 U	< 0.85 UJ-	< 0.83 U	< 0.81 U	< 0.73 U	< 0.73 U	< 0.85 U	< 0.71 U
		40	< 0.32 U	< 0.57 U	< 0.36 U	< 0.36 U	< 0.46 U	< 0.34 U	< 0.42 U	< 0.38 U	< 0.4 U
	BP-09	0	< 1.4 U	< 0.98 U	< 1.2 U	< 0.88 UJ	< 0.58 U	< 0.58 UJ	< 0.48 U	< 0.5 UJ	< 0.49 U
		10	< 0.25 U	< 0.33 U	< 0.28 U	< 0.36 U	< 0.52 U	< 0.32 U	< 0.46 U	< 0.37 U	< 0.44 U
		30	< 0.55 U	< 0.74 U	< 0.6 U	< 0.68 U	< 0.95 U	< 0.6 U	< 0.87 U	< 0.71 U	< 0.82 U
		40	< 0.31 U	< 0.37 U	< 0.35 U	< 0.52 U	< 0.68 U	< 0.48 U	< 0.6 U	< 0.54 U	< 0.58 U
	BP-10	0	8.1	< 2.1 U	2.7	6.3	< 0.45 U	4	< 0.85 U	< 0.74 U	< 0.94 U
		10	< 1.8 U	< 0.39 U	< 0.29 U	< 0.33 U	< 0.44 U	< 0.3 U	< 0.4 U	< 0.35 U	< 0.43 U
		30	< 0.28 U	< 0.4 U	< 0.32 U	< 0.61 U	< 0.75 U	< 0.55 U	< 0.69 U	< 0.63 U	< 0.65 U
		40	< 0.63 U	< 0.82 U	< 0.69 U	< 0.89 U	< 1.2 U	< 0.79 U	< 1.1 U	< 0.92 U	< 1 U

All results in pg/g.

TABLE D1-1
DIOXINS/FURANS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 2 of 2)

DVSR	Location	Depth (ft bgs)	1,2,3,7,8-Pentachlorodibenzofuran	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	2,3,4,6,7,8-Hexachlorodibenzofuran	2,3,4,7,8-Pentachlorodibenzofuran	2,3,7,8-Tetrachlorodibenzofuran	2,3,7,8-Tetrachlorodibenzo-p-dioxin	Octachlorodibenzodioxin	Octachlorodibenzofuran	TCDD TEQ[1]
36	BP-01	0	6.8 J-	< 0.51 UJ-	< 2.3 U	5 J-	13 J+/-	< 0.2 U	110 J-	89	7.9
		10	< 1.7 U	< 0.18 U	< 0.47 U	< 1.3 U	2.8	< 0.1 U	< 4.2 U	9.6	1.47
		30	< 0.15 U	< 0.21 U	< 0.21 U	< 0.15 U	< 0.11 U	< 0.15 U	< 5.3 U	< 2.3 U	0.33
	BP-02	0	15	< 0.74 U	5.2	10	20	< 0.48 U	34	180	15.36
		10	< 0.1 U	< 0.16 U	< 0.12 U	< 0.1 U	< 0.099 U	< 0.1 U	< 1.1 U	< 0.54 U	0.22
		30	< 0.21 U	< 0.33 U	< 0.24 U	< 0.21 U	< 0.19 U	< 0.19 U	< 2.2 U	< 0.79 U	0.42
		40	< 0.19 U	< 0.38 U	< 0.19 U	< 0.19 U	< 0.14 U	< 0.16 U	< 1.3 U	< 0.61 U	0.40
	BP-03	0	15	< 1.2 U	3.8	9.0	23	< 0.43 U	260 J-	300 J-	14.67
		10	< 0.25 U	< 0.58 U	< 0.42 U	< 0.24 U	< 0.21 U	< 0.18 U	< 1.9 U	< 1.6 U	0.61
		30	< 0.5 U	< 1.1 U	< 0.78 U	< 0.48 U	< 0.35 U	< 0.35 U	< 2.8 U	< 4 U	1.1
	BP-04	0	23	< 1.3 UJ-	6.1	12	25	0.83	66 J-	240 J-	20.49
		10	< 0.35 U	< 0.68 U	< 0.46 U	< 0.34 U	< 0.24 U	< 0.21 U	< 2.5 UJ-	< 3.8 UJ-	0.73
		30	< 0.5 U	< 0.97 U	< 0.67 U	< 0.48 U	< 0.44 U	< 0.53 U	< 5.5 U	< 3.6 U	1.2
	BP-05	0	< 0.47 U	< 0.69 U	< 0.74 U	< 0.48 U	1.1	< 0.21 U	5.1 J-	< 6.4 UJ-	0.99
		10	< 0.28 U	< 0.57 U	< 0.36 U	< 0.27 U	< 0.22 U	< 0.18 U	< 1.7 U	< 2.4 U	0.61
		30	< 0.5 U	< 1.1 U	< 0.7 U	< 0.48 U	< 0.37 U	< 0.37 U	19	43	2.0
		40	< 0.7 U	< 1.4 U	< 0.89 U	< 0.68 U	< 0.45 U	< 0.42 U	< 3.9 U	< 6 U	1.5
	BP-06	0	< 0.47 U	< 0.24 U	< 0.21 U	< 0.24 U	0.93	< 0.13 U	< 1.3 U	< 1.2 U	0.47
		10	< 0.54 U	< 1.1 U	< 0.76 U	< 0.54 U	< 0.4 U	< 0.38 U	< 6.2 U	< 3.8 U	1.2
		30	< 0.38 U	< 0.91 U	< 0.46 U	< 0.36 U	< 0.3 U	< 0.34 U	< 1.5 U	< 1.1 U	0.94
		40	< 0.75 U	< 1.6 U	< 1 U	< 0.75 U	< 0.54 U	< 0.47 U	< 5 U	< 5.2 U	1.7
	BP-07	0	4.8	< 1 U	< 1.6 U	< 2.3 U	4.3	< 0.39 U	< 3.5 U	9.2	3.5
		10	< 0.31 U	< 0.68 U	< 0.39 U	< 0.29 U	< 0.22 U	< 0.22 U	< 1.4 UJ-	< 1.5 UJ-	0.70
		30	< 0.6 U	< 1.3 U	< 0.89 U	< 0.59 U	< 0.43 U	< 0.45 U	< 3.7 U	< 3.7 U	1.4
		40	< 0.19 U	< 0.32 U	< 0.33 U	< 0.17 U	< 0.15 U	< 0.2 U	< 0.49 U	< 0.34 U	0.44
	BP-08	0	9.8	< 0.88 U	4.4	4	7.4	< 0.52 U	11	79	8.1
		10	< 0.17 U	< 0.31 U	< 0.3 U	< 0.16 U	< 0.15 U	< 0.17 U	< 0.46 U	< 0.43 U	0.41
		30	< 0.46 U	< 0.81 U	< 0.81 U	< 0.44 U	< 0.34 U	< 0.34 U	< 1.7 UJ-	< 1.4 UJ-	1.0
		40	< 0.28 U	< 0.53 U	< 0.36 U	< 0.28 U	< 0.3 U	< 0.34 U	< 0.79 U	< 0.73 U	0.67
	BP-09	0	< 0.66 UJ-	< 1.8 UJ-	< 0.4 UJ	< 0.38 UJ-	< 1.4 U	< 61 U	< 1.5 U	< 2.6 U	31.8
		10	< 0.25 U	< 0.81 U	< 0.36 U	< 0.23 U	< 0.27 U	< 4.3 U	< 0.47 U	< 0.3 U	2.8
		30	< 0.57 U	< 1.3 U	< 0.65 U	< 0.55 U	< 0.46 U	< 0.74 U	< 1.8 U	< 1.5 U	1.5
		40	< 0.41 U	< 0.85 U	< 0.52 U	< 0.39 U	< 0.31 U	< 0.46 U	< 1.1 U	< 0.79 U	0.98
	BP-10	0	2.8	< 0.48 U	< 1.4 U	3.2	2.7	< 0.26 U	8.2	23	3.75
		10	< 0.32 U	< 0.56 U	< 0.33 U	< 0.3 U	< 0.2 U	< 0.26 U	< 3.6 U	< 3.2 U	0.64
		30	< 0.47 U	< 0.97 U	< 0.61 U	< 0.45 U	< 0.32 U	< 0.38 U	< 1 U	< 0.83 U	1.0
		40	< 0.59 U	< 1.3 U	< 0.89 U	< 0.56 U	< 0.49 U	< 0.66 U	< 4.8 U	< 2.3 U	1.5

All results in pg/g.

[1]One-half the detection limit used for calculating the TEQ for individual congeners that are non-detect in a particular sample. TEFs from USEPA 2000

TABLE D1-2
PERCHLORATE ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Perchlorate
10a/13a	B-15	0	2100
		5	< 40
		20	120
		30	48
	B-16	0	6400
		5	490
		20	< 40
		30	< 40
26b	EB-3	0.5	230
		15	< 400
		25	91
	EB-7	35	< 40
		0.5	310
		15	150
		25	55
		35	< 40
	EB-8	0.5	510
		15	78
		25	68
		35	< 40
	PEB-11	0.5	170
		15	< 40
		25	110
		35	100
	PEB-13	0.5	90
		15	< 40
		25	100
		35	< 40
	PEB-17	0.5	80
		15	360
		25	320
		35	< 40
	PEB-18	0.5	140
		15	66
		25	100
		35	59
	PEB-9	0.5	240
		15	190
		25	< 40
		35	< 40
36	BP-01	0	24100
		10	881
		20	< 41.7 U
		30	< 68.8 U
		40	< 51.6 U
	BP-02	0	18700
		10	64.3
		20	< 41.9 U
		30	< 87.7 U
		40	< 76.8 U
	BP-03	0	< 40.7 U
		10	< 44.1 U
		20	< 60.1 U
		30	< 74.3 U

TABLE D1-2
PERCHLORATE ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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DVSR	Location	Depth (ft bgs)	Perchlorate
36	BP-04	0	900
		10	909
		20	114
		30	< 76.2 U
	BP-05	0	104 J+
		10	140 J+
		20	89.3 J+
		30	< 77.6 U
		40	< 93.9 U
	BP-06	0	93.1 J+
		10	< 72.6 U
		20	< 41.2 U
		30	104 J+
		40	< 93.2 U
	BP-07	0	339
		10	105
		20	75
		30	< 75.5 U
		40	90.4
	BP-08	0	149
		10	47.8
		20	< 86.1 U
		30	136
		40	< 80.9 U
	BP-09	0	556
		10	550
		20	19700
		30	46100
		40	268
	BP-10	0	49.1
		10	113
		20	272
		30	111
		40	169

All results in µg/kg.

TABLE D1-3
CHLORINATED HERBICIDES ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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(Page 1 of 1)

DVSR	Location	Depth (ft bgs)	2,2-Dichloropropionic acid	2,4,5-T	2,4,5-TP	2,4-D	4-(2,4-Dichlorophenoxy)butyric acid	4-Amino-3,5,6-trichloropicolinic acid	Dicamba	Dichlorprop	Dinitrobutyl phenol	MCPA (2-Methyl-4-chlorophenoxyacetic	MCPP	Mecoprop
10a/13a	B-15	0	< 0.5	< 1.2	3.16	< 1.1	< 5	< 1.1	< 0.6	< 0.8	< 1.1	< 200	< 150	
		5	< 0.5	< 1.2	< 1.2	< 1.1	< 5	< 1.1	< 0.6	< 0.8	< 1.1	< 200	< 150	
		20	< 0.5	< 1.2	< 1.2	< 1.1	< 5	< 1.1	< 0.6	< 0.8	< 1.1	< 200	< 150	
		30	< 0.5	< 1.2	< 1.2	< 1.1	< 5	< 1.1	< 0.6	< 0.8	< 1.1	< 200	< 150	
	B-16	0	< 0.5	< 1.2	< 1.2	< 1.1	< 5	< 1.1	< 0.6	< 0.8	< 1.1	< 200	< 150	
		5	< 0.5	< 1.2	1.13	< 1.1	< 5	< 1.1	< 0.6	1.62	< 1.1	< 200	< 150	
		20	< 0.5	< 1.2	< 1.2	< 1.1	< 5	< 1.1	2.48	< 0.8	< 1.1	< 200	< 150	
		30	< 0.5	< 1.2	< 1.2	< 1.1	< 5	< 1.1	2.8	< 0.8	< 1.1	< 200	< 150	
36	BP-01	0	< 42 U	< 21 U	< 21 U	< 83 U	< 83 U		< 42 U	< 83 U	< 26 UJ	< 8300 U		< 8300 U
	BP-02	0	< 41 U	< 20 U	< 20 U	< 82 U	< 82 U		< 41 U	< 82 U	< 26 UJ	< 8200 U		< 8200 U
	BP-03	0	< 41 U	< 20 UJ	< 20 UJ	< 81 UJ	< 81 U		< 41 UJ	< 81 UJ	< 25 UJ	< 8100 U		< 8100 U
	BP-04	0	< 40 U	< 20 U	< 20 U	< 81 U	< 81 U		< 40 U	< 81 U	< 25 UJ	< 8100 U		< 8100 U
	BP-05	0	< 40 U	< 20 U	< 20 U	< 81 U	< 81 U		< 40 U	< 81 U	< 25 UJ	< 8100 U		< 8100 U
	BP-06	0	< 40 U	< 20 U	< 20 U	< 81 U	< 81 U		< 40 U	< 81 U	< 25 U	< 8100 U		< 8100 U
	BP-07	0	< 41 U	< 20 U	< 20 U	< 81 U	< 81 U		< 41 U	< 81 U	< 25 U	< 8100 U		< 8100 U
	BP-08	0	< 41 UJ-	< 20 UJ-	< 20 UJ-	< 81 UJ-	< 81 UJ-		< 41 UJ-	< 81 UJ-	< 25 UJ-	< 8100 UJ-		< 8100 UJ-
	BP-09	0	< 41 UJ-	< 20 UJ-	< 20 UJ-	< 81 UJ-	< 81 UJ-		< 41 UJ-	< 81 UJ-	< 25 UJ-	< 8100 UJ-		< 8100 UJ-
	BP-10	0	< 41 UJ-	< 20 UJ-	< 20 UJ-	< 81 UJ-	< 81 UJ-		< 41 UJ-	< 81 UJ-	< 25 UJ-	< 8100 UJ-		< 8100 UJ-

All results in µg/kg.

TABLE D1-4
METALS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium (Total)	Chromium (VI)
10a/13a	B-15	0			R	R			R		R	R
		5			R	R			R		R	R
		20			R	R			R		R	R
		30			R	R			R		R	R
	B-16	0			R	R			R		R	R
		5			R	R			R		R	R
		20			R	R			R		R	R
		30			R	R			R		R	R
26b	EB-3	0.5	7800	< 0.47 UJ	2.8	130 J-	< 0.47		< 0.47		10	< 0.5
		15	7300	< 0.52 UJ	3.7	180 J-	< 0.52		< 0.52		6.6	< 0.5
		25	6400	< 0.5 UJ	5.1	140 J-	< 0.5		< 0.5		7.8	< 0.5
		35	4400	< 0.52 UJ	5.4	85 J-	< 0.52		< 0.52		7.1	< 0.5
	EB-7	0.5	6500	< 0.51	2.3	140	0.47		< 0.51		8.8	< 0.5
		15	5800	< 0.51	4.8	110	0.42		< 0.51		5.5	< 0.5
		25	6600	< 0.49	5.2	160	0.46		< 0.49		8.5	< 0.5
		35	5500	< 0.5	6.4	110	0.39		< 0.5		9.9	< 0.5
	EB-8	0.5	7700	< 0.5	1.9	160	0.51		< 0.5		8.7	< 0.5
		15	7100	< 0.49	4.2	150	0.5		< 0.49		9.8	< 0.5
		25	6000	< 0.51	6.2	140	0.44		< 0.51		10	< 0.5
		35	5200	< 0.5	8.1	130	0.42		< 0.5		13	< 0.5
	PEB-11	0.5	8600	< 0.5 UJ	3.1	160 J-	< 0.5		< 0.5		12	< 0.5
		15	4000	< 0.5 UJ	3	110 J-	< 0.5		< 0.5		6.6	< 0.5
		25	5100	< 0.48 UJ	4.5	130 J-	< 0.48		< 0.48		< 6.4 U	< 0.5
		35	6600	< 0.51 UJ	16	74 J-	< 0.51		< 0.51		24	< 0.5
	PEB-13	0.5	8100	< 0.48	2.9	160	< 0.48		< 0.48		14	< 0.5
		15	8400	< 0.51	5.2	150	0.57		< 0.51		12	< 0.5
		25	6300	< 0.53	4.4	140	< 0.53		< 0.53		13	< 0.5
		35	6000	< 0.5	6.3	140	< 0.5		< 0.5		12	< 0.5
	PEB-17	0.5	5600 J+	< 0.47	6	110	0.48		< 0.47		9.1	< 0.5
		15	5700 J+	< 0.51	3.8	100	0.54		< 0.51		10	< 0.5
		25	5200 J+	< 0.51	3.8	130	< 0.48		< 0.51		16	< 0.5
		35	15000 J+	< 0.49	17	120	1.1		< 0.49		21	< 0.5
	PEB-18	0.5	8800	< 0.51	3.1	200	0.74		< 0.51		11	< 0.5
		15	5500	< 0.53	3.3	120	< 0.53		< 0.53		7	< 0.5
		25	5500	< 0.51	5.5	120	< 0.51		< 0.51		8.6	< 0.5
		35	4100	< 0.49	7	89	< 0.49		< 0.49		7.9	< 0.5

TABLE D1-4
METALS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium (Total)	Chromium (VI)
26b	PEB-9	0.5	7600	< 0.48	2.5	160	0.65		< 0.48		12	< 0.5
		15	8500	< 0.51	3.7	160	0.76		< 0.51		15	< 0.5
		25	7700	< 0.5	4	140	0.74		< 0.5		16	< 0.5
		35	6500	< 0.46	4.9	110	0.53		< 0.46		11	< 0.5
36	BP-01	0	6930	0.31 J-	6.5	163 J+	0.45	15.8 J	0.11 J	51600	5 J	< 0.42 U
		10	4860	0.18 J-	3.9	119 J+	0.31	< 5.2 B	0.087	38700	7.1	< 0.42 U
		20	4120	0.097 J-	3.1	109 J+	0.3	< 7.2 B	0.034 J	15000	4.8	< 0.42 U
		30	9350	0.21 J-	12.9	390 J+	0.58	< 11.6 B	0.085 J	38300	16.8	< 0.69 U
		40	6870	< 3.2 UJ-	12.1	40 J+	0.41	< 32.2 B	0.1 J	216000	6.9	< 0.52 U
	BP-02	0	6730	0.16 J-	3.9	155 J+	0.44	< 6.3 B	0.13	43700	7.4	< 0.41 U
		10	4410	0.094 J-	3.1	108 J+	0.33	< 5.2 B	0.063	33400	5.1	< 0.42 U
		20	5010	0.12 J-	3.4	135 J+	0.33	< 5.2 B	0.042 J	22100	4.6	< 0.42 U
		30	8630	0.19 J-	9.7	212 J+	0.58	< 11 B	0.066 J	42600	8.1	< 0.88 U
		40	9200	0.15 J-	11.3	257 J+	0.58	< 9.6 B	0.078 J	59600	18.6	< 0.77 U
	BP-03	0	8090 J	0.24 J-	5.3	199 J-	0.51	< 8.2 B	0.15	39200	9.4 J-	< 0.41 U
		10	6310 J	0.16 J-	6.1	124 J-	0.4	< 5.7 B	0.075	53900	6.9 J-	< 0.44 U
		20	5780 J	0.16 J-	5.8	142 J-	0.43	< 7.5 B	0.07 J	29500	6.9 J-	< 0.6 U
		30	6280 J	0.11 J-	7.6	164 J-	0.42	< 9.3 B	0.072 J	42500	6.1 J-	< 0.74 U
	BP-04	0	5560 J	0.15 J-	3.7	132 J-	0.35	< 5.3 B	0.12	35200	5.9 J-	< 0.4 U
		10	3580 J	0.072 J-	2.6	76.7 J-	0.27	< 5.3 B	0.045 J	25100	2.8 J-	< 0.42 U
		20	4170 J	0.09 J-	4.3	103 J-	0.31	< 5.2 B	0.041 J	25400	6.7 J-	< 0.41 U
		30	11000 J	0.21 J-	10.5	233 J-	0.65	< 10.1 B	0.11	47700	11.9 J-	< 0.76 U
	BP-05	0	6870 J	0.19 J-	2.9	114 J-	0.47	< 7.7 B	0.066	19100	7.6 J-	< 0.4 U
		10	6290 J	0.13 J-	5.8	165 J-	0.45	< 7.8 B	0.11	45200	6 J-	< 0.43 U
		20	5320 J	0.12 J-	3.5	124 J-	0.34	< 7.1 B	0.047 J	29600	6 J-	< 0.42 U
		30	12200 J	0.27 J-	19	214 J-	0.77	16.7	0.089 J	49600	13.2 J-	< 0.78 U
		40	11200 J	< 5.9 UJ-	24.5	927 J-	0.69	< 58.7 U	0.068 J	383000	27.7 J-	< 0.94 U
	BP-06	0	7300 J	0.19 J-	3.1	171 J+	0.51	6.7	0.085	41800 J	7.8 J-	< 0.4 U
		10	10700 J	0.21 J-	7.1	299 J+	0.81	13.6	0.13	58900 J	10.7 J-	< 0.73 U
		20	5080 J	0.11 J-	3.5	140 J+	0.36	< 6.5 B	0.052	19200 J	8.6 J-	< 0.41 U
		30	9030 J	0.2 J-	14	193 J+	0.61	12.7	0.067 J	38700 J	17 J-	< 0.81 U
		40	11700 J	0.2 J-	15.3	308 J+	0.72	9.3 J	0.15	327000 J	24.4 J-	< 0.93 U
	BP-07	0	7830 J	0.19 J-	2.7	189 J+	0.53	7.3	0.091	26500 J	8.8 J-	< 0.41 U
		10	5440 J	0.12 J-	4.4	139 J+	0.43	9.9	0.058	32500 J	9 J-	< 0.44 U
		20	5310 J	0.094 J-	7.4	139 J+	0.35	8.6	0.11	81800 J	8.1 J-	< 0.42 U
		30	7610 J	0.15 J-	5.7	176 J+	0.59	17.5	0.089 J	29600 J	8.4 J-	< 0.76 U
		40	15300 J+	0.28 J-	12.7	85.4	0.88 J+	18.3	0.047 J	3170 J+/-	56 J+	R

TABLE D1-4
METALS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium (Total)	Chromium (VI)
36	BP-08	0	5510 J	0.15 J-	2.8	137	0.36	< 5.1 B	0.1	21000 J-	5.7 J	< 0.41 U
		10	10000 J+	0.23 J-	7.6	245	0.58 J+	10.9	0.11	48200 J+/-	9.4 J+	< 0.43 U
		20	12100 J	0.29 J-	10.2	308	0.74	13.6	0.13	43700 J-	15.1 J	< 0.86 U
		30	14700 J	0.31 J-	25.4	213	0.88	28.5	0.095 J	32200 J-	19.9 J	< 0.98 U
		40	17400 J	< 5.1 UJ-	20.7	110	1.1	14.4 J	0.19 J	209000 J-	23.5 J	< 0.81 U
	BP-09	0	4980 J	0.12 J-	2.4	156	0.33	< 5.1 B	0.092	28500 J-	5.9 J	< 0.41 U
		10	6270 J	0.15 J-	5.7	174	0.39	< 5.7 B	0.074	44500 J-	6.6 J	< 0.43 U
		20	7170 J	0.18 J-	5.9	159	0.58	9.3 J	0.07 J	19800 J-	10.8 J	< 0.78 U
		30	15600 J	0.34 J-	10.4	241	0.93	31.5	0.13 J	86300 J-	28 J	< 1.1 U
		40	6350 J	0.14 J-	21.4	115	0.46	7.7 J	0.06 J	71900 J-	10.5 J	< 0.83 U
	BP-10	0	5820 J	0.15 J-	2.6	139	0.37	< 5.1 B	0.072	22500 J-	6.5 J	< 0.41 U
		10	5580 J	0.12 J-	3.6	150	0.37	< 5.2 B	0.064	27400 J-	6.8 J	< 0.42 U
		20	3990 J	0.12 J-	4.2	71.9	0.28	< 5.3 B	0.054	21400 J-	11.3 J	< 0.42 U
		30	9310 J	0.2 J-	10.2	174	0.56	11.8	0.058 J	15400 J-	17.4 J	< 0.79 U
		40	17600 J	< 8.3 UJ-	10.8 J	70.1	1.1	< 82.5 U	0.32 J	692000 J-	110 J	< 1.3 U

All results in mg/kg.

TABLE D1-4
METALS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Cobalt	Copper	Cyanide (Total)	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum
10a/13a	B-15	0					R				R	
		5					R				R	
		20					R				R	
		30					R				R	
	B-16	0					R				R	
		5					R				R	
		20					R				R	
		30					R				R	
26b	EB-3	0.5	6.1	16		11000	7.5		7000	120	< 0.029	0.65
		15	6.1	16		9500	6.7		7500	130	< 0.032	0.77
		25	4.8	11		8200	5.7		6000	94	< 0.032	0.56
		35	5.8	13		8400	5.9		5100	86	< 0.033	0.57
	EB-7	0.5	5.6	15		6500	8.4		8300	180	< 0.032	0.73
		15	4.9	14		4700	4.6		6600	110	< 0.031	0.55
		25	5.1	15		5900	6.1		5800	130	< 0.032	0.61
		35	4.1	12		4900	4.2		5900	91	< 0.033	0.66
	EB-8	0.5	5.3	12		9200	7.9		5800	180	< 0.032	0.57
		15	5.9	15		9700	6		7300	160	< 0.27	0.8
		25	6.2	12		9200	5.5		6100	150	< 0.029	0.71
		35	4.8	12		10000	5.9		5700	100	< 0.029	< 0.5
	PEB-11	0.5	7.2	17		13000	9		8200	170	< 0.032	0.8
		15	4.4	13		8200	3.7		4700	95	< 0.032	1.3
		25	5	13		8300	5.8		4600	120	< 0.032	0.84
		35	5.6	12		7500	4.4		13000	120	< 0.033	0.68
	PEB-13	0.5	6.7	15		13000	15		6600	220	< 0.033	0.71
		15	6.3	13		11000	6.6		7500	150	< 0.033	0.66
		25	6.6	14		14000	5.9		5400	150	< 0.033	0.59
		35	5.4	13		11000	5.8		6100	110	< 0.032	0.65
	PEB-17	0.5	5.4	14		8900 J+	4.8		7200	120	< 0.026	< 0.47
		15	6	15		12000 J+	5.6		5800	150	< 0.033	0.54
		25	5.4	13		10000 J+	4.8		5300	130	0.035	0.56
		35	4	7.9		9100 J+	7.3		32000	130	< 0.033	0.5
	PEB-18	0.5	6.9	16		13000 J-	7.8		9200	200	< 0.026	0.61
		15	5.6	12		9300 J-	5		5300	150	< 0.029	0.57
		25	4.9	13		10000 J-	5.1		5000	100	< 0.029	0.52
		35	3.4	10		6200 J-	4		5000	68	< 0.029	< 0.49

TABLE D1-4
METALS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Cobalt	Copper	Cyanide (Total)	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum
26b	PEB-9	0.5	5.9	13		12000	7.6		5500	210	< 0.032	0.77
		15	6.5	13		12000	6.4		7900	160	< 0.032	0.56
		25	8.4	18		17000	6.9		7300	200	< 0.03	0.62
		35	4.9	12		9800	5.1		7200	110	< 0.03	0.53
36	BP-01	0	4.1	11.6	R	9440 J-	10.6	11.1	13400	314	< 0.035 B	0.85 J
		10	4	13.8	R	8170 J-	8	11.1	6040	171	< 0.035 B	1.1
		20	3.8	9.9	R	8350 J-	4.7	11.7	4720	175	< 0.035 U	0.49 J
		30	6.9	20.9	R	18600 J-	8.7	27.3	8280	265	< 0.057 B	2.1
		40	3.5	7.4	R	8300 J-	5.8	21.7 J	14700	218	< 0.043 B	0.48 J
	BP-02	0	5.4	11.7	R	10600 J-	18.5	12.1	17700	336	< 0.034 B	0.62
		10	4.1	10.2	R	7920 J-	5	13.2	5250	137	< 0.035 U	0.5 J
		20	4.4	10.4	R	8360 J-	6.5	13	4780	278	< 0.035 B	0.5 J
		30	6.9	18.2	R	14900 J-	8.8	24.3	8120	264	< 0.073 U	0.96 J
		40	5	15.2	R	16700 J-	9.5	26	8970	175	< 0.064 U	1.5
	BP-03	0	5.1 J	12.8 J-	R	12100	14.2	15.5	10400 J	335 J	0.024 J	0.72
		10	4.5 J	10.4 J-	R	9650	6.5	16.4	7240 J	207 J	0.014 J	0.67
		20	6.4 J	15.4 J-	R	12700	8.4	18.4	6640 J	310 J	0.015 J	0.78
		30	4.2 J	13.6 J-	R	9450	8.7	21.4	6600 J	179 J	0.023 J	0.49 J
	BP-04	0	4 J	10.9 J-	R	8620	8.7	12.2	9660 J	309 J	0.012 J	1.2
		10	2.3 J	7.8 J-	R	4810	3.4	10.8	4110 J	95.6 J	0.012 J	0.33 J
		20	4 J	11.1 J-	R	9210	4.4	12.1	4880 J	156 J	0.011 J	0.73
		30	7.6 J	19.1 J-	< 0.95 U	16800	10.9	29.1	10200 J	277 J	< 0.064 U	1
	BP-05	0	4.5 J	9.4 J-	< 0.51 U	10500	7.9	14.7	6520 J	227 J	0.028 J	0.56
		10	5.7 J	13.3 J-	< 0.54 U	10800	7.4	15.6	5730 J	281 J	0.0099 J	0.54
		20	4.1 J	10.5 J-	< 0.53 U	8220	4.9	13.2	4940 J	181 J	< 0.035 U	0.9
		30	7.2 J	18.4 J-	< 0.97 U	17200	12.1	38.1	14600 J	275 J	< 0.065 U	1
		40	5.5 J	13.2 J-	< 1.2 U	13600	8.5	37.3 J	28200 J	763 J	0.047 J	5.9
	BP-06	0	5.1 J	11.3 J-	< 0.51 U	11300	8.1 J	12.5	7470 J-	235 J	< 0.034 B	0.47 J
		10	9.1 J	20.5 J-	< 0.91 U	17100	11.1 J	21.4	9930 J-	457 J	< 0.061 U	0.97
		20	5.1 J	16 J-	< 0.51 U	10800	5.8 J	9.9	4590 J-	190 J	< 0.034 B	0.61
		30	7.2 J	17.7 J-	< 1 U	18000	9 J	41.7	10100 J-	214 J	< 0.067 U	1
		40	6.9 J	15.2 J-	< 1.2 U	19000	11.6 J	< 11.7 U	16200 J-	353 J	< 0.078 U	0.97 J
	BP-07	0	5.4 J	11 J-	< 0.51 U	11700	8.7 J	10.2	7320 J-	298 J	< 0.034 B	0.6
		10	5.3 J	10.3 J-	< 0.54 U	8450	6 J	13.2	6130 J-	204 J	< 0.036 B	0.53 J
		20	3.6 J	9.1 J-	< 0.52 U	8500	4 J	11.2	6430 J-	130 J	< 0.035 U	0.4 J
		30	5.3 J	14.3 J-	< 0.94 U	14700	8.6 J	17	7290 J-	248 J	< 0.063 U	0.95
		40	3.4 J+	7.9 J+/-	< 0.66 U	11700 J+/-	8.5	61.8	16200 J+	113 J+	< 0.044 U	0.77

TABLE D1-4
METALS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Cobalt	Copper	Cyanide (Total)	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum
36	BP-08	0	4.3 J	10.1 J-	< 0.51 U	8480 J-	8.4	8.4	6170 J	288 J	0.017 J	0.62
		10	6.8 J+	15.1 J+/-	< 0.54 U	13200 J+/-	9.9	30.2	11300 J+	295 J+	0.0093 J	0.97
		20	10.1 J	24.9 J-	< 1.1 U	23300 J-	11.4	29.9	12400 J	380 J	< 0.072 U	1.1
		30	8.7 J	21.8 J-	< 1.2 U	19200 J-	13.6	52.1	36500 J	287 J	0.035 J	2.1
		40	9.4 J	23.4 J-	< 1 U	22200 J-	14.3	36.2 J	27400 J	706 J	0.016 J	1.4 J
	BP-09	0	4.6 J	9.8 J-	< 0.51 U	9320 J-	7.0	7.9	5440 J	282 J	0.018 J	0.56
		10	4.4 J	9.5 J-	< 0.54 U	8410 J-	8.4	14.2	7430 J	195 J	0.013 J	0.49 J
		20	8.3 J	21.5 J-	< 0.97 U	17100 J-	8.6	21.2	9200 J	293 J	0.025 J	1.1
		30	10.9 J	22.6 J-	< 1.4 U	19400 J-	13.1	48.6	27400 J	406 J	0.035 J	0.98 J
		40	5.9 J	15.9 J-	< 1 U	11900 J-	7.2	34.9	8610 J	151 J	< 0.069 U	0.86 J
	BP-10	0	4.2 J	10 J-	< 0.51 U	8830 J-	7.4	10.7	6470 J	244 J	0.012 J	0.47 J
		10	4.7 J	11.6 J-	< 0.52 U	9810 J-	5.5	11.6	4980 J	218 J	0.0071 J	0.63
		20	5.4 J	12 J-	< 0.53 U	14200 J-	5.1	11.3	4700 J	176 J	0.023 J	0.58
		30	8.8 J	16.9 J-	< 0.99 U	18800 J-	10.5	28.5	8440 J	243 J	0.03 J	1.3
		40	9.7 J	15.7 J-	< 1.6 U	15800 J-	11.4	< 82.5 U	21700 J	402 J	0.04 J	< 8.3 U

All results in mg/kg.

TABLE D1-4
METALS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Nickel	Niobium	Palladium	Phosphorus (as P)	Platinum	Potassium	Selenium	Silicon	Silver	Sodium
10a/13a	B-15	0							R		R	
		5							R		R	
		20							R		R	
		30							R		R	
	B-16	0							R		R	
		5							R		R	
		20							R		R	
		30							R		R	
26b	EB-3	0.5	58						< 0.47		< 0.47	
		15	55						< 0.52		< 0.52	
		25	46						< 0.5		< 0.5	
		35	48						0.64		< 0.52	
	EB-7	0.5	55						< 0.51		< 0.51	
		15	40						< 0.51		< 0.51	
		25	50						< 0.49		< 0.49	
		35	40						< 0.5		< 0.5	
	EB-8	0.5	42						< 0.5		0.7	
		15	47						< 0.49		< 0.49	
		25	44						< 0.51		< 0.51	
		35	44						< 0.5		< 0.5	
	PEB-11	0.5	70						< 0.5		< 0.5	
		15	46						< 0.5		< 0.5	
		25	45						< 0.48		< 0.48	
		35	42						< 0.51		< 0.51	
	PEB-13	0.5	65						< 0.48		< 0.48	
		15	59						< 0.51		< 0.51	
		25	64						< 0.53		< 0.53	
		35	50						< 0.5		< 0.5	
	PEB-17	0.5	42						< 0.47		< 0.47	
		15	53						< 0.51		< 0.51	
		25	47						< 0.48		< 0.51	
		35	43						< 0.49		< 0.49	
	PEB-18	0.5	57						< 0.51		< 0.51	
		15	42						< 0.53		< 0.53	
		25	43						< 0.51		< 0.51	
		35	27						< 0.49		< 0.49	

TABLE D1-4
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DVSR	Location	Depth (ft bgs)	Nickel	Niobium	Palladium	Phosphorus (as P)	Platinum	Potassium	Selenium	Silicon	Silver	Sodium
26b	PEB-9	0.5	51						< 0.48		< 0.48	
		15	59						< 0.51		< 0.51	
		25	72						< 0.5		< 0.5	
		35	45						< 0.46		< 0.46	
36	BP-01	0	9.2	< 13 BJ+	0.59	1120 J-	< 0.52 U	2740	< 2.6 U	164 J+	< 26 U	3770
		10	8.2	< 2.6 BJ+	0.39	853 J-	< 0.11 U	1600	< 0.52 U	< 103 BJ+	0.076 J	734
		20	7.1	< 2.6 BJ+	0.33	1010 J-	< 0.1 U	1370	< 0.52 U	< 103 BJ+	0.059 J	1190
		30	12.7	< 4.3 BJ+	1.6	1790 J-	< 0.17 U	3270	< 0.86 U	163 J+	0.15 J	2730
		40	10.7	< 16.1 BJ+	0.4 J	606 J-	< 0.65 U	1800	< 3.2 U	162 J+	< 32.2 U	910
	BP-02	0	10.2	< 2.6 BJ+	0.33	1420 J-	< 0.1 U	3000	< 0.51 U	153 J+	0.084 J	1020
		10	8.2	< 2.6 BJ+	0.38	914 J-	< 0.1 U	1260	< 0.52 U	< 87.8 BJ+	0.086 J	375
		20	7.6	< 2.6 BJ+	0.49	901 J-	< 0.11 U	1590	< 0.52 U	< 94.4 BJ+	0.079 J	502
		30	11.2	< 5.5 BJ+	0.82	1990 J-	< 0.22 U	2780	< 1.1 U	224 J+	0.14 J	1860
		40	11.5	< 4.8 BJ+	0.57	1480 J-	< 0.19 U	2900	< 0.96 U	204 J+	0.14 J	1570
	BP-03	0	11.7 J-	< 2.5 BJ+	0.41	853 J-	< 0.1 U	3430 J	< 0.51 U	74.8 J+	0.16 J	257
		10	10 J-	< 2.8 BJ+	0.78	852 J-	< 0.11 U	2040 J	< 0.55 U	124 J+	0.083 J	516
		20	13.3 J-	< 3.8 BJ+	0.64	1490 J-	< 0.15 U	1910 J	< 0.75 U	150 J+	0.086 J	501
		30	11.5 J-	< 4.6 BJ+	0.44	1570 J-	< 0.19 U	2180 J	< 0.93 U	186 J+	0.083 J	574
	BP-04	0	8.3 J-	< 2.5 BJ+	0.41	1150 J-	< 0.1 U	2510 J	< 0.51 U	81.4 J+	0.08 J	1210
		10	5 J-	< 2.6 BJ+	0.34	747 J-	< 0.11 U	1740 J	< 0.53 U	100 J+	0.056 J	1010
		20	8.3 J-	< 2.6 BJ+	0.36	946 J-	< 0.1 U	1440 J	< 0.52 U	97.8 J+	0.063 J	515
		30	16.9 J-	< 4.8 BJ+	0.98	1650 J-	< 0.19 U	4050 J	< 0.95 U	168 J+	0.13 J	1760
	BP-05	0	9.4 J-	< 2.5 BJ+	0.32	564 J-	< 0.1 U	4210 J	< 0.51 U	74.9 J+	0.091 J	294
		10	12.7 J-	< 2.7 BJ+	0.63	1180 J-	< 0.11 U	2090 J	< 0.54 U	104 J+	0.087 J	651
		20	8.1 J-	< 2.6 BJ+	1.3	936 J-	< 0.11 U	1630 J	< 0.53 U	93.9 J+	0.073 J	1140
		30	17.4 J-	< 4.9 BJ+	1.1	1070 J-	< 0.19 U	4360 J	< 0.97 U	158 J+	0.17 J	2500
		40	20.6 J-	< 29.4 U	0.85 J	863 J-	< 1.2 U	2990 J	< 5.9 U	278 J+	< 58.7 U	1590
	BP-06	0	10.5 J-	< 2.5 BJ+	0.46	847 J-	< 0.1 U	3480 J	< 0.51 U	56.1 J+	0.1 J	313
		10	16.5 J-	< 4.5 BJ+	0.87	1620 J-	< 0.18 U	3590 J	< 0.91 U	126 J+	0.16 J	1260
		20	9.6 J-	< 2.6 BJ+	0.36	1030 J-	< 0.1 U	1610 J	< 0.52 U	73.1 J+	0.17 J	1010
		30	13.9 J-	< 5 BJ+	0.6	1320 J-	< 0.2 U	3210 J	< 1 U	155 J+	0.13 J	2440
		40	18.2 J-	< 5.8 BJ+	0.96	1460 J-	< 0.23 U	3640 J	< 1.2 U	235 J+	0.2 J	1740
	BP-07	0	10.1 J-	< 2.5 BJ+	0.37	697 J-	< 0.1 U	3470 J	< 0.51 U	67.8 J+	0.1 J	335
		10	13.5 J-	< 2.7 BJ+	0.82	1240 J-	< 0.11 U	1820 J	0.12 J	63.7 J+	0.066 J	762
		20	7.8 J-	< 2.6 BJ+	0.48	960 J-	< 0.11 U	1640 J	< 0.53 U	90 J+	0.064 J	979
		30	10.5 J-	< 4.7 BJ+	0.6	1320 J-	< 0.19 U	3130 J	< 0.94 U	141 J+	0.12 J	2830
		40	10.7 J+/-	2 J	0.14	297 J	0.015 J	2770 J+	< 0.66 U	106 J+	0.11 J	1420 J+

TABLE D1-4
METALS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Nickel	Niobium	Palladium	Phosphorus (as P)	Platinum	Potassium	Selenium	Silicon	Silver	Sodium
36	BP-08	0	8.2 J-	0.8 J	0.18	906	< 0.1 U	2130 J	< 0.51 U	< 69.4 BJ+	0.072 J	191 J
		10	15.8 J+/-	1.1 J	0.5	1310 J+	< 0.11 U	3470 J+	< 0.54 U	81.2 J+	0.13 J	1000 J+
		20	22.1 J-	1.5 J	0.66	2340	< 0.22 U	3650 J	< 1.1 U	167 J+	0.17 J	1520 J
		30	19.7 J-	1.5 J	0.47	963	0.026 J	4920 J	< 1.2 U	220 J+	0.23 J	2950 J
		40	27.9 J-	< 25.3 U	0.34 J	1110	< 1 U	5290 J	< 5.1 U	226 J+	< 50.5 U	1530 J
	BP-09	0	10.8 J-	0.84 J	0.22	1990	< 0.1 U	1890 J	< 0.51 U	88.6 J+	0.052 J	1130 J
		10	10.6 J-	0.51 J	0.41	968	< 0.11 U	2390 J	< 0.54 U	90.6 J+	0.08 J	2180 J
		20	18.2 J-	1 J	0.33	2030	< 0.2 U	2510 J	< 0.97 U	187 J+	0.099 J	973 J
		30	23.7 J-	1 J	1.2	1950	< 0.27 U	7300 J	< 1.4 U	208 J+	0.17 J	2810 J
		40	10.2 J-	0.94 J	0.81	1450	< 0.21 U	2320 J	< 1 U	172 J+	0.11 J	1340 J
	BP-10	0	8.9 J-	0.4 J	0.28	1140	< 0.1 U	2340 J	0.3 J	< 77.5 BJ+	0.074 J	167 J
		10	8.4 J-	0.66 J	0.31	999	< 0.1 U	1850 J	0.15 J	< 77.6 BJ+	0.071 J	382 J
		20	9.7 J-	0.57 J	0.18	1200	< 0.11 U	1330 J	< 0.53 U	< 74.2 BJ+	0.056 J	515 J
		30	16 J-	1.2 J	0.29	1150	< 0.2 U	3270 J	< 0.99 U	141 J+	0.12 J	1470 J
		40	29.8 J-	< 41.2 U	0.87 J	822	< 1.7 U	3940 J	< 8.3 U	< 82.5 BJ+	< 82.5 U	987 J

All results in mg/kg.

TABLE D1-4
METALS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Strontium	Sulfur	Thallium	Tin	Titanium	Tungsten	Uranium	Vanadium	Zinc	Zirconium
10a/13a	B-15	0										
		5										
		20										
		30										
	B-16	0										
		5										
		20										
		30										
26b	EB-3	0.5			< 0.47		710	R		29	25	
		15			< 0.52		620	0.62 J-		27	26	
		25			< 0.5		510	R		24	20	
		35			1.6		570	0.69 J-		29	18	
	EB-7	0.5			< 0.51		680	< 0.51 UJ		28	37	
		15			< 0.51		520	0.56 J-		24	26	
		25			< 0.49		680	0.59 J-		30	32	
		35			< 0.5		660	< 0.5 UJ		30	25	
	EB-8	0.5			< 0.5		640	< 0.5 UJ		20	< 0.5	
		15			< 0.49		720	1.1 J-		30	38	
		25			< 0.51		730	0.72 J-		34	35	
		35			< 0.5		790	< 0.5 UJ		41	36	
	PEB-11	0.5			< 0.5		870	R		37	31	
		15			< 0.5		660	0.9 J-		30	19	
		25			< 0.48		620	0.78 J-		30	19	
		35			< 0.51		540	R		30	28	
	PEB-13	0.5			< 0.48		860	< 0.48		40	45	
		15			< 0.51		790	< 0.51		37	38	
		25			< 0.53		960	< 0.53		49	39	
		35			< 0.5		810	< 0.5		39	33	
	PEB-17	0.5			< 0.47		560 J+	< 0.47		30	28	
		15			< 0.51		860 J+	2.6		42	38	
		25			< 0.48		740 J+	1		36	34	
		35			< 0.49		520 J+	< 0.49		31	39	
	PEB-18	0.5			< 0.51		1000 J-	< 0.51		40	45	
		15			< 0.53		680 J-	< 0.53		31	31	
		25			< 0.51		780 J-	< 0.51		39	32	
		35			< 0.49		420 J-	< 0.49		23	19	

TABLE D1-4
METALS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Strontium	Sulfur	Thallium	Tin	Titanium	Tungsten	Uranium	Vanadium	Zinc	Zirconium
26b	PEB-9	0.5			< 0.48		870	< 0.48		35	39	
		15			< 0.51		860	< 0.51		38	42	
		25			< 0.5		1200	< 0.5		64	52	
		35			< 0.46		750	< 0.46		33	34	
36	BP-01	0	287	1040	< 1 U	0.68 J	405 J+	< 2.6 BJ-	0.87	28.5	29.6	158 J-
		10	172	494 J	< 0.21 B	0.47	313 J+	< 0.52 BJ-	0.84	19.7	21.9	145 J-
		20	155	419 J	< 0.21 B	0.33	376 J+	< 0.52 BJ-	0.74	26	16.3	147 J-
		30	676	1360	< 0.34 B	0.71	1030 J+	< 1.1 BJ-	1.8	58.9	31.2	280 J-
		40	178	< 3220 U	< 1.3 U	0.38 J	366 J+	< 3.2 BJ-	0.99	24	17.7	201 J-
	BP-02	0	133	705	< 0.2 B	0.51	390 J+	< 0.51 BJ-	0.84	24.6	41.9	174 J-
		10	176	243 J	< 0.21 B	0.31	366 J+	< 0.52 BJ-	0.76	22.8	14.3	139 J-
		20	205	< 523 U	< 0.21 B	0.37	399 J+	< 0.52 BJ-	0.89	28.3	15.6	153 J-
		30	338	741 J	< 0.44 U	0.54	687 J+	< 1.1 BJ-	1.8	48.7	26	288 J-
		40	255	486 J	< 0.38 B	0.64	823 J+	< 0.96 BJ-	2	47.1	25.6	255 J-
	BP-03	0	166 J-	493 J	< 0.2 B	0.65	383 J+	< 0.51 BJ-	0.91	26.3	32.8 J-	176 J-
		10	327 J-	387 J	< 0.22 B	0.38	354 J+	< 0.63 BJ-	1.2	23.4	20.5 J-	161 J-
		20	262 J-	< 752 U	< 0.3 B	0.49	579 J+	0.76 J-	1.1	38.5	31.4 J-	235 J-
		30	194 J-	< 929 U	< 0.37 U	0.43	483 J+	< 0.93 BJ-	1.3	28.4	20.1 J-	225 J-
	BP-04	0	173 J-	519	< 0.2 B	0.54	364 J+	< 0.51 BJ-	0.71	23.2	22.2 J-	196 J-
		10	155 J-	349 J	< 0.21 B	0.22	271 J+	< 0.53 BJ-	0.54	13.7	10.3 J-	114 J-
		20	163 J-	436 J	< 0.21 B	0.31	422 J+	< 0.52 BJ-	0.91	27.1	17.3 J-	151 J-
		30	405 J-	848 J	< 0.38 B	0.69	736 J+	< 0.95 BJ-	1.9	51.1	35.4 J-	297 J-
	BP-05	0	122 J-	490 J	< 0.2 B	0.43	320 J+	< 0.51 BJ-	0.73	21.3	22.5 J-	153 J-
		10	260 J-	484 J	< 0.22 B	0.42	448 J+	< 0.54 BJ-	1.2	31.7	21.7 J-	199 J-
		20	569 J-	9480	< 0.21 B	0.4	411 J+	< 0.53 BJ-	0.73	23.6	16 J-	162 J-
		30	450 J-	3280	< 0.39 B	0.75	736 J+	< 0.97 BJ-	3.1	51.7	36.5 J-	299 J-
		40	405 J-	< 5870 U	< 2.4 U	0.55 J	588 J+	< 5.9 BJ-	2.1	41.1	34.2 J-	298 J-
	BP-06	0	190 J-	463 J	< 0.2 B	0.46	418 J	< 0.51 BJ-	1.1 J	25.9 J-	23.8 J-	177 J-
		10	375 J-	4050	< 0.36 B	0.69	730 J	1 J-	1.7 J	48.9 J-	34.3 J-	328 J-
		20	152 J-	347 J	< 0.21 B	0.39	499 J	< 0.70 BJ-	0.93 J	37.5 J-	20 J-	175 J-
		30	246 J-	1150	< 0.4 U	0.68	886 J	1 J-	2.6 J	66.2 J-	30.5 J-	302 J-
		40	400 J-	< 5830 U	< 0.47 B	0.79	1060 J	0.91 J-	2.9 J	56 J-	31.9 J-	374 J-
	BP-07	0	154 J-	530	< 0.2 B	0.51	439 J	< 0.51 BJ-	0.83 J	27 J-	24.2 J-	172 J-
		10	388 J-	3110	< 0.22 U	0.34	328 J	< 0.55 BJ-	1.2 J	24.3 J-	18.5 J-	174 J-
		20	202 J-	656	< 0.21 B	0.3	370 J	< 0.53 BJ-	1.3 J	22.6 J-	15.1 J-	148 J-
		30	268 J-	2550	< 0.38 U	0.64	774 J	< 0.94 BJ-	1.2 J	45.3 J-	29.1 J-	245 J-
		40	68.9 J+/-	1080	< 0.27 B	0.84	380 J+	< 0.66 BJ-	1.6	19.1 J+	26.1 J+/-	64.7 J

TABLE D1-4
METALS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Strontium	Sulfur	Thallium	Tin	Titanium	Tungsten	Uranium	Vanadium	Zinc	Zirconium
36	BP-08	0	110 J-	333 J	< 0.2 B	0.43	329 J+	< 1.0 BJ-	0.61	20.3	25 J-	172
		10	266 J+/-	852	< 0.22 B	0.67	516 J+	1.4 J-	1.9	36.7 J+	28.1 J+/-	309
		20	391 J-	2840	< 0.43 B	0.83	952 J+	1.4 J-	2.1	73.5	44.1 J-	376
		30	267 J-	2610	< 0.49 B	1.1	1030 J+	1.8 J-	4.6	78.1	37.3 J-	356
		40	238 J-	< 5050 U	< 2 B	1 J	804 J+	< 5.1 BJ-	2.8	46.7	58.7 J-	311
	BP-09	0	119 J-	501 J	< 0.2 B	0.37	372 J+	< 0.54 BJ-	0.56	23.6	18.8 J-	156
		10	222 J-	1110	< 0.22 B	0.37	284 J+	< 0.54 BJ-	1.2	20.9	18 J-	144
		20	205 J-	1270	< 0.39 U	0.65	752 J+	< 0.97 BJ-	1.4	51.7	31.2 J-	340
		30	678 J-	2670	< 0.55 B	0.85	753 J+	< 1.4 BJ-	3.8	49.8	41.3 J-	361
		40	492 J-	48900	< 0.41 U	0.54	645 J+	< 1 BJ-	2.6	51.1	23.8 J-	315
	BP-10	0	153 J-	371 J	< 0.2 B	0.39	311 J+	< 0.51 BJ-	0.81	22.5	19.9 J-	143
		10	187 J-	465 J	< 0.21 B	0.42	483 J+	0.62 J-	0.95	30	20 J-	187
		20	101 J-	402 J	< 0.21 B	0.39	658 J+	< 0.53 BJ-	0.92	54.2	22.7 J-	169
		30	172 J-	557 J	< 0.4 B	0.77	922 J+	0.61 J-	2.3	72.1	34.6 J-	302
		40	457 J-	< 8250 U	< 3.3 U	0.73 J	641 J+	< 8.3 BJ-	2.1	51.6	41.6 J-	497

All results in mg/kg.

TABLE D1-5
ORGANOCHLORINE PESTICIDES ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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DVSR	Location	Depth (ft bgs)	2,4-DDD	2,4-DDE	4,4-DDD	4,4-DDE	4,4-DDT	Aldrin	alpha-BHC	alpha-Chlordane
26a	EB-1	5			< 5	< 5	< 5	< 5	< 5	< 5
		10			< 5	< 5	< 5	< 5	< 5	< 5
		20			< 5	< 5	< 5	< 5	< 5	< 5
		30			< 5	< 5	< 5	< 5	57	< 5
		35			< 5	< 5	< 5	< 5	68	< 5
	EB-2	5			< 5	< 5	< 5	< 5	< 5	< 5
		10			< 5	< 5	< 5	< 5	< 5	< 5
		20			< 5	< 5	< 5	< 5	6.7	< 5
		30			< 5	< 5	< 5	< 5	50	< 5
		35			< 5	< 5	< 5	< 5	25	< 5
	EB-3	5			< 5	< 5	< 5	< 5	< 5	< 5
		10			< 5	< 5	< 5	< 5	< 5	< 5
		20			< 5	< 5	< 5	< 5	< 5	< 5
		30			< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	31 J-	< 5 UJ
		35			< 5	< 5	< 5	< 5	25	< 5
	EB-7	5			< 5	< 5	< 5	< 5	< 5	< 5
		10			< 5	< 5	< 5	< 5	< 5	< 5
		20			< 5	< 5	< 5	< 5	< 5	< 5
		30			< 5	< 5	< 5	< 5	73	< 5
		35			< 5	< 5	< 5	< 5	9.3	< 5
	EB-8	5			< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		10			< 5	< 5	< 5	< 5	< 5	< 5
		20			< 5	< 5	< 5	< 5	< 5	< 5
		30			< 5	< 5	< 5	< 5	12	< 5
		35			< 5	< 5	< 5	< 5	23	< 5
26b	EB-3	0.5			< 5	9	8.3	< 5	< 5	< 5
		15			< 5	< 5	< 5	< 5	< 5	< 5
		25			< 5	< 5	< 5	< 5	6	< 5
	EB-7	0.5			< 5	< 5	< 5	< 5	< 5	< 5
		15			< 5	< 5	< 5	< 5	< 5	< 5
		25			< 5	< 5	< 5	< 5	12	< 5
	EB-8	0.5			< 5	< 5	< 5	< 5	< 5	< 5
		15			< 5	< 5	< 5	< 5	< 5	< 5
		25			< 5	< 5	< 5	< 5	< 5	< 5

TABLE D1-5
ORGANOCHLORINE PESTICIDES ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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DVSR	Location	Depth (ft bgs)	2,4-DDD	2,4-DDE	4,4-DDD	4,4-DDE	4,4-DDT	Aldrin	alpha-BHC	alpha-Chlordane
26b	PEB-11	0.5			< 5	< 5	< 5	< 5	< 5	< 5
		15			< 5	< 5	< 5	< 5	< 5	< 5
		25			< 5	< 5	< 5	< 5	< 5	< 5
		35			< 5	< 5	< 5	< 5	23 J+	< 5
	PEB-13	0.5			< 5	< 5	< 5	< 5	< 5	< 5
		15			< 5	< 5	< 5	< 5	< 5	< 5
		25			< 5	< 5	< 5	< 5	< 5	< 5
		35			< 5	< 5	< 5	< 5	13	< 5
	PEB-17	0.5			< 5	< 5	< 5	< 5	< 5	< 5
		15			< 5	< 5	< 5	< 5	< 5	< 5
		25			< 5	< 5	< 5	< 5	< 5	< 5
		35			< 5	< 5	< 5	< 5	< 5	< 5
	PEB-18	0.5			< 5	< 5	< 5	< 5	< 5	< 5
		15			< 5	< 5	< 5	< 5	< 5	< 5
		25			< 5	< 5	16	< 5	< 5	< 5
		35			< 5	< 5	< 5	< 5	< 5	< 5
	PEB-9	0.5			< 5	< 5	< 5	< 5	< 5	< 5
		15			< 5	< 5	< 5	< 5	< 5	< 5
		25			< 5	< 5	< 5	< 5	< 5	< 5
		35			< 5	< 5	< 5	< 5	< 5	< 5
36	BP-01	0	< 1.8 U	3.9	< 1.8 U	4.7	5.3	< 1.8 U	< 1.8 U	< 1.8 U
		10	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		20	< 1.8 U	< 1.8 U	< 1.8 U	4.1	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		30	< 2.9 U	< 2.9 U	< 2.9 U	< 2.9 U	< 2.9 U	< 2.9 U	< 2.9 U	< 2.9 U
		40	< 2.2 U	< 2.2 U	< 2.2 U	< 2.2 U	< 2.2 U	< 2.2 U	3.3	< 2.2 U
	BP-02	0	< 1.7 U	6.7	< 1.7 U	11	5.4 J	< 1.7 U	3.9	< 1.7 U
		10	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		20	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		30	< 3.7 U	< 3.7 U	< 3.7 U	< 3.7 U	< 3.7 U	< 3.7 U	< 3.7 U	< 3.7 U
		40	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U
	BP-03	0	< 1.7 U	4.8	< 1.7 U	6.9	4.8	< 1.7 U	< 1.7 U	< 1.7 U
		10	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U
		20	< 2.6 U	< 2.6 U	< 2.6 U	< 2.6 U	< 2.6 U	< 2.6 U	< 2.6 U	< 2.6 U
		30	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U

TABLE D1-5
ORGANOCHLORINE PESTICIDES ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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DVSR	Location	Depth (ft bgs)	2,4-DDD	2,4-DDE	4,4-DDD	4,4-DDE	4,4-DDT	Aldrin	alpha-BHC	alpha-Chlordane
36	BP-04	0	< 1.7 U	< 1.7 U	< 1.7 U	2.8	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U
		10	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		20	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		30	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	12	< 3.2 U
	BP-05	0	< 1.7 U	3.1	< 1.7 U	4.2	3.2	< 1.7 U	< 1.7 U	< 1.7 U
		10	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		20	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		30	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	6.6	< 3.3 U
		40	< 4 U	< 4 U	< 4 U	< 4 U	4.5	< 4 U	12	< 4 U
	BP-06	0	< 1.7 U	< 1.7 U	< 1.7 U	1.7	< 1.7 U	< 1.7 U	1.8	< 1.7 U
		10	< 3.1 U	< 3.1 U	< 3.1 U	< 3.1 U	< 3.1 U	< 3.1 U	< 3.1 U	< 3.1 U
		20	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 UJ	< 1.8 U	< 1.8 U	< 1.8 U
		30	< 3.4 U	< 3.4 U	< 3.4 U	< 3.4 U	< 3.4 UJ	< 3.4 U	< 3.4 U	< 3.4 U
		40	< 4 U	< 4 U	< 4 U	< 4 U	< 4 U	< 4 U	< 4 U	< 4 U
	BP-07	0	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	1.8	< 1.7 U	< 1.7 U	< 1.7 U
		10	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U
		20	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		30	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U
		40	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-
	BP-08	0	< 1.7 UJ-	4 J-	< 1.7 UJ-	5.7 J-	4.7 J-	< 1.7 UJ-	3.5 J-	< 1.7 UJ-
		10	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-
		20	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-
		30	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-
		40	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-
	BP-09	0	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	12 J+/-	< 1.7 UJ-
		10	120 J-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	2 J+/-	< 1.8 UJ-	2.2 J+/-	< 1.8 UJ-
		20	5.3 J+/-	< 3.3 UJ-	< 3.3 UJ-	< 3.3 UJ-	3.9 J+/-	< 3.3 UJ-	< 3.3 UJ-	< 3.3 UJ-
		30	< 4.6 UJ-	< 4.6 UJ-	< 4.6 UJ-	< 4.6 UJ-	6.8 J+/-	< 4.6 UJ-	5.5 J+/-	< 4.6 UJ-
		40	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-
	BP-10	0	< 1.7 UJ-	22 J-	2.2 J-	63 J-	62 J-	< 1.7 UJ-	2.8 J-	< 1.7 UJ-
		10	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-
		20	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-
		30	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-
		40	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-

All results in µg/kg.

TABLE D1-5
ORGANOCHLORINE PESTICIDES ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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DVSR	Location	Depth (ft bgs)	beta-BHC	Chlordane	delta-BHC	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulfate	Endrin
26a	EB-1	5	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		10	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		20	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		30	17	< 20	61	< 5	< 5	< 5	< 5	< 5
		35	74	< 20	57	< 5	< 5	< 5	< 5	< 5
	EB-2	5	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		10	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		20	< 5	< 20	10	< 5	< 5	< 5	< 5	< 5
		30	< 5	< 20	59	< 5	< 5	< 5	< 5	< 5
		35	30	< 20	27	< 5	< 5	< 5	< 5	< 5
	EB-3	5	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		10	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		20	14	< 20	5.3	< 5	< 5	< 5	< 5	< 5
		30	< 5 UJ	< 20 UJ	35 J-	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35	48	< 20	16	< 5	< 5	< 5	< 5	< 5
	EB-7	5	33	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		10	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		20	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		30	28	< 20	100	< 5	< 5	< 5	< 5	< 5
		35	17	< 20	9.3	< 5	< 5	< 5	< 5	< 5
	EB-8	5	20 J-	< 20 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		10	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		20	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		30	< 5	< 20	17	< 5	< 5	< 5	< 5	< 5
		35	34	< 20	25	< 5	< 5	< 5	< 5	< 5
26b	EB-3	0.5	110	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		15	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		25	16	< 20	14	< 5	< 5	< 5	< 5	< 5
	EB-7	0.5	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		15	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		25	7	< 20	26	< 5	< 5	< 5	< 5	< 5
	EB-8	0.5	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		15	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		25	< 5	< 20	8.7	< 5	< 5	< 5	< 5	< 5

TABLE D1-5
ORGANOCHLORINE PESTICIDES ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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DVSR	Location	Depth (ft bgs)	beta-BHC	Chlordane	delta-BHC	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulfate	Endrin
26b	PEB-11	0.5	5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		15	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		25	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		35	< 5	< 20	43 J+	< 5	< 5	< 5	< 5	< 5
	PEB-13	0.5	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		15	32	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		25	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		35	6.7	< 20	27	< 5	< 5	< 5	< 5	< 5
	PEB-17	0.5	10	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		15	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		25	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		35	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
	PEB-18	0.5	11	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		15	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		25	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		35	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
	PEB-9	0.5	26	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		15	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		25	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
		35	< 5	< 20	< 5	< 5	< 5	< 5	< 5	< 5
36	BP-01	0	11	< 18 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		10	< 1.8 U	< 18 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		20	< 1.8 U	< 18 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		30	< 2.9 U	< 29 U	< 2.9 U	< 2.9 U	< 2.9 U	< 2.9 U	< 2.9 U	< 2.9 U
		40	< 2.2 U	< 22 U	< 2.2 U	< 2.2 U	< 2.2 U	< 2.2 U	< 2.2 U	< 2.2 U
	BP-02	0	46	< 17 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U
		10	< 1.8 U	< 18 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		20	< 1.8 U	< 18 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		30	< 3.7 U	< 37 U	< 3.7 U	< 3.7 U	< 3.7 U	< 3.7 U	< 3.7 U	< 3.7 U
		40	< 3.3 U	< 33 U	17	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U
	BP-03	0	57	< 17 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U
		10	< 1.9 U	< 19 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U
		20	< 2.6 U	< 26 U	< 2.6 U	< 2.6 U	< 2.6 U	< 2.6 U	< 2.6 U	< 2.6 U
		30	< 3.2 U	< 32 U	8.1	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U

TABLE D1-5
ORGANOCHLORINE PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	beta-BHC	Chlordane	delta-BHC	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulfate	Endrin
36	BP-04	0	58	< 17 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U
		10	< 1.8 U	< 18 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		20	< 1.8 U	< 18 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		30	< 3.2 U	< 32 U	56	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U
	BP-05	0	53	< 17 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U
		10	< 1.8 U	< 18 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		20	< 1.8 U	< 18 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		30	< 3.3 U	< 33 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U
		40	< 4 U	< 40 U	4.6	< 4 U	< 4 U	< 4 U	< 4 U	< 4 U
	BP-06	0	150 J	< 17 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U
		10	8.9	< 31 U	< 3.1 U	< 3.1 U	< 3.1 U	< 3.1 UJ	< 3.1 UJ	< 3.1 U
		20	< 1.8 U	< 18 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		30	< 3.4 U	< 34 U	< 3.4 U	< 3.4 U	< 3.4 U	< 3.4 U	< 3.4 U	< 3.4 U
		40	< 4 U	< 40 U	< 4 U	< 4 U	< 4 U	< 4 U	< 4 U	< 4 U
	BP-07	0	160	< 17 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U
		10	3.7	< 19 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U
		20	< 1.8 U	< 18 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U
		30	< 3.2 U	< 32 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U
		40	< 2.3 UJ-	< 23 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-
	BP-08	0	160 J-	< 17 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-
		10	< 1.8 UJ-	< 18 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-
		20	< 3.7 UJ-	< 37 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-
		30	< 4.1 UJ-	< 41 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-
		40	< 3.4 UJ-	< 34 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-
	BP-09	0	460 J-	< 17 UJ-	< 1.7 UJ-	15 J+/-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	2.2 J+/-
		10	< 1.8 UJ-	< 18 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-
		20	< 3.3 UJ-	< 33 UJ-	< 3.3 UJ-	< 3.3 UJ-	< 3.3 UJ-	< 3.3 UJ-	< 3.3 UJ-	< 3.3 UJ-
		30	< 4.6 UJ-	< 46 UJ-	< 4.6 UJ-	< 4.6 UJ-	< 4.6 UJ-	< 4.6 UJ-	< 4.6 UJ-	< 4.6 UJ-
		40	< 3.5 UJ-	< 35 UJ-	4.7 J-	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-
	BP-10	0	240 J-	< 17 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-
		10	< 1.8 UJ-	< 18 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-
		20	< 1.8 UJ-	< 18 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-
		30	< 3.4 UJ-	< 34 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-
		40	< 5.6 UJ-	< 56 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-

All results in µg/kg.

TABLE D1-5
ORGANOCHLORINE PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Endrin aldehyde	Endrin ketone	gamma-Chlordane	Heptachlor	Heptachlor epoxide	Lindane	Methoxychlor	Toxaphene
26a	EB-1	5	< 5 UJ	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		10	< 5 UJ	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		20	< 5 UJ	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		30	< 5 UJ	< 5	< 5	< 5	< 5	15	< 20	< 60
		35	< 5 UJ	< 5	< 5	< 5	< 5	17	< 20	< 60
	EB-2	5	< 5 UJ	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		10	< 5 UJ	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		20	< 5 UJ	< 5	< 5	< 5	< 5	5.7	< 20	< 60
		30	< 5 UJ	< 5	< 5	< 5	< 5	18	< 20	< 60
		35	< 5 UJ	< 5	< 5	< 5	< 5	8.7	< 20	< 60
	EB-3	5	< 5 UJ	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		10	< 5 UJ	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		20	< 5 UJ	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	16 J-	< 20 UJ	< 60 UJ
		35	< 5 UJ	< 5	< 5	< 5	< 5	10	< 20	< 60
	EB-7	5	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		10	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		20	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		30	< 5	< 5	< 5	< 5	< 5	22	< 20	< 60
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
	EB-8	5	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 20 UJ	< 60 UJ
		10	< 5 UJ	< 5	< 5	< 5	< 5	< 5	< 20 UJ	< 60
		20	< 5 UJ	< 5	< 5	< 5	< 5	< 5	< 20 UJ	< 60
		30	< 5 UJ	< 5	< 5	< 5	< 5	< 5	< 20 UJ	< 60
		35	< 5 UJ	< 5	< 5	< 5	< 5	5.3	< 20 UJ	< 60
26b	EB-3	0.5	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		25	< 5	< 5	< 5	< 5	< 5	5	< 20	< 60
	EB-7	0.5	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		25	< 5	< 5	< 5	< 5	< 5	6	< 20	< 60
	EB-8	0.5	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60

TABLE D1-5
ORGANOCHLORINE PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Endrin aldehyde	Endrin ketone	gamma-Chlordane	Heptachlor	Heptachlor epoxide	Lindane	Methoxychlor	Toxaphene
26b	PEB-11	0.5	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		35	< 5	< 5	< 5	< 5	< 5	7.7 J+	< 20	< 60
	PEB-13	0.5	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
	PEB-17	0.5	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
	PEB-18	0.5	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
	PEB-9	0.5	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 20	< 60
36	BP-01	0	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 3.4 U	< 70 U
		10	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 3.5 U	< 70 U
		20	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 3.4 U	< 70 U
		30	< 2.9 U	< 2.9 U	< 2.9 U	< 2.9 U	< 2.9 U	< 2.9 U	< 5.7 U	< 120 U
		40	< 2.2 U	< 2.2 U	< 2.2 U	< 2.2 U	< 2.2 U	7.3	< 4.3 U	< 86 U
	BP-02	0	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 3.4 U	< 68 U
		10	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 3.4 U	< 70 U
		20	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 3.5 U	< 70 U
		30	< 3.7 U	< 3.7 U	< 3.7 U	< 3.7 U	< 3.7 U	< 3.7 U	< 7.2 U	< 150 U
		40	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 6.3 U	< 130 U
	BP-03	0	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 3.4 U	< 68 U
		10	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 3.6 U	< 74 U
		20	< 2.6 U	< 2.6 U	< 2.6 U	< 2.6 U	< 2.6 U	< 2.6 U	< 5 U	< 100 U
		30	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 6.1 U	< 120 U

TABLE D1-5
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DVSR	Location	Depth (ft bgs)	Endrin aldehyde	Endrin ketone	gamma-Chlordane	Heptachlor	Heptachlor epoxide	Lindane	Methoxychlor	Toxaphene
36	BP-04	0	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 3.3 U	< 68 U
		10	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 3.5 U	< 71 U
		20	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 3.4 U	< 69 U
		30	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	16	< 6.3 U	< 130 U
	BP-05	0	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 3.3 U	< 68 U
		10	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 3.6 U	< 72 UJ
		20	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 3.5 U	< 70 UJ
		30	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	< 3.3 U	16	< 6.4 U	< 130 UJ
		40	< 4 U	< 4 U	< 4 U	< 4 U	< 4 U	5	28	< 160 UJ
	BP-06	0	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 3.3 U	< 68 U
		10	< 3.1 U	< 3.1 U	< 3.1 U	< 3.1 U	< 3.1 U	< 3.1 U	< 6 UJ	< 120 U
		20	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 3.4 U	< 69 U
		30	< 3.4 U	< 3.4 U	< 3.4 U	< 3.4 U	< 3.4 U	< 3.4 U	< 6.6 U	< 130 U
		40	< 4 U	< 4 U	< 4 U	< 4 U	< 4 U	< 4 U	< 7.7 U	< 160 U
	BP-07	0	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 1.7 U	< 3.4 U	< 68 U
		10	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 1.9 U	< 3.6 U	< 73 U
		20	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 1.8 U	< 3.5 U	< 70 U
		30	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 3.2 U	< 6.2 U	< 130 U
		40	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 2.3 UJ-	< 4.4 UJ-	< 89 UJ-
	BP-08	0	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 3.3 UJ-	< 68 UJ-
		10	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 3.6 UJ-	< 72 UJ-
		20	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 3.7 UJ-	< 7.1 UJ-	< 140 UJ-
		30	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 4.1 UJ-	< 8.1 UJ-	< 160 UJ-
		40	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 6.7 UJ-	< 140 UJ-
	BP-09	0	< 1.7 UJ-	< 1.7 UJ-	11 J+/-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 3.3 UJ-	< 68 UJ-
		10	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	11 J+/-	< 72 UJ-
		20	< 3.3 UJ-	< 3.3 UJ-	< 3.3 UJ-	< 3.3 UJ-	< 3.3 UJ-	< 3.3 UJ-	34 J+/-	< 130 UJ-
		30	< 4.6 UJ-	< 4.6 UJ-	< 4.6 UJ-	< 4.6 UJ-	< 4.6 UJ-	< 4.6 UJ-	44 J+/-	< 180 UJ-
		40	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-	< 3.5 UJ-	< 6.8 UJ-	< 140 UJ-
	BP-10	0	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 1.7 UJ-	< 3.3 UJ-	< 68 UJ-
		10	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 3.4 UJ-	< 70 UJ-
		20	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 1.8 UJ-	< 3.5 UJ-	< 71 UJ-
		30	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 3.4 UJ-	< 6.5 UJ-	< 130 UJ-
		40	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 5.6 UJ-	< 11 UJ-	< 220 UJ-

All results in µg/kg.

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Aspon	Atrazine	Azinphos-ethyl	Azinphos-methyl	Bidrin	Carbophenothion	Carbophenothion-methyl	Chlorfenvinfos
26a	EB-7	5				< 5				
		10				< 5				
		20				< 5				
		30				< 5				
		35				< 5				
	EB-8	5				< 5				
		10				< 5				
		20				< 5				
		30				< 5				
		35				< 5				
26b	EB-3	25	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.085 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
		35	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.085 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
	EB-7	25	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
		35	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
	EB-8	25	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
		35	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
	PEB-11	25	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.085 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
		35	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.085 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
	PEB-13	25	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
		35	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
	PEB-17	25	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.085 UJ	< 0.1 UJ	< 0.1 UJ		< 0.1 UJ
		35	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.085 UJ	< 0.1 UJ	< 0.1 UJ		< 0.1 UJ
	PEB-18	25	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.085 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
		35	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
	PEB-9	25	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
		35	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ		< 0.01 UJ
36	BP-01	0			< 34 UJ-	< 13 UJ-		< 34 UJ-	< 34 UJ-	
		10			< 35 UJ	< 14 U		< 35 UJ	< 35 UJ	
		30			< 57 UJ	< 22 U		< 57 UJ	< 57 UJ	
	BP-02	0			< 34 UJ	< 13 U		< 34 UJ	< 34 UJ	
		10			< 34 UJ	< 14 U		< 34 UJ	< 34 UJ	
		30			< 72 UJ	< 29 U		< 72 UJ	< 72 UJ	
		40			< 63 UJ	< 25 U		< 63 UJ	< 63 UJ	
	BP-03	0			< 34 UJ	< 13 UJ		< 34 UJ	< 34 UJ	
		10			< 36 UJ	< 14 UJ		< 36 UJ	< 36 UJ	
		30			< 61 UJ	< 24 UJ		< 61 UJ	< 61 UJ	

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Aspon	Atrazine	Azinphos-ethyl	Azinphos-methyl	Bidrin	Carbophenothion	Carbophenothion-methyl	Chlorfenvinfos
36	BP-04	0			< 33 UJ	< 13 UJ		< 33 UJ	< 33 UJ	
		10			< 35 UJ	< 14 UJ		< 35 UJ	< 35 UJ	
		30			< 63 UJ	< 25 U		< 63 UJ	< 63 UJ	
	BP-05	0			< 33 UJ	< 13 U		< 33 UJ	< 33 UJ	
		10			< 36 UJ	< 14 U		< 36 UJ	< 36 UJ	
		30			< 64 UJ	< 25 U		< 64 UJ	< 64 UJ	
		40			< 77 UJ	< 31 U		< 77 UJ	< 77 UJ	
	BP-06	0			< 33 UJ	< 13 U		< 33 U	< 33 U	
		10			< 60 UJ	< 24 U		< 60 U	< 60 U	
		30			< 66 UJ	< 26 U		< 66 U	< 66 U	
		40			< 77 UJ	< 30 U		< 77 U	< 77 U	
	BP-07	0			< 34 UJ	< 13 U		< 34 U	< 34 U	
		10			< 36 UJ-	< 14 UJ-		< 36 UJ-	< 36 UJ-	
		30			< 62 UJ	< 25 U		< 62 U	< 62 U	
		40			< 44 UJ-	< 17 UJ-		< 44 UJ-	< 44 UJ-	
	BP-08	0			< 33 UJ-	< 13 UJ-		< 33 UJ-	< 33 UJ-	
		10			< 36 UJ-	< 14 UJ-		< 36 UJ-	< 36 UJ-	
		30			< 81 UJ-	< 32 UJ-		< 81 UJ-	< 81 UJ-	
		40			< 67 UJ-	< 26 UJ-		< 67 UJ-	< 67 UJ-	
	BP-09	0			< 33 UJ-	< 13 UJ-		< 33 UJ-	41 J-	
		10			< 36 UJ-	< 14 UJ-		< 36 UJ-	< 36 UJ-	
		30			< 90 UJ-	< 71 UJ-		< 90 UJ-	< 90 UJ-	
		40			< 68 UJ-	< 27 UJ-		< 68 UJ-	< 68 UJ-	
	BP-10	0			< 33 UJ-	< 13 UJ-		< 33 UJ-	< 33 UJ-	
		10			< 34 UJ-	< 14 UJ-		< 34 UJ-	< 34 UJ-	
		30			< 65 UJ-	< 26 UJ-		< 65 UJ-	< 65 UJ-	
		40			< 110 UJ-	< 43 UJ-		< 110 UJ-	< 110 UJ-	

All results in µg/kg.

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Chlorpyrifos	Chlorpyrophos methyl ester	Coumaphos	Crotoxyphos	Demeton	Demeton-O	Demeton-S	Diazinon
26a	EB-7	5	< 5		< 5		< 5			< 5
		10	< 5		< 5		< 5			< 5
		20	< 5		< 5		< 5			< 5
		30	< 5		< 5		< 5			< 5
		35	< 5		< 5		< 5			< 5
	EB-8	5	< 5		< 5		< 5			< 5
		10	< 5		< 5		< 5			< 5
		20	< 5		< 5		< 5			< 5
		30	< 5		< 5		< 5			< 5
		35	< 5		< 5		< 5			< 5
26b	EB-3	25	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	EB-7	25	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	EB-8	25	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-11	25	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-13	25	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-17	25	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-18	25	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-9	25	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.1 UJ	< 0.22 UJ	< 0.1 UJ		< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
36	BP-01	0	< 13 UJ-		< 13 UJ-			< 13 UJ-	< 13 UJ-	< 13 UJ-
		10	< 14 U		< 14 U			< 14 U	< 14 UJ	< 14 UJ
		30	< 22 U		< 22 U			< 22 U	< 22 UJ	< 22 UJ
	BP-02	0	< 13 U		< 13 U			< 13 U	< 13 UJ	< 13 UJ
		10	< 14 U		< 14 U			< 14 U	< 14 UJ	< 14 UJ
		30	< 29 U		< 29 U			< 29 U	< 29 UJ	< 29 UJ
		40	< 25 U		< 25 U			< 25 U	< 25 UJ	< 25 UJ
	BP-03	0	< 13 U		< 13 U			< 13 U	< 13 UJ	< 13 U
		10	< 14 U		< 14 U			< 14 U	< 14 UJ	< 14 U
		30	< 24 U		< 24 U			< 24 U	< 24 UJ	< 24 U

TABLE D1-6
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DVSR	Location	Depth (ft bgs)	Chlorpyrifos	Chlorpyrophos methyl ester	Coumaphos	Crotoxyphos	Demeton	Demeton-O	Demeton-S	Diazinon
36	BP-04	0	< 13 U		< 13 U			< 13 U	< 13 UJ	< 13 U
		10	< 14 U		< 14 U			< 14 U	< 14 UJ	< 14 U
		30	< 25 U		< 25 U			< 25 U	< 25 UJ	< 25 U
	BP-05	0	< 13 U		< 13 U			< 13 U	< 13 UJ	< 13 U
		10	< 14 U		< 14 U			< 14 U	< 14 UJ	< 14 U
		30	< 25 U		< 25 U			< 25 U	< 25 UJ	< 25 U
		40	< 31 U		< 31 U			< 31 U	< 31 UJ	< 31 U
	BP-06	0	< 13 UJ		< 13 U			< 13 U	< 13 UJ	< 13 UJ
		10	< 24 UJ		< 24 U			< 24 U	< 24 UJ	< 24 UJ
		30	< 26 UJ		< 26 U			< 26 U	< 26 UJ	< 26 UJ
		40	< 30 UJ		< 30 U			< 30 U	< 30 UJ	< 30 UJ
	BP-07	0	< 13 UJ		< 13 U			< 13 U	< 13 UJ	< 13 UJ
		10	< 14 UJ-		< 14 UJ-			< 14 UJ-	< 14 UJ-	< 14 UJ-
		30	< 25 UJ		< 25 U			< 25 U	< 25 UJ	< 25 UJ
		40	< 17 UJ-		< 17 UJ-			< 17 UJ-	< 17 UJ-	< 17 UJ-
	BP-08	0	< 13 UJ-		< 13 UJ-			< 13 UJ-	< 13 UJ-	< 13 UJ-
		10	< 14 UJ-		< 14 UJ-			< 14 UJ-	< 14 UJ-	< 14 UJ-
		30	< 32 UJ-		< 32 UJ-			< 32 UJ-	< 32 UJ-	< 32 UJ-
		40	< 26 UJ-		< 26 UJ-			< 26 UJ-	< 26 UJ-	< 26 UJ-
	BP-09	0	< 13 UJ-		< 13 UJ-			< 13 UJ-	< 13 UJ-	< 13 UJ-
		10	< 14 UJ-		< 14 UJ-			< 14 UJ-	< 14 UJ-	< 14 UJ-
		30	< 71 UJ-		< 71 UJ-			< 71 UJ-	23 J+/-	< 71 UJ-
		40	< 27 UJ-		< 27 UJ-			< 27 UJ-	< 27 UJ-	< 27 UJ-
	BP-10	0	< 13 UJ-		< 13 UJ-			< 13 UJ-	< 13 UJ-	< 13 UJ-
		10	< 14 UJ-		< 14 UJ-			< 14 UJ-	< 14 UJ-	< 14 UJ-
		30	< 26 UJ-		< 26 UJ-			< 26 UJ-	< 26 UJ-	< 26 UJ-
		40	< 43 UJ-		< 43 UJ-			< 43 UJ-	< 43 UJ-	< 43 UJ-

All results in µg/kg.

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Dichlorfenthion	Dichlorvos	Dimethoate	Dioxathion	Disulfoton	Ethion	Ethoprophos	Ethyl p-nitrophenyl phenylphosphorothioate
26a	EB-7	5		< 5			< 5		< 5	
		10		< 5			< 5		< 5	
		20		< 5			< 5		< 5	
		30		< 5			< 5		< 5	
		35		< 5			< 5		< 5	
	EB-8	5		< 5			< 5		< 5	
		10		< 5			< 5		< 5	
		20		< 5			< 5		< 5	
		30		< 5			< 5		< 5	
		35		< 5			< 5		< 5	
26b	EB-3	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
	EB-7	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
	EB-8	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
	PEB-11	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
	PEB-13	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
	PEB-17	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
	PEB-18	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
	PEB-9	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.07 UJ
36	BP-01	0		< 13 UJ-	< 13 UJ-		< 13 UJ-		< 13 UJ-	< 13 UJ-
		10		< 14 UJ	< 14 U		< 14 UJ		< 14 U	< 14 U
		30		< 22 UJ	< 22 U		< 22 UJ		< 22 U	< 22 U
	BP-02	0		< 13 UJ	< 13 U		< 13 UJ		< 13 U	< 13 U
		10		< 14 UJ	< 14 U		< 14 UJ		< 14 U	< 14 U
		30		< 29 UJ	< 29 U		< 29 UJ		< 29 U	< 29 U
		40		< 25 UJ	< 25 U		< 25 UJ		< 25 U	< 25 U
	BP-03	0		< 13 UJ	< 13 U		< 13 U		< 13 U	< 13 UJ
		10		< 14 UJ	< 14 U		< 14 U		< 14 U	< 14 UJ
		30		< 24 UJ	< 24 U		< 24 U		< 24 U	< 24 UJ

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Dichlorfenthion	Dichlorvos	Dimethoate	Dioxathion	Disulfoton	Ethion	Ethoprophos	Ethyl p-nitrophenyl phenylphosphorothioate
36	BP-04	0		< 13 UJ	< 13 U		< 13 U		< 13 U	< 13 UJ
		10		< 14 UJ	< 14 U		< 14 U		< 14 U	< 14 UJ
		30		< 25 U	< 25 U		< 25 UJ		< 25 U	< 25 U
	BP-05	0		< 13 U	< 13 U		< 13 UJ		< 13 U	< 13 U
		10		< 14 U	< 14 U		< 14 UJ		< 14 U	< 14 U
		30		< 25 U	< 25 U		< 25 UJ		< 25 U	< 25 U
		40		< 31 U	< 31 U		< 31 UJ		< 31 U	< 31 U
	BP-06	0		< 13 U	< 13 U		< 13 U		< 13 U	< 13 U
		10		< 24 U	< 24 U		< 24 U		< 24 U	< 24 U
		30		< 26 U	< 26 U		< 26 U		< 26 U	< 26 U
		40		< 30 U	< 30 U		< 30 U		< 30 U	< 30 U
	BP-07	0		< 13 U	< 13 U		< 13 U		< 13 U	< 13 U
		10		< 14 UJ-	< 14 UJ-		< 14 UJ-		< 14 UJ-	< 14 UJ-
		30		< 25 U	< 25 U		< 25 U		< 25 U	< 25 U
		40		< 17 UJ-	< 17 UJ-		< 17 UJ-		< 17 UJ-	< 17 UJ-
	BP-08	0		< 13 UJ-	< 13 UJ-		< 13 UJ-		< 13 UJ-	< 13 UJ-
		10		< 14 UJ-	< 14 UJ-		< 14 UJ-		< 14 UJ-	< 14 UJ-
		30		< 32 UJ-	< 32 UJ-		< 32 UJ-		< 32 UJ-	< 32 UJ-
		40		< 26 UJ-	< 26 UJ-		< 26 UJ-		< 26 UJ-	< 26 UJ-
	BP-09	0		< 13 UJ-	< 13 UJ-		< 13 UJ-		< 13 UJ-	< 13 UJ-
		10		< 14 UJ-	< 14 UJ-		< 14 UJ-		< 14 UJ-	< 14 UJ-
		30		2900 J+/-	< 71 UJ-		< 71 UJ-		< 71 UJ-	< 71 UJ-
		40		540 J-	< 27 UJ-		< 27 UJ-		< 27 UJ-	< 27 UJ-
	BP-10	0		< 13 UJ-	< 13 UJ-		< 13 UJ-		< 13 UJ-	< 13 UJ-
		10		< 14 UJ-	< 14 UJ-		< 14 UJ-		< 14 UJ-	< 14 UJ-
		30		< 26 UJ-	< 26 UJ-		< 26 UJ-		< 26 UJ-	< 26 UJ-
		40		< 43 UJ-	< 43 UJ-		< 43 UJ-		< 43 UJ-	< 43 UJ-

All results in µg/kg.

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Famphur	Fensulfothion	Fenthion	Fonofos	Hexamethylphosphoramide	Leptophos	Malathion	Merphos
26a	EB-7	5		< 10	< 5				< 5	< 5
		10		< 5	< 5				< 5	< 5
		20		< 10	< 5				< 5	< 5
		30		< 10	< 5				< 5	< 5
		35		< 10	< 5				< 5	< 5
	EB-8	5		< 10	< 5				< 5	< 5
		10		< 10	< 5				< 5	< 5
		20		< 10	< 5				< 5	< 5
		30		< 10	< 5				< 5	< 5
		35		< 10	< 5				< 5	< 5
26b	EB-3	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
	EB-7	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
	EB-8	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-11	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-13	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-17	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-18	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-9	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ
36	BP-01	0	< 13 UJ-		< 13 UJ-				< 13 UJ-	
		10	< 14 U		< 14 U				< 14 UJ	
		30	< 22 U		< 22 U				< 22 UJ	
	BP-02	0	< 13 U		< 13 U				< 13 UJ	
		10	< 14 U		< 14 U				< 14 UJ	
		30	< 29 U		< 29 U				< 29 UJ	
		40	< 25 U		< 25 U				< 25 UJ	
	BP-03	0	< 13 U		< 13 U				< 13 UJ	
		10	< 14 U		< 14 U				< 14 UJ	
		30	< 24 U		< 24 U				< 24 UJ	

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Famphur	Fensulfothion	Fenthion	Fonofos	Hexamethylphosphoramide	Leptophos	Malathion	Merphos
36	BP-04	0	< 13 U		< 13 U				< 13 UJ	
		10	< 14 U		< 14 U				< 14 UJ	
		30	< 25 U		< 25 U				< 25 U	
	BP-05	0	< 13 U		< 13 U				< 13 U	
		10	< 14 U		< 14 U				< 14 U	
		30	< 25 U		< 25 U				< 25 U	
		40	< 31 U		< 31 U				< 31 U	
	BP-06	0	< 13 U		< 13 UJ				< 13 UJ	
		10	< 24 U		< 24 UJ				< 24 UJ	
		30	< 26 U		< 26 UJ				< 26 UJ	
		40	< 30 U		< 30 UJ				< 30 UJ	
	BP-07	0	< 13 U		< 13 UJ				< 13 UJ	
		10	< 14 UJ-		< 14 UJ-				< 14 UJ-	
		30	< 25 U		< 25 UJ				< 25 UJ	
		40	< 17 UJ-		< 17 UJ-				< 17 UJ-	
	BP-08	0	< 13 UJ-		< 13 UJ-				< 13 UJ-	
		10	< 14 UJ-		< 14 UJ-				< 14 UJ-	
		30	< 32 UJ-		< 32 UJ-				< 32 UJ-	
		40	< 26 UJ-		< 26 UJ-				< 26 UJ-	
	BP-09	0	< 13 UJ-		< 13 UJ-				< 13 UJ-	
		10	< 14 UJ-		< 14 UJ-				< 14 UJ-	
		30	< 71 UJ-		< 71 UJ-				< 71 UJ-	
		40	< 27 UJ-		< 27 UJ-				< 27 UJ-	
	BP-10	0	< 13 UJ-		< 13 UJ-				< 13 UJ-	
		10	< 14 UJ-		< 14 UJ-				< 14 UJ-	
		30	< 26 UJ-		< 26 UJ-				< 26 UJ-	
		40	< 43 UJ-		< 43 UJ-				< 43 UJ-	

All results in µg/kg.

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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DVSR	Location	Depth (ft bgs)	Metathione	Methyl parathion	Mevinphos	Monocrotophos	Naled	O,O,O-Triethyl phosphorothioate	o,o-Diethyl o-pyrazinyl phosphorothioate	Parathion
26a	EB-7	5		< 5	< 5		< 5			
		10		< 5	< 5		< 5			
		20		< 5	< 5		< 5			
		30		< 5	< 5		< 5			
		35		< 5	< 5		< 5			
	EB-8	5		< 5	< 5		< 5			
		10		< 5	< 5		< 5			
		20		< 5	< 5		< 5			
		30		< 5	< 5		< 5			
		35		< 5	< 5		< 5			
26b	EB-3	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
	EB-7	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
	EB-8	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
	PEB-11	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
	PEB-13	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
	PEB-17	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
	PEB-18	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
	PEB-9	25	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
		35	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 1 UJ	< 0.05 UJ		< 0.1 UJ	< 0.07 UJ
36	BP-01	0		< 13 UJ-	< 13 UJ-		< 34 UJ-	< 13 UJ-		< 13 UJ-
		10		< 14 U	< 14 UJ		< 35 U	< 14 U		< 14 U
		30		< 22 U	< 22 UJ		< 57 U	< 22 U		< 22 U
	BP-02	0		< 13 U	< 13 UJ		< 34 U	< 13 U		< 13 U
		10		< 14 U	< 14 UJ		< 34 U	< 14 U		< 14 U
		30		< 29 U	< 29 UJ		< 72 U	< 29 U		< 29 U
		40		< 25 U	< 25 UJ		< 63 U	< 25 U		< 25 U
	BP-03	0		< 13 U	< 13 UJ		< 34 U	< 13 U		< 13 U
		10		< 14 U	< 14 UJ		< 36 U	< 14 U		< 14 U
		30		< 24 U	< 24 UJ		< 61 U	< 24 U		< 24 U

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Metathione	Methyl parathion	Mevinphos	Monocrotophos	Naled	O,O,O-Triethyl phosphorothioate	o,o-Diethyl o-pyrazinyl phosphorothioate	Parathion
36	BP-04	0		< 13 U	< 13 UJ		< 33 U	< 13 U		< 13 U
		10		< 14 U	< 14 UJ		< 35 U	< 14 U		< 14 U
		30		< 25 U	< 25 UJ		< 63 UJ	< 25 U		< 25 U
	BP-05	0		< 13 U	< 13 UJ		< 33 UJ	< 13 U		< 13 U
		10		< 14 U	< 14 UJ		< 36 UJ	< 14 U		< 14 U
		30		< 25 U	< 25 UJ		< 64 UJ	< 25 U		< 25 U
		40		< 31 U	< 31 UJ		< 77 UJ	< 31 U		< 31 U
	BP-06	0		< 13 U	< 13 UJ		< 33 UJ	< 13 UJ		< 13 U
		10		< 24 U	< 24 UJ		< 60 UJ	< 24 UJ		< 24 U
		30		< 26 U	< 26 UJ		< 66 UJ	< 26 UJ		< 26 U
		40		< 30 U	< 30 UJ		< 77 UJ	< 30 UJ		< 30 U
	BP-07	0		< 13 U	< 13 UJ		< 34 UJ	< 13 UJ		< 13 U
		10		< 14 UJ-	< 14 UJ-		< 36 UJ-	< 14 UJ-		< 14 UJ-
		30		< 25 U	< 25 UJ		< 62 UJ	< 25 UJ		< 25 U
		40		< 17 UJ-	< 17 UJ-		< 44 UJ-	< 17 UJ-		< 17 UJ-
	BP-08	0		< 13 UJ-	< 13 UJ-		< 33 UJ-	< 13 UJ-		< 13 UJ-
		10		< 14 UJ-	< 14 UJ-		< 36 UJ-	< 14 UJ-		< 14 UJ-
		30		< 32 UJ-	< 32 UJ-		< 81 UJ-	< 32 UJ-		< 32 UJ-
		40		< 26 UJ-	< 26 UJ-		< 67 UJ-	< 26 UJ-		< 26 UJ-
	BP-09	0		< 13 UJ-	< 13 UJ-		< 33 UJ-	< 13 UJ-		< 13 UJ-
		10		< 14 UJ-	< 14 UJ-		< 36 UJ-	14 J+/-		< 14 UJ-
		30		< 71 UJ-	< 71 UJ-		< 180 UJ-	37 J-		< 71 UJ-
		40		< 27 UJ-	52 J-		< 68 UJ-	< 27 UJ-		< 27 UJ-
	BP-10	0		< 13 UJ-	< 13 UJ-		< 33 UJ-	< 13 UJ-		< 13 UJ-
		10		< 14 UJ-	< 14 UJ-		< 34 UJ-	< 14 UJ-		< 14 UJ-
		30		< 26 UJ-	< 26 UJ-		< 65 UJ-	< 26 UJ-		< 26 UJ-
		40		< 43 UJ-	< 43 UJ-		< 110 UJ-	< 43 UJ-		< 43 UJ-

All results in µg/kg.

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Phorate	Phosmet	Phosphamidon	Ronnel	Simazine	Stirophos (tetrachlorovinphos)	Sulfotep	Sulprofos
26a	EB-7	5	< 5			< 5		< 5		< 5
		10	< 5			< 5		< 5		< 5
		20	< 5			< 5		< 5		< 5
		30	< 5			< 5		< 5		< 5
		35	< 5			< 5		< 5		< 5
	EB-8	5	< 5			< 5		< 5		< 5
		10	< 5			< 5		< 5		< 5
		20	< 5			< 5		< 5		< 5
		30	< 5			< 5		< 5		< 5
		35	< 5			< 5		< 5		< 5
26b	EB-3	25	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	EB-7	25	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	EB-8	25	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-11	25	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-13	25	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-17	25	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-18	25	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
	PEB-9	25	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
		35	< 0.05 UJ	< 0.5 UJ	< 0.1 UJ	< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ
36	BP-01	0	< 13 UJ-	< 70 UJ-		< 70 UJ-			< 13 UJ-	
		10	< 14 U	< 70 UJ		< 70 U			< 14 U	
		30	< 22 U	< 120 UJ		< 120 U			< 22 U	
	BP-02	0	< 13 U	< 68 UJ		< 68 U			< 13 U	
		10	< 14 U	< 70 UJ		< 70 U			< 14 U	
		30	< 29 U	< 150 UJ		< 150 U			< 29 U	
		40	< 25 U	< 130 UJ		< 130 U			< 25 U	
	BP-03	0	< 13 U	< 68 UJ		< 68 U			< 13 U	
		10	< 14 U	< 74 UJ		< 74 U			< 14 U	
		30	< 24 U	< 120 UJ		< 120 U			< 24 U	

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Phorate	Phosmet	Phosphamidon	Ronnel	Simazine	Stirophos (tetrachlorovinphos)	Sulfotep	Sulprofos
36	BP-04	0	< 13 U	< 68 UJ		< 68 U			< 13 U	
		10	< 14 U	< 71 UJ		< 71 U			< 14 U	
		30	< 25 U	< 130 UJ		< 130 UJ			< 25 UJ	
	BP-05	0	< 13 U	< 68 UJ		< 68 UJ			< 13 UJ	
		10	< 14 U	< 72 UJ		< 72 UJ			< 14 UJ	
		30	< 25 U	< 130 UJ		< 130 UJ			< 25 UJ	
		40	< 31 U	< 160 UJ		< 160 UJ			< 31 UJ	
	BP-06	0	< 13 U	< 68 UJ		< 68 UJ			< 13 UJ	
		10	< 24 U	< 120 UJ		< 120 UJ			< 24 UJ	
		30	< 26 U	< 130 UJ		< 130 UJ			< 26 UJ	
		40	< 30 U	< 160 UJ		< 160 UJ			< 30 UJ	
	BP-07	0	< 13 U	< 68 UJ		< 68 UJ			< 13 UJ	
		10	< 14 UJ-	< 73 UJ-		< 73 UJ-			< 14 UJ-	
		30	< 25 U	< 130 UJ		< 130 UJ			< 25 UJ	
		40	< 17 UJ-	< 89 UJ-		< 89 UJ-			< 17 UJ-	
	BP-08	0	< 13 UJ-	< 68 UJ-		< 68 UJ-			< 13 UJ-	
		10	< 14 UJ-	< 72 UJ-		< 72 UJ-			< 14 UJ-	
		30	< 32 UJ-	< 160 UJ-		< 160 UJ-			< 32 UJ-	
		40	< 26 UJ-	< 140 UJ-		< 140 UJ-			< 26 UJ-	
	BP-09	0	< 13 UJ-	< 68 UJ-		11 J-			< 13 UJ-	
		10	< 14 UJ-	< 72 UJ-		< 72 UJ-			< 14 UJ-	
		30	< 71 UJ-	< 180 UJ-		< 370 UJ-			< 71 UJ-	
		40	< 27 UJ-	< 140 UJ-		< 140 UJ-			< 27 UJ-	
	BP-10	0	< 13 UJ-	< 68 UJ-		< 68 UJ-			< 13 UJ-	
		10	< 14 UJ-	< 70 UJ-		< 70 UJ-			< 14 UJ-	
		30	< 26 UJ-	< 130 UJ-		< 130 UJ-			< 26 UJ-	
		40	< 43 UJ-	< 220 UJ-		< 220 UJ-			< 43 UJ-	

All results in µg/kg.

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Tepp	Terbufos	Tetrachlorvinphos (Stirophos)	Tokuthion	Tokuthion (Prototthiofos)	Trichlorfon	Trichloronate	Tri-o-Cresyl Phosphate (TOCP)
26a	EB-7	5				< 5			< 5	
		10				< 5			< 5	
		20				< 5			< 5	
		30				< 5			< 5	
		35				< 5			< 5	
	EB-8	5				< 5			< 5	
		10				< 5			< 5	
		20				< 5			< 5	
		30				< 5			< 5	
		35				< 5			< 5	
26b	EB-3	25	< 0.08 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
		35	< 0.08 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
	EB-7	25	< 0.05 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
		35	< 0.05 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
	EB-8	25	< 0.05 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
		35	< 0.05 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
	PEB-11	25	< 0.08 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
		35	< 0.08 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
	PEB-13	25	< 0.05 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
		35	< 0.05 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
	PEB-17	25	< 0.08 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
		35	< 0.08 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
	PEB-18	25	< 0.05 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
		35	< 0.05 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
	PEB-9	25	< 0.05 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
		35	< 0.05 UJ	< 0.1 UJ			< 0.05 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ
36	BP-01	0			< 13 UJ-					
		10			< 14 U					
		30			< 22 U					
	BP-02	0			< 13 U					
		10			< 14 U					
		30			< 29 U					
		40			< 25 U					
	BP-03	0			< 13 UJ					
		10			< 14 UJ					
		30			< 24 UJ					

TABLE D1-6
ORGANOPHOSPHOROUS PESTICIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Tepp	Terbufos	Tetrachlorvinphos (Stirophos)	Tokuthion	Tokuthion (Prototthiofos)	Trichlorfon	Trichloronate	Tri-o-Cresyl Phosphate (TOCP)
36	BP-04	0			< 13 UJ					
		10			< 14 UJ					
		30			< 25 U					
	BP-05	0			< 13 U					
		10			< 14 U					
		30			< 25 U					
		40			< 31 U					
	BP-06	0			< 13 UJ					
		10			< 24 UJ					
		30			< 26 UJ					
		40			< 30 UJ					
	BP-07	0			< 13 UJ					
		10			< 14 UJ-					
		30			< 25 UJ					
		40			< 17 UJ-					
	BP-08	0			< 13 UJ-					
		10			< 14 UJ-					
		30			< 32 UJ-					
		40			< 26 UJ-					
	BP-09	0			< 13 UJ-					
		10			< 14 UJ-					
		30			< 71 UJ-					
		40			< 27 UJ-					
	BP-10	0			< 13 UJ-					
		10			< 14 UJ-					
		30			< 26 UJ-					
		40			< 43 UJ-					

All results in µg/kg.

TABLE D1-7
POLYCHLORINATED BIPHENYLS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
36	BP-01	0	< 34 UJ	< 34 UJ	< 34 UJ	< 34 UJ	< 34 UJ	< 34 UJ	< 34 UJ
		10	< 35 UJ	< 35 UJ	< 35 UJ	< 35 UJ	< 35 UJ	< 35 UJ	< 35 UJ
		30	< 57 UJ	< 57 UJ	< 57 UJ	< 57 UJ	< 57 UJ	< 57 UJ	< 57 UJ
	BP-02	0	< 34 UJ	< 34 UJ	< 34 UJ	< 34 UJ	< 34 UJ	< 34 UJ	< 34 UJ
		10	< 34 UJ	< 34 UJ	< 34 UJ	< 34 UJ	< 34 UJ	< 34 UJ	< 34 UJ
		30	< 72 U	< 72 U	< 72 U	< 72 U	< 72 U	< 72 U	< 72 U
		40	< 63 U	< 63 U	< 63 U	< 63 U	< 63 U	< 63 U	< 63 U
	BP-03	0	< 34 U	< 34 U	< 34 U	< 34 U	< 34 U	< 34 U	< 34 U
		10	< 36 U	< 36 U	< 36 U	< 36 U	< 36 U	< 36 U	< 36 U
		30	< 61 U	< 61 U	< 61 U	< 61 U	< 61 U	< 61 U	< 61 U
	BP-04	0	< 33 U	< 33 U	< 33 U	< 33 U	< 33 U	< 33 U	< 33 U
		10	< 35 U	< 35 U	< 35 U	< 35 U	< 35 U	< 35 U	< 35 U
		30	< 63 U	< 63 U	< 63 U	< 63 U	< 63 U	< 63 U	< 63 U
	BP-05	0	< 33 U	< 33 U	< 33 U	< 33 U	< 33 U	< 33 U	< 33 U
		10	< 36 U	< 36 U	< 36 U	< 36 U	< 36 U	< 36 U	< 36 U
		30	< 64 U	< 64 U	< 64 U	< 64 U	< 64 U	< 64 U	< 64 U
		40	< 77 U	< 77 U	< 77 U	< 77 U	< 77 U	< 77 U	< 77 U
	BP-06	0	< 33 U	< 33 U	< 33 U	< 33 U	< 33 U	< 33 U	< 33 U
		10	< 60 U	< 60 U	< 60 U	< 60 U	< 60 U	< 60 U	< 60 U
		30	< 66 U	< 66 U	< 66 U	< 66 U	< 66 U	< 66 U	< 66 U
		40	< 77 U	< 77 U	< 77 U	< 77 U	< 77 U	< 77 U	< 77 U
	BP-07	0	< 34 U	< 34 U	< 34 U	< 34 U	< 34 U	< 34 U	< 34 U
		10	< 36 U	< 36 U	< 36 U	< 36 U	< 36 U	< 36 U	< 36 U
		30	< 62 U	< 62 U	< 62 U	< 62 U	< 62 U	< 62 U	< 62 U
		40	< 44 UJ-	< 44 UJ-	< 44 UJ-	< 44 UJ-	< 44 UJ-	57 J-	< 44 UJ-
	BP-08	0	< 33 UJ-	< 33 UJ-	< 33 UJ-	< 33 UJ-	< 33 UJ-	< 33 UJ-	< 33 UJ-
		10	< 36 UJ-	< 36 UJ-	< 36 UJ-	< 36 UJ-	< 36 UJ-	< 36 UJ-	< 36 UJ-
		30	< 81 UJ-	< 81 UJ-	< 81 UJ-	< 81 UJ-	< 81 UJ-	< 81 UJ-	< 81 UJ-
		40	< 67 UJ-	< 67 UJ-	< 67 UJ-	< 67 UJ-	< 67 UJ-	< 67 UJ-	< 67 UJ-
	BP-09	0	< 33 UJ-	< 33 UJ-	< 33 UJ-	< 33 UJ-	< 33 UJ-	< 33 UJ-	< 33 UJ-
		10	< 36 UJ-	< 36 UJ-	< 36 UJ-	< 36 UJ-	< 36 UJ-	< 36 UJ-	< 36 UJ-
		30	< 90 UJ-	< 90 UJ-	< 90 UJ-	< 90 UJ-	< 90 UJ-	< 90 UJ-	< 90 UJ-
		40	< 68 UJ-	< 68 UJ-	< 68 UJ-	< 68 UJ-	< 68 UJ-	< 68 UJ-	< 68 UJ-
	BP-10	0	< 33 UJ-	< 33 UJ-	< 33 UJ-	< 33 UJ-	< 33 UJ-	< 33 UJ-	< 33 UJ-
		10	< 34 UJ-	< 34 UJ-	< 34 UJ-	< 34 UJ-	< 34 UJ-	< 34 UJ-	< 34 UJ-
		30	< 65 UJ-	< 65 UJ-	< 65 UJ-	< 65 UJ-	< 65 UJ-	< 65 UJ-	< 65 UJ-
		40	< 110 UJ-	< 110 UJ-	< 110 UJ-	< 110 UJ-	< 110 UJ-	< 110 UJ-	< 110 UJ-

All results in µg/kg.

TABLE D1-8
POLYNUCLEAR AROMATIC HYDROCARBONS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	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	Naphthalene	Phenanthrene	Pyrene
10a/13a	B-15	0	< 500	< 500	< 500	< 500	< 500		< 500		< 500	< 500	< 500	< 10	< 500	< 500
		5	< 500	< 500	< 500	< 500	< 500		< 500		< 500	< 500	< 500	< 10	< 500	< 500
		20	< 500	< 500	< 500	< 500	< 500		< 500		< 500	< 500	< 500	< 10	< 500	< 500
		30	< 500	< 500	< 500	< 500	< 500		< 500		< 500	< 500	< 500	< 10	< 500	< 500
	B-16	0	< 500	< 500	< 500	< 500	< 500		< 500		< 500	< 500	< 500	< 10	< 500	< 500
		5	< 500	< 500	< 500	< 500	< 500		< 500		< 500	< 500	< 500	< 10	< 500	< 500
		20	< 500	< 500	< 500	< 500	< 500		< 500		< 500	< 500	< 500	< 10	< 500	< 500
		30	< 500	< 500	< 500	< 500	< 500		< 500		< 500	< 500	< 500	< 10	< 500	< 500
26a	EB-1	5												30 J+		
		10	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
		20												< 25 UJ		
		30												< 25		
		35												< 25 UJ		
	EB-2	5												< 25		
		10	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
		20												< 25 UJ		
		30												< 25 UJ		
		35												R		
	EB-3	5												< 25 UJ		
		10												< 25 UJ		
		20												< 25 UJ		
		30												< 25 UJ		
		35	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25 UJ	< 330	< 330
	EB-7	5												R		
		10												R		
		20												R		
		30	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
		35												34 J-		
	EB-8	5												R		
		10												R		
		20	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
		30												R		
		35												R		

TABLE D1-8
POLYNUCLEAR AROMATIC HYDROCARBONS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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DVSR	Location	Depth (ft bgs)	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	Naphthalene	Phenanthrene	Pyrene
26b	EB-3	0.5	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25 UJ	< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25 UJ	< 330	< 330
		35												< 25 UJ		
	EB-7	0.5	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
	EB-8	0.5	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
	PEB-11	0.5	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25 UJ	< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25 UJ	< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25 UJ	< 330	< 330
	PEB-13	0.5	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
	PEB-17	0.5	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
	PEB-18	0.5	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25 UJ	< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25 UJ	< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25 UJ	< 330	< 330
	PEB-9	0.5	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 25	< 330	< 330
36	BP-01	0	< 52 U	< 100 UJ	< 31 U	< 16 U	< 16 UJ	< 16 U	< 31 U	< 16 U	< 16 U	< 31 U	< 16 UJ	< 340 U	< 31 U	< 31 U
		10	< 52 U	< 100 U	< 31 U	< 16 U	< 16 UJ	< 16 U	< 31 U	< 16 UJ	< 16 U	< 31 U	< 16 UJ	< 350 U	< 31 U	< 31 U
		30	< 86 U	< 170 U	< 52 U	< 26 U	< 26 UJ	< 26 U	< 52 U	< 26 UJ	< 26 U	< 52 U	< 26 UJ	< 570 U	< 52 U	< 52 U

TABLE D1-8
POLYNUCLEAR AROMATIC HYDROCARBONS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	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	Naphthalene	Phenanthrene	Pyrene
36	BP-02	0	< 51 U	< 100 U	< 31 U	< 15 U	< 15 UJ	< 15 U	< 31 U	< 15 UJ	< 15 U	< 31 U	< 15 UJ	< 340 U	< 31 U	< 31 U
		10	< 52 U	< 100 U	< 31 U	< 16 U	< 16 UJ	< 16 U	< 31 U	< 16 UJ	< 16 U	< 31 U	< 16 UJ	< 340 U	< 31 U	< 31 U
		30	< 110 U	< 220 U	< 66 U	< 33 U	< 33 UJ	< 33 U	< 66 U	< 33 UJ	< 33 U	< 66 U	< 33 UJ	< 720 U	< 66 U	< 66 U
		40	< 96 U	< 190 U	< 58 U	< 29 U	< 29 UJ	< 29 U	< 58 U	< 29 UJ	< 29 U	< 58 U	< 29 UJ	< 630 U	< 58 U	< 58 U
	BP-03	0	< 51 U	< 100 U	< 31 U	< 15 U	< 15 UJ	< 15 U	< 31 U	< 15 UJ	< 15 U	< 31 U	< 15 UJ	< 340 U	< 31 U	< 31 U
		10	< 55 U	< 110 U	< 33 U	< 17 U	< 17 UJ	< 17 U	< 33 U	< 17 U	< 17 U	< 33 U	< 17 UJ	< 360 U	< 33 U	< 33 U
		30	< 93 U	< 190 U	< 56 U	< 28 U	< 28 UJ	< 28 U	< 56 U	< 28 U	< 28 U	< 56 U	< 28 UJ	< 610 U	< 56 U	< 56 U
	BP-04	0	< 51 U	< 100 U	< 30 U	< 15 U	< 15 UJ	< 15 U	< 30 U	< 15 U	< 15 U	< 30 U	< 15 UJ	< 330 U	< 30 U	< 30 U
		10	< 53 U	< 110 U	< 32 U	< 16 U	< 16 UJ	< 16 U	< 32 U	< 16 U	< 16 U	< 32 U	< 16 UJ	< 350 U	< 32 U	< 32 U
		30	< 95 U	< 190 U	< 57 U	< 29 U	< 29 UJ	< 29 U	< 57 U	< 29 U	< 29 U	< 57 U	< 29 UJ	< 630 U	< 57 U	< 57 U
	BP-05	0	< 51 U	< 100 U	< 30 U	< 15 U	< 15 UJ	< 15 U	< 30 U	< 15 U	< 15 U	< 30 U	< 15 UJ	< 330 U	< 30 U	< 30 U
		10	< 54 U	< 110 U	< 32 U	< 16 U	< 16 UJ	< 16 U	< 32 U	< 16 U	< 16 U	< 32 U	< 16 UJ	< 360 U	< 32 U	< 32 U
		30	< 97 U	< 190 U	< 58 U	< 29 U	< 29 UJ	< 29 U	< 58 U	< 29 U	< 29 U	< 58 U	< 29 UJ	< 640 U	< 58 U	< 58 U
		40	< 120 U	< 230 U	< 70 U	< 35 U	< 35 UJ	< 35 U	< 70 U	< 35 U	< 35 U	< 70 U	< 35 UJ	< 770 U	< 70 U	< 70 U
	BP-06	0	< 51 U	< 100 U	< 30 U	< 15 U	< 15 U	< 15 U	< 30 U	< 15 U	< 15 U	< 30 U	< 15 UJ	< 330 U	< 30 U	< 30 U
		10	< 91 U	< 180 U	< 54 U	< 27 U	< 27 U	< 27 U	< 54 U	< 27 U	< 27 U	< 54 U	< 27 UJ	< 600 U	< 54 U	< 54 U
		30	< 100 U	< 200 U	< 60 U	< 30 U	< 30 U	< 30 U	< 60 U	< 30 U	< 30 U	< 60 U	< 30 UJ	< 660 U	< 60 U	< 60 U
		40	< 120 U	< 230 U	< 70 U	< 35 U	< 35 U	< 35 U	< 70 U	< 35 U	< 35 U	< 70 U	< 35 UJ	< 770 U	< 70 U	< 70 U
	BP-07	0	< 51 U	< 100 U	< 30 U	< 15 U	< 15 U	< 15 U	< 30 U	< 15 U	< 15 U	< 30 U	< 15 UJ	< 340 U	< 30 U	< 30 U
		10	< 54 U	< 110 U	< 33 U	< 16 U	< 16 U	< 16 U	< 33 U	< 16 U	< 16 U	< 33 U	< 16 UJ	< 360 U	< 33 U	< 33 U
		30	< 94 U	< 190 U	< 57 U	< 28 U	< 28 U	< 28 U	< 57 U	< 28 U	< 28 U	< 57 U	< 28 UJ	< 620 U	< 57 U	< 57 U
		40	< 66 UJ-	< 130 UJ-	< 40 UJ-	< 20 UJ-	< 20 UJ-	< 20 UJ-	< 40 UJ-	< 20 UJ-	< 20 UJ-	< 40 UJ-	< 20 UJ-	< 440 UJ-	< 40 UJ-	< 40 UJ-
	BP-08	0	< 51 UJ-	< 100 UJ-	< 30 UJ-	< 15 UJ-	< 15 UJ-	< 15 UJ-	< 30 UJ-	< 15 UJ-	< 15 UJ-	< 30 UJ-	< 15 UJ-	< 330 UJ-	< 30 UJ-	< 30 UJ-
		10	< 54 UJ-	< 110 UJ-	< 32 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 32 UJ-	< 16 UJ-	< 16 UJ-	< 32 UJ-	< 16 UJ-	< 360 UJ-	< 32 UJ-	< 32 UJ-
		30	< 120 UJ-	< 240 UJ-	< 73 UJ-	< 37 UJ-	< 37 UJ-	< 37 UJ-	< 73 UJ-	< 37 UJ-	< 37 UJ-	< 73 UJ-	< 37 UJ-	< 810 UJ-	< 73 UJ-	< 73 UJ-
		40	< 100 UJ-	< 200 UJ-	< 61 UJ-	< 30 UJ-	< 30 UJ-	< 30 UJ-	< 61 UJ-	< 30 UJ-	< 30 UJ-	< 61 UJ-	< 30 UJ-	< 670 UJ-	< 61 UJ-	< 61 UJ-
	BP-09	0	< 51 UJ-	< 100 UJ-	< 30 UJ-	< 15 UJ-	< 15 UJ-	< 15 UJ-	< 30 UJ-	< 15 UJ-	< 15 UJ-	< 30 UJ-	< 15 UJ-	< 330 UJ-	< 30 UJ-	< 30 UJ-
		10	< 54 UJ-	< 110 UJ-	< 32 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 32 UJ-	< 16 UJ-	< 16 UJ-	< 32 UJ-	< 16 UJ-	< 360 UJ-	< 32 UJ-	< 32 UJ-
		30	< 140 UJ-	< 270 UJ-	< 82 UJ-	< 41 UJ-	< 41 UJ-	< 41 UJ-	< 82 UJ-	< 41 UJ-	< 41 UJ-	< 82 UJ-	< 41 UJ-	< 900 UJ-	< 82 UJ-	< 82 UJ-
		40	< 100 UJ-	< 210 UJ-	< 62 UJ-	< 31 UJ-	< 31 UJ-	< 31 UJ-	< 62 UJ-	< 31 UJ-	< 31 UJ-	< 62 UJ-	< 31 UJ-	< 680 UJ-	< 62 UJ-	< 62 UJ-
	BP-10	0	< 51 UJ-	< 100 UJ-	< 30 UJ-	< 15 UJ-	< 15 UJ-	< 15 UJ-	< 30 UJ-	< 15 UJ-	< 15 UJ-	< 30 UJ-	< 15 UJ-	< 330 UJ-	< 30 UJ-	< 30 UJ-
		10	< 52 UJ-	< 100 UJ-	< 31 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 31 UJ-	< 16 UJ-	< 16 UJ-	< 31 UJ-	< 16 UJ-	< 340 UJ-	< 31 UJ-	< 31 UJ-
		30	< 99 UJ-	< 200 UJ-	< 59 UJ-	< 30 UJ-	< 30 UJ-	< 30 UJ-	< 59 UJ-	< 30 UJ-	< 30 UJ-	< 59 UJ-	< 30 UJ-	< 650 UJ-	< 59 UJ-	< 59 UJ-
		40	< 160 UJ-	< 330 UJ-	< 99 UJ-	< 49 UJ-	< 49 UJ-	< 49 UJ-	< 99 UJ-	< 49 UJ-	< 49 UJ-	< 99 UJ-	< 49 UJ-	< 1100 UJ-	< 99 UJ-	< 99 UJ-

All results in µg/kg.

TABLE D1-9
RADIONUCLIDES ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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DVSR	Location	Depth (ft bgs)	Actinium-228	Americium-241	Bismuth-210	Bismuth-212	Bismuth-214	Cesium-137	Cobalt-57	Cobalt-60
26b	EB-3	25	2.21		0.8	< 0.99	1.04			
		35	2.18		0.9	< 0.76	1.2			
	EB-7	25	1.96		0.6	< 0.88	1.18			
		35	2.07		0.3	< 1.14	1.3			
	EB-8	25	2.23		1.2	1.42	1.49			
		35	1.83		0.8	< 0.59	1.36			
	PEB-11	25	1.47		0.1	1.13	0.94			
		35	1.98		0.6	< 0.9	1.58			
	PEB-18	25	1.62		1.5	1.07	1.19			
		35	1.68		1.5	< 0.75	1.45			
	PEB-9	25	1.85		1.1	1.17	1.28			
		35	1.87		0.52	1.33	1.11			
36	BP-01	0	< 0.757 U	< 0.148 U		< 1.61 U	< 0.343 U	< 0.0829 U	< 0.424 U	< 0.0851 U
		10	1.75	< 0.493 U		< 1.58 U	1.75	< 0.0838 U	< 0.499 U	< 0.085 U
		30	2.95	< 0.212 U		< 2.25 U	< 0.396 U	< 0.114 U	< 0.614 U	< 0.118 U
	BP-02	0	< 0.802 U	< 0.235 U		< 1.76 U	< 0.428 U	< 0.0995 U	< 0.458 U	< 0.0955 U
		10	1.71	< 0.275 U		< 1.81 U	< 0.384 U	< 0.0913 U	< 0.477 U	< 0.0803 U
		30	2.1	< 0.169 U		< 1.84 U	< 0.385 U	< 0.0828 U	< 0.491 U	< 0.0941 U
		40	2	< 0.293 U		< 2.2 U	< 0.451 U	< 0.103 U	< 0.501 U	< 0.105 U
	BP-03	0	1.74E+00	< 0.314 U		< 1.52 U	< 0.329 U	< 0.0859 U	< 0.471 U	< 0.0743 U
		10	2.1	< 0.789 U		< 1.55 U	< 0.356 U	< 0.0753 U	< 0.477 U	< 0.0854 U
		30	1.92	< 0.506 U		< 1.66 U	< 0.396 U	< 0.0721 U	< 0.494 U	< 0.0952 U
	BP-04	0	1.74	< 0.223 U		< 1.68 U	< 0.376 U	< 0.1 U	< 0.448 U	< 0.102 U
		10	2.05	< 0.287 U		< 1.68 U	< 0.386 U	< 0.0958 U	< 0.472 U	< 0.0917 U
		30	2.33	< 0.185 U		< 1.97 U	< 0.446 U	< 0.0876 U	< 0.534 U	< 0.0757 U
	BP-05	0	2.07	< 0.161 U		< 1.64 U	< 0.327 U	< 0.078 U	< 0.45 U	< 0.097 U
		10	2.01	< 0.48 U		< 1.74 U	< 0.357 U	< 0.0861 U	< 0.491 U	< 0.0928 U
		30	2.24	< 0.227 U		< 1.69 U	< 0.384 U	< 0.0923 U	< 0.444 U	< 0.111 U
		40	< 0.907 U	< 0.348 U		< 2.13 U	< 0.678 U	< 0.117 U	< 0.609 U	< 0.13 U
	BP-06	0	1.66E+00	< 0.435 U		< 1.59 U	< 0.342 U	< 0.0916 U	< 0.45 U	< 0.0947 U
		10	1.68	< 0.242 U		< 1.7 U	< 0.371 U	< 0.0897 U	< 0.447 U	< 0.097 U
		30	2.6	< 0.176 U		< 1.97 U	< 0.418 U	< 0.113 U	< 0.522 U	< 0.103 U
		40	1.15	< 0.421 U		< 1.48 U	< 0.371 U	< 0.0778 U	< 0.453 U	< 0.11 U
	BP-07	0	1.76	< 0.154 U		< 1.74 U	< 0.355 U	< 0.0933 U	< 0.465 U	< 0.0813 U
		10	< 0.728 U	< 0.216 U		< 1.62 U	< 0.377 U	< 0.0885 U	< 0.43 U	< 0.0831 U
		30	1.96	< 0.282 U		< 1.67 U	1.18	< 0.098 U	< 0.473 U	< 0.0919 U
		40	< 0.52 U	< 0.689 U		< 1.09 U	1.41	< 0.0683 U	< 0.455 U	< 0.0541 U

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DVSR	Location	Depth (ft bgs)	Actinium-228	Americium-241	Bismuth-210	Bismuth-212	Bismuth-214	Cesium-137	Cobalt-57	Cobalt-60
36	BP-08	0	1.89	< 0.732 U		< 1.48 U	< 0.308 U	< 0.0822 U	< 0.464 U	< 0.0692 U
		10	2.33	< 0.369 U		< 1.63 U	1.23	< 0.0835 U	< 0.573 U	< 0.0749 U
		30	1.76	< 0.474 U		< 1.59 U	1.25	< 0.0984 U	< 0.417 U	< 0.0753 U
		40	< 0.42 U	< 0.218 U		< 1.05 U	1.05	< 0.0567 U	< 0.317 U	< 0.0693 U
	BP-09	0	2.18	< 0.332 U		< 1.47 U	1.09	< 0.0726 U	< 0.467 U	< 0.0667 U
		10	1.53	< 0.233 U		< 1.33 U	1.22	< 0.0677 U	< 0.363 U	< 0.0595 U
		30	1.96	< 0.331 U		< 1.43 U	< 0.324 U	< 0.0665 U	< 0.464 U	< 0.0691 U
		40	1.72	< 0.393 U		< 1.11 U	0.997	< 0.0628 U	< 0.351 U	< 0.0665 U
	BP-10	0	1.74	< 0.249 U		< 1.33 U	0.98	< 0.0708 U	< 0.363 U	< 0.0648 U
		10	1.5	< 0.698 U		< 1.38 U	< 0.315 U	< 0.0754 U	< 0.463 U	< 0.0838 U
		30	2.03	< 0.339 U		< 1.44 U	< 0.349 U	< 0.072 U	< 0.505 U	< 0.0782 U
		40	1.1	< 0.398 U		< 1.13 U	< 0.249 U	< 0.0775 U	< 0.325 U	< 0.0666 U

All results in pCi/g.

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RADIONUCLIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Lead-210	Lead-212	Lead-214	Polonium-210	Polonium-212	Polonium-214	Polonium-216	Polonium-218
26b	EB-3	25	< 0.8	1.73	1.38	0.8	0.63	1.04	1.79	2.08
		35	< 0.9	1.82	1.36	0.9	0.49	1.2	2.49	1.86
	EB-7	25	< 0.6	1.53	1.18	0.6	0.56	1.18	1.98	1.72
		35	< 0.3	1.72	1.53	0.3	0.73	1.3	2.02	2.27
	EB-8	25	< 1.2	1.86	1.4	1.2	0.91	1.49	2.19	2.43
		35	< 0.8	1.54	1.36	0.8	0.38	1.36	1.96	2.35
	PEB-11	25	< 0.1	1.57	1.09	0.1	0.72	0.94	1.94	1.73
		35	< 0.6	1.56	1.37	0.6	0.58	1.58	2.64	1.73
	PEB-18	25	< 1.5	1.34	1.25	1.5	0.69	1.19	2.01	2.24
		35	1.5	1.53	1.66	1.5	0.48	1.45	1.82	2.59
	PEB-9	25	< 1.1	1.7	1.17	1.1	0.75	1.28	2.01	2.68
		35	< 0.52	1.78	1.24	0.52	0.85	1.11	2.51	2.99
36	BP-01	0	< 1.45 U	1.51	0.93					
		10	< 14.1 U	1.87	1.78					
		30	2.31	2.85	0.866					
	BP-02	0	< 4.13 U	1.81	2.08					
		10	< 5.17 U	1.99	1.29					
		30	< 1.34 U	1.89	1.13					
		40	< 4.65 U	2.19	1.58					
	BP-03	0	< 6.52 U	1.80E+00	1.05					
		10	< 40.2 U	2.1	1.23					
		30	< 14.6 U	1.92	1.51					
	BP-04	0	< 4.03 U	1.91	1.07					
		10	< 5.44 U	1.91	1.45					
		30	< 1.7 U	2.23	1.49					
	BP-05	0	2	1.97	1.09					
		10	< 12.6 U	1.9	1.15					
		30	< 4.19 U	1.68	1.33					
		40	< 7.2 U	1.17	2.6					
	BP-06	0	< 14.3 U	1.76E+00	1.07					
		10	< 4.26 U	1.63	1.19					
		30	< 1.77 U	2.01	1.28					
		40	< 13 U	0.929	1.2					
	BP-07	0	< 1.48 U	1.79	1.05					
		10	< 3.89 U	1.78	1.34					
		30	< 5.57 U	2.07	1.5					
		40	< 38.6 U	0.953	1.72					

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DVSR	Location	Depth (ft bgs)	Lead-210	Lead-212	Lead-214	Polonium-210	Polonium-212	Polonium-214	Polonium-216	Polonium-218
36	BP-08	0	< 38.4 U	1.93	1.2					
		10	< 7.33 U	2.22	1.56					
		30	< 16.5 U	2.21	1.66					
		40	< 5.54 U	0.727	1.24					
	BP-09	0	< 6.66 U	2.11	1.3					
		10	< 4.82 U	2	1.25					
		30	< 6.68 U	1.97	1.68					
		40	< 16.5 U	1.7	1.16					
	BP-10	0	< 5.33 U	1.98	1.38					
		10	< 35.9 U	1.95	1.35					
		30	< 7.06 U	2.17	1.69					
		40	< 15.3 U	1.34	0.708					

All results in pCi/g.

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RADIONUCLIDES ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Potassium-40	Protactinium-234	Radium-224	Radium-226	Radium-228	Radon-220	Radon-222	Thallium-208
26b	EB-3	25	27.4	1.52	3.4	2.08	1.68	1.79	2.08	0.67
		35	28.8	1.39	8.7	1.86	2.02	2.49	1.86	0.56
	EB-7	25	25.3	1.51	3.3	1.72	2.09	1.98	1.72	0.6
		35	28.9	1.63	3.7	2.27	1.44	2.02	2.27	0.66
	EB-8	25	26.9	1.52	4.5	2.43	2.22	2.19	2.43	0.55
		35	23.9	1.7	4.2	2.35	1.69	1.96	2.35	0.46
	PEB-11	25	27.1	1.19	3.4	1.73	1.88	1.94	1.73	0.57
		35	28.5	1.45	4.2	2.52	1.81	2.64	2.52	0.51
	PEB-18	25	23.8	1.41	3.6	2.24	1.61	2.01	2.24	0.49
		35	26.1	1.61	4.6	2.59	1.43	1.82	2.59	0.5
	PEB-9	25	26.4	1.52	3.9	2.68	2.32	2.01	2.68	0.54
		35	28.5	1.3	4.9	2.99	2.14	2.51	2.99	0.63
36	BP-01	0	18.4			0.925	1.54 J			0.483
		10	24.9			3.11 J+	1.76 J			0.535
		30	14.4			2.98	2.5			1.02
	BP-02	0	23.9			2.76 J+	2.04			0.501
		10	24.7			1.58	1.74 J			0.54
		30	25.9			1.68 J+	1.41 J			0.604
		40	29.6			1.84 J+	2.28			0.623
	BP-03	0	2.33E+01			1.24	3.25			0.565
		10	28.1			1.47	2.46			0.611
		30	27.5			4.52	2.95			0.489
	BP-04	0	22.3			1.22	1.77			0.629
		10	26.6			1.28	2.02			0.634
		30	28.1			2.02	2.32			0.687
	BP-05	0	26.3			1.03	2.42			0.625
		10	27.6			1.31	2.03			0.554
		30	25.6			2.06	2.05			0.617
		40	15.7			2.26	2.74			0.413
	BP-06	0	2.42E+01			1.47	1.39E+00 J			0.585
		10	22.4			1.47 J+	1.93 J			0.59
		30	29.6			2.77	1.6 J			0.679
		40	13.4			1.91	0.781 J			0.33
	BP-07	0	24.5			1.61	2.83			0.58
		10	24			2.14	1.67 J			0.543
		30	27			2.01 J+	2.05			0.576
		40	9.44			3.55 J	< 2.00 B			0.267

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DVSR	Location	Depth (ft bgs)	Potassium-40	Protactinium-234	Radium-224	Radium-226	Radium-228	Radon-220	Radon-222	Thallium-208
36	BP-08	0	27.8			1.27	2.6			0.502
		10	30.8			1.81 J	2.35			0.662
		30	28.7			1.59 J	3.24			0.638
		40	10.1			1.52 J	< 4.23E+00 B			0.234
	BP-09	0	28.2			1.65 J	2.81			0.682
		10	24			1.61 J	< 2.00 B			0.54
		30	25.2			2.18 J	2.64			0.616
		40	24.8			2.25 J	1.97			0.466
	BP-10	0	26.2			1.45 J	2.41			0.429
		10	24			2.1	2.19			0.569
		30	30.5			2.56	2.75			0.654
		40	13.6			0.928 J	< 2.00 B			0.384

All results in pCi/g.

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DVSR	Location	Depth (ft bgs)	Thorium-227	Thorium-228	Thorium-230	Thorium-232	Thorium-234	Uranium-234	Uranium-235	Uranium-238
26b	EB-3	25		1.79	1.45	1.88	1.52	1.63	< 0.021	1.52
		35		2.49	1.95	1.84	1.39	1.58	< 0.025	1.39
	EB-7	25		1.98	1.68	2.12	1.51	1.49	< 0.098	1.51
		35		2.02	2.2	1.91	1.63	1.69	< 0.11	1.63
	EB-8	25		2.19	2.06	1.91	2.3	1.79	< 0.1	2.1
		35		1.96	2.38	1.62	1.7	2.12	0.24	1.7
	PEB-11	25		1.94	1.59	1.86	1.19	1.38	< 0.039	1.19
		35		2.64	2.46	1.96	1.45	1.57	< 0.13	1.45
	PEB-18	25		2.01	2.05	1.76	1.41	1.54	< 0.08	1.41
		35		1.82	2.56	1.48	1.61	1.68	< 0.055	1.61
	PEB-9	25		2.01	1.57	1.51	1.52	1.4	< 0.049	1.52
		35		2.51	1.84	1.95	1.3	1.15	< 0.1	1.3
36	BP-01	0	< 0.532 U	0.912	0.88	0.845	< 1.28 U	0.818	0.0192 J	0.575 J
		10	< 0.513 U	1.84	3.24	1.47	< 3.18 U	3.69	0.125 J	2.73
		30	< 0.702 U	2.53	1.2	2.64	1.86	0.975	0.0309 J	0.769
	BP-02	0	< 0.536 U	1.75	2.62	1.28	< 1.81 U	2.71	0.078 J	2.17
		10	< 0.574 U	1.49	0.897	1.48	< 2.01 U	0.557 J	0.0372 J	0.628
		30	< 0.576 U	1.22	1.39	1.23	< 1.21 U	1.52	0.0744 J	1.45
		40	< 0.613 U	1.38	1.5	1.41	< 2.17 U	1.96	0.032 J	1.57
	BP-03	0	< 0.538 U	1.57	1.1	1.45 J	< 2.34 U	1.12	0.0446 J	1.01
		10	< 0.538 U	1.45	1.44	1.43 J	< 4.57 U	2.04	0.0828 J	1.45
		30	< 0.516 U	1.79	1.95	1.36 J	< 3.14 U	1.89	0.0632 J	1.5
	BP-04	0	< 0.53 U	1.69	1.23	1.48 J	< 1.67 U	0.894	< 0.6 U	0.844
		10	< 0.536 U	1.77	1.42	1.58 J	< 2.04 U	1.53	0.0636 J	1.38
		30	< 0.637 U	1.43	1.64	1.53 J	< 1.42 U	2.11	0.108 J	1.89
	BP-05	0	< 0.496 U	1.53	1.18	1.58 J	< 1.34 U	0.84	0.0366 J	0.913
		10	< 0.521 U	1.8	1.21	1.61 J	< 3.15 U	1.42	0.0394 J	1.3
		30	< 0.564 U	1.64	2.06	1.53 J	< 1.7 U	2.17	0.0612 J	1.85
		40	< 0.663 U	1.07	2.26	0.901 J	< 2.73 U	1.54	< 0.6 U	1.44
	BP-06	0	< 0.466 U	1.51E+00	0.927	1.41	< 3.11 U	1.13E+00	3.55E-02 J	9.00E-01
		10	< 0.519 U	2.15	1.5	1.93	< 1.76 U	1.6	0.0841 J	1.32
		30	< 0.64 U	1.65	1.45	1.57	< 1.45 U	1.45	< 0.6 U	1.42
		40	< 0.47 U	0.977	1.13	0.841	< 2.71 U	1.03	0.0619 J	0.922
	BP-07	0	< 0.52 U	1.83	1.11	1.85	< 1.22 U	1.11	0.0449 J	0.862
		10	< 0.52 U	1.57	1.87	1.41	< 1.73 U	2.2	0.0835 J	1.82
		30	< 0.563 U	1.48	1.47	1.49	< 2.07 U	1.47	0.0596 J	1.3
		40	< 0.496 U	0.77	2.04	0.817	< 3.94 U	1.77	0.0543 J	1.18

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DVSR	Location	Depth (ft bgs)	Thorium-227	Thorium-228	Thorium-230	Thorium-232	Thorium-234	Uranium-234	Uranium-235	Uranium-238
36	BP-08	0	< 0.544 U	1.94	1.24	1.67	< 4.17 U	0.811	< 0.6 U	0.827
		10	< 0.589 U	2	1.73	1.78	< 2.56 U	2.07	0.059 J	1.66
		30	< 0.413 U	1.81	1.94	1.18	< 3.28 U	2.12	0.066 J	2.07
		40	< 0.362 U	0.551	1.31	0.549	< 1.46 U	1.11	0.042 J	0.955
	BP-09	0	< 0.547 U	1.98	1.17	1.65	< 2.43 U	0.849	< 0.6 U	7.41E-01
		10	< 0.425 U	1.63	1.66	1.32	< 1.62 U	1.85	0.0662 J	1.61
		30	< 0.523 U	1.73	1.62	1.44	< 2.34 U	1.53	0.0439 J	1.41
		40	< 0.353 U	1.29	1.29	1.17	< 2.66 U	1.31	0.0837 J	1.21
	BP-10	0	< 0.446 U	1.72	1.59	1.41	< 1.77 U	2.02	0.0465 J	1.43
		10	< 0.493 U	1.58	1.8	1.57	< 3.64 U	2	0.0472 J	1.58
		30	< 0.555 U	1.92	3.35	1.68	< 2.33 U	3.29	0.0911 J	2.57
		40	< 0.384 U	1.37	0.84	1.2	< 2.63 U	0.793	0.0284 J	0.765

All results in pCi/g.

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	1,2,4,5-Tetrachlorobenzene	1,4-Dioxane	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2,4-Dinitrotoluene	2,6-Dinitrotoluene
10a/13a	B-15	0			< 500	< 500	< 500	< 1000	< 2500	< 500	< 500
		5			< 500	< 500	< 500	< 1000	< 2500	< 500	< 500
		20			< 500	< 500	< 500	< 1000	< 2500	< 500	< 500
		30			< 500	< 500	< 500	< 1000	< 2500	< 500	< 500
	B-16	0			< 500	< 500	< 500	< 1000	< 2500	< 500	< 500
		5			< 500	< 500	< 500	< 1000	< 2500	< 500	< 500
		20			< 500	< 500	< 500	< 1000	< 2500	< 500	< 500
		30			< 500	< 500	< 500	< 1000	< 2500	< 500	< 500
26a	EB-1	10			< 330	< 330	< 330	< 330	< 330	< 330	< 330
	EB-2	10			< 330	< 330	< 330	< 330	< 330	< 330	< 330
	EB-3	35			< 330	< 330	< 330	< 330	< 330	< 330	< 330
	EB-7	30			< 330	< 330	< 330	< 330	< 330	< 330	< 330
	EB-8	20			< 330	< 330	< 330	< 330	< 330	< 330	< 330
26b	EB-3	0.5			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		25			< 330	< 330	< 330	< 330	< 330	< 330	< 330
	EB-7	0.5			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		25			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		35			< 330	< 330	< 330	< 330	< 330	< 330	< 330
	EB-8	0.5			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		25			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		35			< 330	< 330	< 330	< 330	< 330	< 330	< 330
	PEB-11	0.5			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		25			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		35			< 330	< 330	< 330	< 330	< 330	< 330	< 330
	PEB-13	0.5			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		25			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		35			< 330	< 330	< 330	< 330	< 330	< 330	< 330
	PEB-17	0.5			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		25			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		35			< 330	< 330	< 330	< 330	< 330	< 330	< 330

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	1,2,4,5-Tetrachlorobenzene	1,4-Dioxane	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2,4-Dinitrotoluene	2,6-Dinitrotoluene
26b	PEB-18	0.5			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		25			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		35			< 330	< 330	< 330	< 330	< 330	< 330	< 330
	PEB-9	0.5			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		15			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		25			< 330	< 330	< 330	< 330	< 330	< 330	< 330
		35			< 330	< 330	< 330	< 330	< 330	< 330	< 330
36	BP-01	0	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 1700 U	< 340 U	< 340 U
		10	< 350 U	< 350 U	< 350 U	< 350 U	< 350 U	< 350 U	< 1700 U	< 350 U	< 350 U
		30	< 570 U	< 570 U	< 570 U	< 570 U	< 570 U	< 570 U	< 2800 U	< 570 U	< 570 U
	BP-02	0	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 1600 U	< 340 U	< 340 U
		10	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 1700 U	< 340 U	< 340 U
		30	< 720 U	< 720 U	< 720 U	< 720 U	< 720 U	< 720 U	< 3500 U	< 720 U	< 720 U
		40	< 630 U	< 630 U	< 630 U	< 630 U	< 630 U	< 630 U	< 3100 U	< 630 U	< 630 U
	BP-03	0	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 1600 U	< 340 U	< 340 U
		10	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U	< 1800 U	< 360 U	< 360 U
		30	< 610 U	< 610 U	< 610 U	< 610 U	< 610 U	< 610 U	< 3000 U	< 610 U	< 610 U
	BP-04	0	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U	< 1600 U	< 330 U	< 330 U
		10	< 350 U	< 350 U	< 350 U	< 350 U	< 350 U	< 350 U	< 1700 U	< 350 U	< 350 U
		30	< 630 U	< 630 U	< 630 U	< 630 U	< 630 U	< 630 U	< 3000 U	< 630 U	< 630 U
	BP-05	0	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U	< 1600 U	< 330 U	< 330 U
		10	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U	< 1700 U	< 360 U	< 360 U
		30	< 640 U	< 640 U	< 640 U	< 640 U	< 640 U	< 640 U	< 3100 U	< 640 U	< 640 U
		40	< 770 U	< 770 U	< 770 U	< 770 U	< 770 U	< 770 U	< 3800 U	< 770 U	< 770 U
	BP-06	0	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U	< 1600 UJ	< 330 U	< 330 U
		10	< 600 U	< 600 U	< 600 U	< 600 U	< 600 U	< 600 U	< 2900 U	< 600 U	< 600 U
		30	< 660 U	< 660 U	< 660 U	< 660 U	< 660 U	< 660 U	< 3200 U	< 660 U	< 660 U
		40	< 770 U	< 770 U	< 770 U	< 770 U	< 770 U	< 770 U	< 3700 U	< 770 U	< 770 U
	BP-07	0	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 1600 U	< 340 U	< 340 U
		10	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U	< 1700 U	< 360 U	< 360 U
		30	< 620 U	< 620 U	< 620 U	< 620 U	< 620 U	< 620 U	< 3000 U	< 620 U	< 620 U
		40	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 2100 UJ-	< 440 UJ-	< 440 UJ-
	BP-08	0	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 1600 UJ-	< 330 UJ-	< 330 UJ-
		10	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 1700 UJ-	< 360 UJ-	< 360 UJ-
		30	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 3900 UJ-	< 810 UJ-	< 810 UJ-
		40	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 3200 UJ-	< 670 UJ-	< 670 UJ-

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	1,2,4,5-Tetrachlorobenzene	1,4-Dioxane	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2,4-Dinitrotoluene	2,6-Dinitrotoluene
36	BP-09	0	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 1600 UJ-	< 330 UJ-	< 330 UJ-
		10	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 1700 UJ-	< 360 UJ-	< 360 UJ-
		20									
		30	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 4400 UJ-	< 900 UJ-	< 900 UJ-
		40	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 3300 UJ-	< 680 UJ-	< 680 UJ-
	BP-10	0	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 1600 UJ-	< 330 UJ-	< 330 UJ-
		10	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 1700 UJ-	< 340 UJ-	< 340 UJ-
		30	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 3200 UJ-	< 650 UJ-	< 650 UJ-
		40	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 5300 UJ-	< 1100 UJ-	< 1100 UJ-

All results in μg/kg.

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	2-Chloronaphthalene	2-Chlorophenol	2-Methylnaphthalene	2-Nitroaniline	2-Nitrophenol	3,3'-Dichlorobenzidine	3-Methylphenol & 4-Methylphenol	3-Nitroaniline	4,6-Dinitro-o-cresol
10a/13a	B-15	0	< 500	< 500	< 500	< 2500	< 500	< 1000		< 2500	< 2500
		5	< 500	< 500	< 500	< 2500	< 500	< 1000		< 2500	< 2500
		20	< 500	< 500	< 500	< 2500	< 500	< 1000		< 2500	< 2500
		30	< 500	< 500	< 500	< 2500	< 500	< 1000		< 2500	< 2500
	B-16	0	< 500	< 500	< 500	< 2500	< 500	< 1000		< 2500	< 2500
		5	< 500	< 500	< 500	< 2500	< 500	< 1000		< 2500	< 2500
		20	< 500	< 500	< 500	< 2500	< 500	< 1000		< 2500	< 2500
		30	< 500	< 500	< 500	< 2500	< 500	< 1000		< 2500	< 2500
26a	EB-1	10	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
	EB-2	10	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
	EB-3	35	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
	EB-7	30	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
	EB-8	20	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
26b	EB-3	0.5	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
	EB-7	0.5	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
	EB-8	0.5	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
	PEB-11	0.5	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
	PEB-13	0.5	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
	PEB-17	0.5	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 5 of 24)

DVSR	Location	Depth (ft bgs)	2-Chloronaphthalene	2-Chlorophenol	2-Methylnaphthalene	2-Nitroaniline	2-Nitrophenol	3,3'-Dichlorobenzidine	3-Methylphenol & 4-Methylphenol	3-Nitroaniline	4,6-Dinitro-o-cresol
26b	PEB-18	0.5	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
	PEB-9	0.5	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		15	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		25	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
		35	< 330	< 330	< 330	< 330	< 330	< 330		< 330	< 330
36	BP-01	0	< 340 U	< 340 U	< 340 U	< 1700 U	< 340 U	< 1700 U	< 690 UJ	< 1700 U	
		10	< 350 U	< 350 U	< 350 U	< 1700 U	< 350 U	< 1700 U	< 690 UJ	< 1700 U	
		30	< 570 U	< 570 U	< 570 U	< 2800 U	< 570 U	< 2800 U	< 1100 UJ	< 2800 U	
	BP-02	0	< 340 U	< 340 U	< 340 U	< 1600 U	< 340 U	< 1600 U	< 670 UJ	< 1600 U	
		10	< 340 U	< 340 U	< 340 U	< 1700 U	< 340 U	< 1700 U	< 690 UJ	< 1700 U	
		30	< 720 U	< 720 U	< 720 U	< 3500 U	< 720 U	< 3500 U	< 1400 UJ	< 3500 U	
		40	< 630 U	< 630 U	< 630 U	< 3100 U	< 630 U	< 3100 U	< 1300 UJ	< 3100 U	
	BP-03	0	< 340 U	< 340 U	< 340 U	< 1600 U	< 340 U	< 1600 U	< 670 UJ	< 1600 U	
		10	< 360 U	< 360 U	< 360 U	< 1800 U	< 360 U	< 1800 U	< 730 UJ	< 1800 U	
		30	< 610 U	< 610 U	< 610 U	< 3000 U	< 610 U	< 3000 U	< 1200 UJ	< 3000 U	
	BP-04	0	< 330 U	< 330 U	< 330 U	< 1600 U	< 330 U	< 1600 U	< 670 UJ	< 1600 U	
		10	< 350 U	< 350 U	< 350 U	< 1700 U	< 350 U	< 1700 U	< 700 UJ	< 1700 U	
		30	< 630 U	< 630 U	< 630 U	< 3000 U	< 630 U	< 3000 U	< 1300 UJ	< 3000 U	
	BP-05	0	< 330 U	< 330 U	< 330 U	< 1600 U	< 330 U	< 1600 U	< 670 UJ	< 1600 U	
		10	< 360 U	< 360 U	< 360 U	< 1700 U	< 360 U	< 1700 U	< 710 UJ	< 1700 U	
		30	< 640 U	< 640 U	< 640 U	< 3100 U	< 640 U	< 3100 U	< 1300 UJ	< 3100 U	
		40	< 770 U	< 770 U	< 770 U	< 3800 U	< 770 U	< 3800 U	< 1500 UJ	< 3800 U	
	BP-06	0	< 330 U	< 330 U	< 330 U	< 1600 U	< 330 U	< 1600 U	< 670 UJ	< 1600 U	
		10	< 600 U	< 600 U	< 600 U	< 2900 U	< 600 U	< 2900 U	< 1200 UJ	< 2900 U	
		30	< 660 U	< 660 U	< 660 U	< 3200 U	< 660 U	< 3200 U	< 1300 UJ	< 3200 U	
		40	< 770 U	< 770 U	< 770 U	< 3700 U	< 770 U	< 3700 U	< 1500 UJ	< 3700 U	
	BP-07	0	< 340 U	< 340 U	< 340 U	< 1600 U	< 340 U	< 1600 U	< 670 UJ	< 1600 U	
		10	< 360 U	< 360 U	< 360 U	< 1700 U	< 360 U	< 1700 U	< 720 UJ	< 1700 U	
		30	< 620 U	< 620 U	< 620 U	< 3000 U	< 620 U	< 3000 U	< 1200 UJ	< 3000 U	
		40	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 2100 UJ-	< 440 UJ-	< 2100 UJ-	< 880 UJ-	< 2100 UJ-	
	BP-08	0	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 1600 UJ-	< 330 UJ-	< 1600 UJ-	< 670 UJ-	< 1600 UJ-	
		10	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 1700 UJ-	< 360 UJ-	< 1700 UJ-	< 710 UJ-	< 1700 UJ-	
		30	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 3900 UJ-	< 810 UJ-	< 3900 UJ-	< 1600 UJ-	< 3900 UJ-	
		40	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 3200 UJ-	< 670 UJ-	< 3200 UJ-	< 1300 UJ-	< 3200 UJ-	

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	2-Chloronaphthalene	2-Chlorophenol	2-Methylnaphthalene	2-Nitroaniline	2-Nitrophenol	3,3'-Dichlorobenzidine	3-Methylphenol & 4-Methylphenol	3-Nitroaniline	4,6-Dinitro-o-cresol
36	BP-09	0	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 1600 UJ-	< 330 UJ-	< 1600 UJ-	< 670 UJ-	< 1600 UJ-	
		10	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 1700 UJ-	< 360 UJ-	< 1700 UJ-	< 710 UJ-	< 1700 UJ-	
		20									
		30	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 4400 UJ-	< 900 UJ-	< 4400 UJ-	< 1800 UJ-	< 4400 UJ-	
		40	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 3300 UJ-	< 680 UJ-	< 3300 UJ-	< 1400 UJ-	< 3300 UJ-	
	BP-10	0	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 1600 UJ-	< 330 UJ-	< 1600 UJ-	< 670 UJ-	< 1600 UJ-	
		10	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 1700 UJ-	< 340 UJ-	< 1700 UJ-	< 690 UJ-	< 1700 UJ-	
		30	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 3200 UJ-	< 650 UJ-	< 3200 UJ-	< 1300 UJ-	< 3200 UJ-	
		40	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 5300 UJ-	< 1100 UJ-	< 5300 UJ-	< 2200 UJ-	< 5300 UJ-	

All results in μg/kg.

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	4-Bromophenyl phenyl ether	4-Chloro-3-methyl phenol	4-Chloro-3-Methylphenol	4-Chlorophenyl phenyl ether	4-Nitrophenol	Acetophenone	Aniline	Azobenzene	Benzenethiol
10a/13a	B-15	0	< 500	< 1000		< 500	< 1		< 1000	< 500	
		5	< 500	< 1000		< 500	< 1		< 1000	< 500	
		20	< 500	< 1000		< 500	< 1		< 1000	< 500	
		30	< 500	< 1000		< 500	< 1		< 1000	< 500	
	B-16	0	< 500	< 1000		< 500	< 1		< 1000	< 500	
		5	< 500	< 1000		< 500	< 1		< 1000	< 500	
		20	< 500	< 1000		< 500	< 1		< 1000	< 500	
		30	< 500	< 1000		< 500	< 1		< 1000	< 500	
26a	EB-1	10	< 330	< 330		< 330	< 330		< 330	< 330	
	EB-2	10	< 330	< 330		< 330	< 330		< 330	< 330	
	EB-3	35	< 330	< 330		< 330	< 330		< 330	< 330	
	EB-7	30	< 330	< 330		< 330	< 330		< 330	< 330	
	EB-8	20	< 330	< 330		< 330	< 330		< 330	< 330	
26b	EB-3	0.5	< 330	< 330		< 330	< 330		< 330	< 330	
		15	< 330	< 330		< 330	< 330		< 330	< 330	
		25	< 330	< 330		< 330	< 330		< 330	< 330	
	EB-7	0.5	< 330	< 330		< 330	< 330		< 330	< 330	
		15	< 330	< 330		< 330	< 330		< 330	< 330	
		25	< 330	< 330		< 330	< 330		< 330	< 330	
		35	< 330	< 330		< 330	< 330		< 330	< 330	
	EB-8	0.5	< 330	< 330		< 330	< 330		< 330	< 330	
		15	< 330	< 330		< 330	< 330		< 330	< 330	
		25	< 330	< 330		< 330	< 330		< 330	< 330	
		35	< 330	< 330		< 330	< 330		< 330	< 330	
	PEB-11	0.5	< 330	< 330		< 330	< 330		< 330	< 330	
		15	< 330	< 330		< 330	< 330		< 330	< 330	
		25	< 330	< 330		< 330	< 330		< 330	< 330	
		35	< 330	< 330		< 330	< 330		< 330	< 330	
	PEB-13	0.5	< 330	< 330		< 330	< 330		< 330	< 330	
		15	< 330	< 330		< 330	< 330		< 330	< 330	
		25	< 330	< 330		< 330	< 330		< 330	< 330	
		35	< 330	< 330		< 330	< 330		< 330	< 330	
	PEB-17	0.5	< 330	< 330		< 330	< 330		< 330	< 330	
		15	< 330	< 330		< 330	< 330		< 330	< 330	
		25	< 330	< 330		< 330	< 330		< 330	< 330	
		35	< 330	< 330		< 330	< 330		< 330	< 330	

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	4-Bromophenyl phenyl ether	4-Chloro-3-methyl phenol	4-Chloro-3-Methylphenol	4-Chlorophenyl phenyl ether	4-Nitrophenol	Acetophenone	Aniline	Azobenzene	Benzenethiol
26b	PEB-18	0.5	< 330	< 330		< 330	< 330		< 330	< 330	
		15	< 330	< 330		< 330	< 330		< 330	< 330	
		25	< 330	< 330		< 330	< 330		< 330	< 330	
		35	< 330	< 330		< 330	< 330		< 330	< 330	
	PEB-9	0.5	< 330	< 330		< 330	< 330		< 330	< 330	
		15	< 330	< 330		< 330	< 330		< 330	< 330	
		25	< 330	< 330		< 330	< 330		< 330	< 330	
		35	< 330	< 330		< 330	< 330		< 330	< 330	
36	BP-01	0	< 340 U		< 340 U	< 340 U	< 1700 U	< 340 U	< 340 U	< 340 U	< 340 U
		10	< 350 U		< 350 U	< 350 U	< 1700 U	< 350 U	< 350 U	< 350 U	< 350 U
		30	< 570 U		< 570 U	< 570 U	< 2800 U	< 570 U	< 570 U	< 570 U	< 570 U
	BP-02	0	< 340 U		< 340 U	< 340 U	< 1600 U	< 340 U	< 340 U	< 340 U	< 340 U
		10	< 340 U		< 340 U	< 340 U	< 1700 U	< 340 U	< 340 U	< 340 U	< 340 U
		30	< 720 U		< 720 U	< 720 U	< 3500 U	< 720 U	< 720 U	< 720 U	< 720 U
		40	< 630 U		< 630 U	< 630 U	< 3100 U	< 630 U	< 630 U	< 630 U	< 630 U
	BP-03	0	< 340 U		< 340 U	< 340 U	< 1600 U	< 340 U	< 340 U	< 340 U	< 340 U
		10	< 360 U		< 360 U	< 360 U	< 1800 U	< 360 U	< 360 U	< 360 U	< 360 U
		30	< 610 U		< 610 U	< 610 U	< 3000 U	< 610 U	< 610 U	< 610 U	< 610 U
	BP-04	0	< 330 U		< 330 U	< 330 U	< 1600 U	< 330 U	< 330 U	< 330 U	< 330 U
		10	< 350 U		< 350 U	< 350 U	< 1700 U	< 350 U	< 350 U	< 350 U	< 350 U
		30	< 630 U		< 630 U	< 630 U	< 3000 U	< 630 U	< 630 U	< 630 U	< 630 U
	BP-05	0	< 330 U		< 330 U	< 330 U	< 1600 U	< 330 U	< 330 U	< 330 U	< 330 U
		10	< 360 U		< 360 U	< 360 U	< 1700 U	< 360 U	< 360 U	< 360 U	< 360 U
		30	< 640 U		< 640 U	< 640 U	< 3100 U	< 640 U	< 640 U	< 640 U	< 640 U
		40	< 770 U		< 770 U	< 770 U	< 3800 U	< 770 U	< 770 U	< 770 U	< 770 U
	BP-06	0	< 330 U		< 330 U	< 330 U	< 1600 U	< 330 U	< 330 U	< 330 U	< 330 U
		10	< 600 U		< 600 U	< 600 U	< 2900 U	< 600 U	< 600 U	< 600 U	< 600 U
		30	< 660 U		< 660 U	< 660 U	< 3200 U	< 660 U	< 660 U	< 660 U	< 660 U
		40	< 770 U		< 770 U	< 770 U	< 3700 U	< 770 U	< 770 U	< 770 U	< 770 U
	BP-07	0	< 340 U		< 340 U	< 340 U	< 1600 U	< 340 U	< 340 U	< 340 U	< 340 U
		10	< 360 U		< 360 U	< 360 U	< 1700 U	< 360 U	< 360 U	< 360 U	< 360 U
		30	< 620 U		< 620 U	< 620 U	< 3000 U	< 620 U	< 620 U	< 620 U	< 620 U
		40	< 440 UJ-		< 440 UJ-	< 440 UJ-	< 2100 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-
	BP-08	0	< 330 UJ-		< 330 UJ-	< 330 UJ-	< 1600 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-
		10	< 360 UJ-		< 360 UJ-	< 360 UJ-	< 1700 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-
		30	< 810 UJ-		< 810 UJ-	< 810 UJ-	< 3900 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-
		40	< 670 UJ-		< 670 UJ-	< 670 UJ-	< 3200 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	4-Bromophenyl phenyl ether	4-Chloro-3-methyl phenol	4-Chloro-3-Methylphenol	4-Chlorophenyl phenyl ether	4-Nitrophenol	Acetophenone	Aniline	Azobenzene	Benzenethiol
36	BP-09	0	< 330 UJ-		< 330 UJ-	< 330 UJ-	< 1600 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-
		10	< 360 UJ-		< 360 UJ-	< 360 UJ-	< 1700 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-
		20									
		30	< 900 UJ-		< 900 UJ-	< 900 UJ-	< 4400 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-
		40	< 680 UJ-		< 680 UJ-	< 680 UJ-	< 3300 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-
	BP-10	0	< 330 UJ-		< 330 UJ-	< 330 UJ-	< 1600 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-
		10	< 340 UJ-		< 340 UJ-	< 340 UJ-	< 1700 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-
		30	< 650 UJ-		< 650 UJ-	< 650 UJ-	< 3200 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-
		40	< 1100 UJ-		< 1100 UJ-	< 1100 UJ-	< 5300 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-

All results in μg/kg.

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	Benzo(b&k)fluoranthene	Benzoic acid	Benzyl alcohol	Benzyl butyl phthalate	bis(2-Chloroethoxy) methane	bis(2-Chloroethyl) ether	bis(2-Chloroisopropyl) ether	bis(2-Ethylhexyl) phthalate	bis(p-Chlorophenyl) disulfide
10a/13a	B-15	0	< 500	< 2500	< 1000	< 500	< 500	< 500	< 500	< 500	
		5	< 500	< 2500	< 1000	< 500	< 500	< 500	< 500	< 500	
		20	< 500	< 2500	< 1000	< 500	< 500	< 500	< 500	< 500	
		30	< 500	< 2500	< 1000	< 500	< 500	< 500	< 500	< 500	
	B-16	0	< 500	< 2500	< 1000	< 500	< 500	< 500	< 500	< 500	
		5	< 500	< 2500	< 1000	< 500	< 500	< 500	< 500	< 500	
		20	< 500	< 2500	< 1000	< 500	< 500	< 500	< 500	< 500	
		30	< 500	< 2500	< 1000	< 500	< 500	< 500	< 500	< 500	
26a	EB-1	10		R	< 330	< 330	< 330	< 330	< 330	< 330	
	EB-2	10		R	< 330	< 330	< 330	< 330	< 330	< 330	
	EB-3	35			< 330	< 330	< 330	< 330	< 330	< 330	
	EB-7	30		R	< 330	< 330	< 330	< 330	< 330	< 330	
	EB-8	20		R	< 330	< 330	< 330	< 330	< 330	< 330	
26b	EB-3	0.5		R	< 330	< 330	< 330	< 330	< 330	< 330	
		15		R	< 330	< 330	< 330	< 330	< 330	< 330	
		25		R	< 330	< 330	< 330	< 330	< 330	< 330	
	EB-7	0.5		R	< 330	< 330	< 330	< 330	< 330	< 330	
		15		R	< 330	< 330	< 330	< 330	< 330	< 330	
		25		R	< 330	< 330	< 330	< 330	< 330	< 330	
		35			< 330	< 330	< 330	< 330	< 330	< 330	
	EB-8	0.5		R	< 330	< 330	< 330	< 330	< 330	< 330	
		15		R	< 330	< 330	< 330	< 330	< 330	< 330	
		25		R	< 330	< 330	< 330	< 330	< 330	< 330	
		35		R	< 330	< 330	< 330	< 330	< 330	< 330	
	PEB-11	0.5		R	< 330	< 330	< 330	< 330	< 330	< 330	
		15		R	< 330	< 330	< 330	< 330	< 330	< 330	
		25		R	< 330	< 330	< 330	< 330	< 330	< 330	
		35		R	< 330	< 330	< 330	< 330	< 330	< 330	
	PEB-13	0.5		< 330	< 330	< 330	< 330	< 330	< 330	< 330	
		15		< 330	< 330	< 330	< 330	< 330	< 330	< 330	
		25		< 330	< 330	< 330	< 330	< 330	< 330	< 330	
		35		< 330	< 330	< 330	< 330	< 330	< 330	< 330	
	PEB-17	0.5		R	< 330	< 330	< 330	< 330	< 330	< 330	
		15		R	< 330	< 330	< 330	< 330	< 330	< 330	
		25		R	< 330	< 330	< 330	< 330	< 330	< 330	
		35		R	< 330	< 330	< 330	< 330	< 330	< 330	

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 11 of 24)

DVSR	Location	Depth (ft bgs)	Benzo(b&k)fluoranthene	Benzoic acid	Benzyl alcohol	Benzyl butyl phthalate	bis(2-Chloroethoxy) methane	bis(2-Chloroethyl) ether	bis(2-Chloroisopropyl) ether	bis(2-Ethylhexyl) phthalate	bis(p-Chlorophenyl) disulfide
26b	PEB-18	0.5		R	< 330	< 330	< 330	< 330	< 330	< 330	
		15		R	< 330	< 330	< 330	< 330	< 330	< 330	
		25		R	< 330	< 330	< 330	< 330	< 330	< 330	
		35		R	< 330	< 330	< 330	< 330	< 330	< 330	
	PEB-9	0.5		R	< 330	< 330	< 330	< 330	< 330	< 330	
		15		R	< 330	< 330	< 330	< 330	< 330	< 330	
		25		R	< 330	< 330	< 330	< 330	< 330	< 330	
		35		R	< 330	< 330	< 330	< 330	< 330	< 330	
36	BP-01	0		< 1700 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U
		10		< 1700 U	< 350 U	< 350 U	< 350 U	< 350 U	< 350 U	< 350 U	< 350 U
		30		94 J	< 570 U	< 570 U	< 570 U	< 570 U	< 570 U	< 570 U	< 570 U
	BP-02	0		< 1600 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U
		10		< 1700 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U
		30		< 3500 U	< 720 U	< 720 U	< 720 U	< 720 U	< 720 U	< 720 U	< 720 U
		40		< 3100 U	< 630 U	< 630 U	< 630 U	< 630 U	< 630 U	< 630 U	< 630 U
	BP-03	0		< 1600 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U
		10		< 1800 U	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U
		30		< 3000 U	< 610 U	< 610 U	< 610 U	< 610 U	< 610 U	< 610 U	< 610 U
	BP-04	0		< 1600 U	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U
		10		< 1700 U	< 350 U	< 350 U	< 350 U	< 350 U	< 350 U	< 350 U	< 350 U
		30		< 3000 U	< 630 U	< 630 U	< 630 U	< 630 U	< 630 U	< 630 U	< 630 U
	BP-05	0		< 1600 U	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U
		10		< 1700 U	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U	46 J	< 360 U
		30		< 3100 U	< 640 U	< 640 U	< 640 U	< 640 U	< 640 U	< 640 U	< 640 U
		40		< 3800 U	< 770 U	< 770 U	< 770 U	< 770 U	< 770 U	< 770 U	< 770 U
	BP-06	0		170 J	< 330 U	< 330 U	< 330 U	< 330 U	< 330 U	36 J	< 330 U
		10		< 2900 U	< 600 U	< 600 U	< 600 U	< 600 U	< 600 U	< 600 U	< 600 U
		30		< 3200 U	< 660 U	< 660 U	< 660 U	< 660 U	< 660 U	< 660 U	< 660 U
		40		< 3700 U	< 770 U	< 770 U	< 770 U	< 770 U	< 770 U	< 770 U	< 770 U
	BP-07	0		< 1600 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U	< 340 U
		10		< 1700 U	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U	< 360 U
		30		< 3000 U	< 620 U	< 620 U	< 620 U	< 620 U	< 620 U	< 620 U	< 620 U
		40		< 2100 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-
	BP-08	0		130 J-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-
		10		44 J-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-
		30		160 J-	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-
		40		< 3200 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	Benzo(b&k)fluoranthene	Benzoic acid	Benzyl alcohol	Benzyl butyl phthalate	bis(2-Chloroethoxy) methane	bis(2-Chloroethyl) ether	bis(2-Chloroisopropyl) ether	bis(2-Ethylhexyl) phthalate	bis(p-Chlorophenyl) disulfide
36	BP-09	0		< 1600 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	26000 J-
		10		< 1700 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-
		20									
		30		< 4400 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-
		40		< 3300 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-
	BP-10	0		< 1600 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-
		10		< 1700 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-
		30		< 3200 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-
		40		< 5300 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-

All results in µg/kg.

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	bis(p-Chlorophenyl) sulfone	Carbazole	Cyclic octaatomic sulfur (TIC)	Dibenzofuran	Dibutyl phthalate	Diethyl phosphorodithioic acid (TIC)	Diethyl phthalate	Dimethyl phthalate	Di-n-octyl phthalate
10a/13a	B-15	0		< 500		< 500	< 500		< 500	< 500	< 500
		5		< 500		< 500	< 500		< 500	< 500	< 500
		20		< 500		< 500	< 500		< 500	< 500	< 500
		30		< 500		< 500	< 500		< 500	< 500	< 500
	B-16	0		< 500		< 500	< 500		< 500	< 500	< 500
		5		< 500		< 500	< 500		< 500	< 500	< 500
		20		< 500		< 500	< 500		< 500	< 500	< 500
		30		< 500		< 500	< 500		< 500	< 500	< 500
26a	EB-1	10		< 330		< 330	< 330		< 330	< 330	< 330
	EB-2	10		< 330		< 330	< 330		< 330	< 330	< 330
	EB-3	35		< 330		< 330	< 330		< 330	< 330	< 330
	EB-7	30		< 330		< 330	< 330		< 330	< 330	< 330
	EB-8	20		< 330		< 330	< 330		< 330	< 330	< 330
26b	EB-3	0.5		< 330		< 330	< 330		< 330	< 330	< 330
		15		< 330		< 330	< 330		< 330	< 330	< 330
		25		< 330		< 330	< 330		< 330	< 330	< 330
	EB-7	0.5		< 330		< 330	< 330		< 330	< 330	< 330
		15		< 330		< 330	< 330		< 330	< 330	< 330
		25		< 330		< 330	< 330		< 330	< 330	< 330
		35		< 330		< 330	< 330		< 330	< 330	< 330
	EB-8	0.5		< 330		< 330	< 330		< 330	< 330	< 330
		15		< 330		< 330	< 330		< 330	< 330	< 330
		25		< 330		< 330	< 330		< 330	< 330	< 330
		35		< 330		< 330	< 330		< 330	< 330	< 330
	PEB-11	0.5		< 330		< 330	< 330		< 330	< 330	< 330
		15		< 330		< 330	< 330		< 330	< 330	< 330
		25		< 330		< 330	< 330		< 330	< 330	< 330
		35		< 330		< 330	< 330		< 330	< 330	< 330
	PEB-13	0.5		< 330		< 330	2300		< 330	< 330	< 330
		15		< 330		< 330	< 330		< 330	< 330	< 330
		25		< 330		< 330	< 330		< 330	< 330	< 330
		35		< 330		< 330	< 330		< 330	< 330	< 330
	PEB-17	0.5		< 330		< 330	< 330		< 330	< 330	< 330
		15		< 330		< 330	< 330		< 330	< 330	< 330
		25		< 330		< 330	< 330		< 330	< 330	< 330
		35		< 330		< 330	< 330		< 330	< 330	< 330

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	bis(p-Chlorophenyl) sulfone	Carbazole	Cyclic octaatomic sulfur (TIC)	Dibenzofuran	Dibutyl phthalate	Diethyl phosphorodithioic acid (TIC)	Diethyl phthalate	Dimethyl phthalate	Di-n-octyl phthalate
26b	PEB-18	0.5		< 330		< 330	< 330 UJ		< 330	< 330	< 330
		15		< 330		< 330	< 330 UJ		< 330	< 330	< 330
		25		< 330		< 330	< 330 UJ		< 330	< 330	< 330
		35		< 330		< 330	< 480 UJ		< 330	< 330	< 330
	PEB-9	0.5		< 330		< 330	< 330		< 330	< 330	< 330
		15		< 330		< 330	< 330		< 330	< 330	< 330
		25		< 330		< 330	< 330		< 330	< 330	< 330
		35		< 330		< 330	< 330		< 330	< 330	< 330
36	BP-01	0	< 340 U	< 340 U		< 340 U	< 340 U		< 340 U	< 340 U	< 340 UJ-
		10	< 350 U	< 350 U		< 350 U	< 350 U		< 350 U	< 350 U	< 350 U
		30	< 570 U	< 570 U		< 570 U	< 570 U		< 570 U	< 570 U	< 570 U
	BP-02	0	< 340 U	< 340 U		< 340 U	< 340 U		< 340 U	< 340 U	< 340 U
		10	< 340 U	< 340 U		< 340 U	< 340 U		< 340 U	< 340 U	< 340 U
		30	< 720 U	< 720 U		< 720 U	< 720 U		< 720 U	< 720 U	< 720 U
		40	< 630 U	< 630 U		< 630 U	< 630 U		< 630 U	< 630 U	< 630 U
	BP-03	0	< 340 U	< 340 U		< 340 U	< 340 U		< 340 U	< 340 U	< 340 U
		10	< 360 U	< 360 U		< 360 U	< 360 U		< 360 U	< 360 U	< 360 U
		30	< 610 U	< 610 U		< 610 U	< 610 U		< 610 U	< 610 U	< 610 U
	BP-04	0	< 330 U	< 330 U		< 330 U	< 330 U		< 330 U	< 330 U	< 330 U
		10	< 350 U	< 350 U		< 350 U	< 350 U		< 350 U	< 350 U	< 350 U
		30	< 630 U	< 630 U		< 630 U	< 630 U		< 630 U	< 630 U	< 630 U
	BP-05	0	< 330 U	< 330 U		< 330 U	< 330 U		< 330 U	< 330 U	< 330 U
		10	< 360 U	< 360 U		< 360 U	64 J		< 360 U	< 360 U	< 360 U
		30	< 640 U	< 640 U		< 640 U	< 640 U		< 640 U	< 640 U	< 640 UJ-
		40	< 770 U	< 770 U		< 770 U	< 770 U		< 770 U	< 770 U	< 770 UJ-
	BP-06	0	< 330 U	< 330 U		< 330 U	< 330 U		< 330 U	< 330 U	< 330 U
		10	< 600 U	< 600 U		< 600 U	< 600 U		< 600 U	< 600 U	< 600 U
		30	< 660 U	< 660 U		< 660 U	< 660 U		< 660 U	< 660 U	< 660 U
		40	< 770 U	< 770 U		< 770 U	< 770 U		< 770 U	< 770 U	< 770 U
	BP-07	0	< 340 U	< 340 U		< 340 U	< 340 U		< 340 U	< 340 U	< 340 U
		10	< 360 U	< 360 U		< 360 U	< 360 U		< 360 U	< 360 U	< 360 U
		30	< 620 U	< 620 U		< 620 U	< 620 U		< 620 U	< 620 U	< 620 U
		40	< 440 UJ-	< 440 UJ-		< 440 UJ-	< 440 UJ-		< 440 UJ-	< 440 UJ-	< 440 UJ-
	BP-08	0	< 330 UJ-	< 330 UJ-		< 330 UJ-	< 330 UJ-		< 330 UJ-	< 330 UJ-	< 330 UJ-
		10	< 360 UJ-	< 360 UJ-		< 360 UJ-	< 360 UJ-		< 360 UJ-	< 360 UJ-	< 360 UJ-
		30	< 810 UJ-	< 810 UJ-		< 810 UJ-	< 810 UJ-		< 810 UJ-	< 810 UJ-	< 810 UJ-
		40	< 670 UJ-	< 670 UJ-		< 670 UJ-	< 670 UJ-		< 670 UJ-	< 670 UJ-	< 670 UJ-

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	bis(p-Chlorophenyl) sulfone	Carbazole	Cyclic octaatomic sulfur (TIC)	Dibenzofuran	Dibutyl phthalate	Diethyl phosphorodithioic acid (TIC)	Diethyl phthalate	Dimethyl phthalate	Di-n-octyl phthalate
36	BP-09	0	< 330 UJ-	< 330 UJ-	150	< 330 UJ-	< 330 UJ-		< 330 UJ-	< 330 UJ-	< 330 UJ-
		10	< 360 UJ-	< 360 UJ-	280	< 360 UJ-	< 360 UJ-	9400	< 360 UJ-	< 360 UJ-	< 360 UJ-
		20						650			
		30	< 900 UJ-	< 900 UJ-	500	< 900 UJ-	< 900 UJ-	1100	< 900 UJ-	< 900 UJ-	< 900 UJ-
		40	< 680 UJ-	< 680 UJ-		< 680 UJ-	< 680 UJ-	48	< 680 UJ-	< 680 UJ-	< 680 UJ-
	BP-10	0	< 330 UJ-	< 330 UJ-		< 330 UJ-	< 330 UJ-		< 330 UJ-	< 330 UJ-	< 330 UJ-
		10	< 340 UJ-	< 340 UJ-		< 340 UJ-	< 340 UJ-		< 340 UJ-	< 340 UJ-	< 340 UJ-
		30	< 650 UJ-	< 650 UJ-		< 650 UJ-	< 650 UJ-		< 650 UJ-	< 650 UJ-	< 650 UJ-
		40	< 1100 UJ-	< 1100 UJ-		< 1100 UJ-	< 1100 UJ-		< 1100 UJ-	< 1100 UJ-	< 1100 UJ-

All results in µg/kg.

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	Diphenyl sulfone	Fluoranthene	Fluorene	Hexachlorobenzene	Hexachlorocyclopentadiene	Hydroxymethyl phthalimide	Isophorone	m,p-Cresols	Nitrobenzene
10a/13a	B-15	0		< 500	< 500	< 500	< 500		< 500	< 500	< 500
		5		< 500	< 500	< 500	< 500		< 500	< 500	< 500
		20		< 500	< 500	< 500	< 500		< 500	< 500	< 500
		30		< 500	< 500	< 500	< 500		< 500	< 500	< 500
	B-16	0		< 500	< 500	< 500	< 500		< 500	< 500	< 500
		5		< 500	< 500	< 500	< 500		< 500	< 500	< 500
		20		< 500	< 500	< 500	< 500		< 500	< 500	< 500
		30		< 500	< 500	< 500	< 500		< 500	< 500	< 500
26a	EB-1	10		< 330	< 330	< 330	< 330		< 330	< 330	< 330
	EB-2	10		< 330	< 330	< 330	< 330		< 330	< 330	< 330
	EB-3	35		< 330	< 330	< 330	< 330		< 330	< 330	< 330
	EB-7	30		< 330	< 330	< 330	< 330		< 330	< 330	< 330
	EB-8	20		< 330	< 330	< 330	< 330		< 330	< 330	< 330
26b	EB-3	0.5		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		15		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		25		< 330	< 330	< 330	< 330		< 330	< 330	< 330
	EB-7	0.5		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		15		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		25		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		35		< 330	< 330	< 330	< 330		< 330	< 330	< 330
	EB-8	0.5		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		15		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		25		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		35		< 330	< 330	< 330	< 330		< 330	< 330	< 330
	PEB-11	0.5		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		15		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		25		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		35		< 330	< 330	< 330	< 330		< 330	< 330	< 330
	PEB-13	0.5		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		15		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		25		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		35		< 330	< 330	< 330	< 330		< 330	< 330	< 330
	PEB-17	0.5		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		15		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		25		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		35		< 330	< 330	< 330	< 330		< 330	< 330	< 330

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	Diphenyl sulfone	Fluoranthene	Fluorene	Hexachlorobenzene	Hexachlorocyclopentadiene	Hydroxymethyl phthalimide	Isophorone	m,p-Cresols	Nitrobenzene
26b	PEB-18	0.5		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		15		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		25		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		35		< 330	< 330	< 330	< 330		< 330	< 330	< 330
	PEB-9	0.5		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		15		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		25		< 330	< 330	< 330	< 330		< 330	< 330	< 330
		35		< 330	< 330	< 330	< 330		< 330	< 330	< 330
36	BP-01	0	< 340 U	< 340 U	< 340 U	< 340 U	< 1700 U	< 340 U	< 340 U		< 340 U
		10	< 350 U	< 350 U	< 350 U	< 350 U	< 1700 U	< 350 U	< 350 U		< 350 U
		30	< 570 U	< 570 U	< 570 U	< 570 U	< 2800 U	< 570 U	< 570 U		< 570 U
	BP-02	0	< 340 U	< 340 U	< 340 U	72 J	< 1600 U	< 340 U	< 340 U		< 340 U
		10	< 340 U	< 340 U	< 340 U	< 340 U	< 1700 U	< 340 U	< 340 U		< 340 U
		30	< 720 U	< 720 U	< 720 U	< 720 U	< 3500 U	< 720 U	< 720 U		< 720 U
		40	< 630 U	< 630 U	< 630 U	< 630 U	< 3100 U	< 630 U	< 630 U		< 630 U
	BP-03	0	< 340 U	< 340 U	< 340 U	< 340 U	< 1600 U	< 340 UJ	< 340 U		< 340 U
		10	< 360 U	< 360 U	< 360 U	< 360 U	< 1800 U	< 360 UJ	< 360 U		< 360 U
		30	< 610 U	< 610 U	< 610 U	< 610 U	< 3000 U	< 610 UJ	< 610 U		< 610 U
	BP-04	0	< 330 U	< 330 U	< 330 U	< 330 U	< 1600 U	< 330 UJ	< 330 U		< 330 U
		10	< 350 U	< 350 U	< 350 U	< 350 U	< 1700 U	< 350 UJ	< 350 U		< 350 U
		30	< 630 U	< 630 U	< 630 U	< 630 U	< 3000 U	< 630 UJ	< 630 U		< 630 U
	BP-05	0	< 330 U	< 330 U	< 330 U	< 330 U	< 1600 U	< 330 UJ	< 330 U		< 330 U
		10	< 360 U	< 360 U	< 360 U	< 360 U	< 1700 U	< 360 UJ	< 360 U		< 360 U
		30	< 640 U	< 640 U	< 640 U	< 640 U	< 3100 U	< 640 UJ-	< 640 U		< 640 U
		40	< 770 U	< 770 U	< 770 U	< 770 U	< 3800 U	< 770 UJ-	< 770 U		< 770 U
	BP-06	0	< 330 U	< 330 U	< 330 U	< 330 U	< 1600 U	< 330 UJ	< 330 U		< 330 U
		10	< 600 U	< 600 U	< 600 U	< 600 U	< 2900 U	< 600 UJ	< 600 U		< 600 U
		30	< 660 U	< 660 U	< 660 U	< 660 U	< 3200 U	< 660 UJ	< 660 U		< 660 U
		40	< 770 U	< 770 U	< 770 U	< 770 U	< 3700 U	< 770 UJ	< 770 U		< 770 U
	BP-07	0	< 340 U	< 340 U	< 340 U	< 340 U	< 1600 U	< 340 UJ	< 340 U		< 340 U
		10	< 360 U	< 360 U	< 360 U	< 360 U	< 1700 U	< 360 UJ	< 360 U		< 360 U
		30	< 620 U	< 620 U	< 620 U	< 620 U	< 3000 U	< 620 UJ	< 620 U		< 620 U
		40	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 2100 UJ-	< 440 UJ-	< 440 UJ-		< 440 UJ-
	BP-08	0	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 1600 UJ-	< 330 UJ-	< 330 UJ-		< 330 UJ-
		10	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 1700 UJ-	< 360 UJ-	< 360 UJ-		< 360 UJ-
		30	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 3900 UJ-	< 810 UJ-	< 810 UJ-		< 810 UJ-
		40	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 3200 UJ-	< 670 UJ-	< 670 UJ-		< 670 UJ-

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	Diphenyl sulfone	Fluoranthene	Fluorene	Hexachlorobenzene	Hexachlorocyclopentadiene	Hydroxymethyl phthalimide	Isophorone	m,p-Cresols	Nitrobenzene
36	BP-09	0	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 1600 UJ-	< 330 UJ-	< 330 UJ-		< 330 UJ-
		10	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 1700 UJ-	< 360 UJ-	< 360 UJ-		< 360 UJ-
		20									
		30	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 4400 UJ-	< 900 UJ-	< 900 UJ-		< 900 UJ-
		40	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 3300 UJ-	< 680 UJ-	< 680 UJ-		< 680 UJ-
	BP-10	0	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 1600 UJ-	< 330 UJ-	< 330 UJ-		< 330 UJ-
		10	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 1700 UJ-	< 340 UJ-	< 340 UJ-		< 340 UJ-
		30	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 3200 UJ-	< 650 UJ-	< 650 UJ-		< 650 UJ-
		40	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 5300 UJ-	< 1100 UJ-	< 1100 UJ-		< 1100 UJ-

All results in μg/kg.

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	N-Nitrosodimethylamine	N-nitrosodi-n-propylamine	N-nitrosodiphenylamine	O,o'-diethyl s-methyl thiophos (TIC)	o-Cresol	Octachlorostyrene	p-Chloroaniline	p-Chlorothiophenol	Pentachlorobenzene
10a/13a	B-15	0	< 500	< 500	< 500		< 500		< 1000		
		5	< 500	< 500	< 500		< 500		< 1000		
		20	< 500	< 500	< 500		< 500		< 1000		
		30	< 500	< 500	< 500		< 500		< 1000		
	B-16	0	< 500	< 500	< 500		< 500		< 1000		
		5	< 500	< 500	< 500		< 500		< 1000		
		20	< 500	< 500	< 500		< 500		< 1000		
		30	< 500	< 500	< 500		< 500		< 1000		
26a	EB-1	10	< 330	< 330	< 330		< 330		< 330		
	EB-2	10	< 330	< 330	< 330		< 330		< 330		
	EB-3	35	< 330	< 330	< 330		< 330		< 330		
	EB-7	30	< 330	< 330	< 330		< 330		< 330		
	EB-8	20	< 330	< 330	< 330		< 330		< 330		
26b	EB-3	0.5	< 330	< 330	< 330		< 330		< 330		
		15	< 330	< 330	< 330		< 330		< 330		
		25	< 330	< 330	< 330		< 330		< 330		
	EB-7	0.5	< 330	< 330	< 330		< 330		< 330		
		15	< 330	< 330	< 330		< 330		< 330		
		25	< 330	< 330	< 330		< 330		< 330		
		35	< 330	< 330	< 330		< 330		< 330		
	EB-8	0.5	< 330	< 330	< 330		< 330		< 330		
		15	< 330	< 330	< 330		< 330		< 330		
		25	< 330	< 330	< 330		< 330		< 330		
		35	< 330	< 330	< 330		< 330		< 330		
	PEB-11	0.5	< 330	< 330	< 330		< 330		< 330		
		15	< 330	< 330	< 330		< 330		< 330		
		25	< 330	< 330	< 330		< 330		< 330		
		35	< 330	< 330	< 330		< 330		< 330		
	PEB-13	0.5	< 330	< 330	< 330		< 330		< 330		
		15	< 330	< 330	< 330		< 330		< 330		
		25	< 330	< 330	< 330		< 330		< 330		
		35	< 330	< 330	< 330		< 330		< 330		
	PEB-17	0.5	< 330	< 330	< 330		< 330		< 330		
		15	< 330	< 330	< 330		< 330		< 330		
		25	< 330	< 330	< 330		< 330		< 330		
		35	< 330	< 330	< 330		< 330		< 330		

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	N-Nitrosodimethylamine	N-nitrosodi-n-propylamine	N-nitrosodiphenylamine	O,o'-diethyl s-methyl thiophos (TIC)	o-Cresol	Octachlorostyrene	p-Chloroaniline	p-Chlorothiophenol	Pentachlorobenzene
26b	PEB-18	0.5	< 330	< 330	< 330		< 330		< 330		
		15	< 330	< 330	< 330		< 330		< 330		
		25	< 330	< 330	< 330		< 330		< 330		
		35	< 330	< 330	< 330		< 330		< 330		
	PEB-9	0.5	< 330	< 330	< 330		< 330		< 330		
		15	< 330	< 330	< 330		< 330		< 330		
		25	< 330	< 330	< 330		< 330		< 330		
		35	< 330	< 330	< 330		< 330		< 330		
36	BP-01	0		< 340 U	< 340 U		< 340 U	< 340 U	< 340 U	< 340 U	< 340 U
		10		< 350 U	< 350 U		< 350 U	< 350 U	< 350 U	< 350 U	< 350 U
		30		< 570 U	< 570 U		< 570 U	< 570 U	< 570 U	< 570 U	< 570 U
	BP-02	0		< 340 U	< 340 U		< 340 U	< 340 U	< 340 U	< 340 U	88 J
		10		< 340 U	< 340 U		< 340 U	< 340 U	< 340 U	< 340 U	< 340 U
		30		< 720 U	< 720 U		< 720 U	< 720 U	< 720 U	< 720 U	< 720 U
		40		< 630 U	< 630 U		< 630 U	< 630 U	< 630 U	< 630 U	< 630 U
	BP-03	0		< 340 U	< 340 U		< 340 U	< 340 U	< 340 U	< 340 U	< 340 U
		10		< 360 U	< 360 U		< 360 U	< 360 U	< 360 U	< 360 U	< 360 U
		30		< 610 U	< 610 U		< 610 U	< 610 U	< 610 U	< 610 U	< 610 U
	BP-04	0		< 330 U	< 330 U		< 330 U	< 330 U	< 330 U	< 330 U	< 330 U
		10		< 350 U	< 350 U		< 350 U	< 350 U	< 350 U	< 350 U	< 350 U
		30		< 630 U	< 630 U		< 630 U	< 630 U	< 630 U	< 630 U	< 630 U
	BP-05	0		< 330 U	< 330 U		< 330 U	< 330 U	< 330 U	< 330 U	< 330 U
		10		< 360 U	< 360 U		< 360 U	< 360 U	< 360 U	< 360 U	< 360 U
		30		< 640 U	< 640 U		< 640 U	< 640 U	< 640 U	< 640 U	< 640 U
		40		< 770 U	< 770 U		< 770 U	< 770 U	< 770 U	< 770 U	< 770 U
	BP-06	0		< 330 U	< 330 U		< 330 U	< 330 U	< 330 U	< 330 U	< 330 U
		10		< 600 U	< 600 U		< 600 U	< 600 U	< 600 U	< 600 U	< 600 U
		30		< 660 U	< 660 U		< 660 U	< 660 U	< 660 U	< 660 U	< 660 U
		40		< 770 U	< 770 U		< 770 U	< 770 U	< 770 U	< 770 U	< 770 U
	BP-07	0		< 340 U	< 340 U		< 340 U	< 340 U	< 340 U	< 340 U	< 340 U
		10		< 360 U	< 360 U		< 360 U	< 360 U	< 360 U	< 360 U	< 360 U
		30		< 620 U	< 620 U		< 620 U	< 620 U	< 620 U	< 620 U	< 620 U
		40		< 440 UJ-	< 440 UJ-		< 440 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-
	BP-08	0		< 330 UJ-	< 330 UJ-		< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-
		10		< 360 UJ-	< 360 UJ-		< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-
		30		< 810 UJ-	< 810 UJ-		< 810 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-
		40		< 670 UJ-	< 670 UJ-		< 670 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	N-Nitrosodimethylamine	N-nitrosodi-n-propylamine	N-nitrosodiphenylamine	O,o'-diethyl s-methyl thiophos (TIC)	o-Cresol	Octachlorostyrene	p-Chloroaniline	p-Chlorothiophenol	Pentachlorobenzene
36	BP-09	0		< 330 UJ-	< 330 UJ-		< 330 UJ-	< 330 UJ-	< 330 UJ-	1500 J-	< 330 UJ-
		10		< 360 UJ-	< 360 UJ-	610	< 360 UJ-	< 360 UJ-	< 360 UJ-	300 J-	< 360 UJ-
		20									
		30		< 900 UJ-	< 900 UJ-		< 900 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-
		40		< 680 UJ-	< 680 UJ-		< 680 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-
	BP-10	0		< 330 UJ-	< 330 UJ-		< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-
		10		< 340 UJ-	< 340 UJ-		< 340 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-
		30		< 650 UJ-	< 650 UJ-		< 650 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-
		40		< 1100 UJ-	< 1100 UJ-		< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-

All results in μg/kg.

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	Pentachlorophenol	Phenol	Phenyl Disulfide	Phenyl Sulfide	Phosphorothioic acid, s-[2-[(1 (TIC)	Phthalic acid	p-Nitroaniline	Pyridine	S-methyl methanethiosulphonate (TIC)
10a/13a	B-15	0	< 1	< 500					< 1000	< 500	
		5	< 1	< 500					< 1000	< 500	
		20	< 1	< 500					< 1000	< 500	
		30	< 1	< 500					< 1000	< 500	
	B-16	0	< 1	< 500					< 1000	< 500	
		5	< 1	< 500					< 1000	< 500	
		20	< 1	< 500					< 1000	< 500	
		30	< 1	< 500					< 1000	< 500	
26a	EB-1	10	< 330	< 330					< 330	< 330	
	EB-2	10	< 330	< 330					< 330	< 330	
	EB-3	35	< 330	< 330					< 330	< 330	
	EB-7	30	< 330	< 330					< 330	< 330	
	EB-8	20	< 330	< 330					< 330	< 330	
26b	EB-3	0.5	< 330	< 330					< 330	< 330	
		15	< 330	< 330					< 330	< 330	
		25	< 330	< 330					< 330	< 330	
	EB-7	0.5	< 330	< 330					< 330	< 330	
		15	< 330	< 330					< 330	< 330	
		25	< 330	< 330					< 330	< 330	
		35	< 330	< 330					< 330	< 330	
	EB-8	0.5	< 330	< 330					< 330	< 330	
		15	< 330	< 330					< 330	< 330	
		25	< 330	< 330					< 330	< 330	
		35	< 330	< 330					< 330	< 330	
	PEB-11	0.5	< 330	< 330					< 330	< 330	
		15	< 330	< 330					< 330	< 330	
		25	< 330	< 330					< 330	< 330	
		35	< 330	< 330					< 330	< 330	
	PEB-13	0.5	< 330	< 330					< 330	< 330	
		15	< 330	< 330					< 330	< 330	
		25	< 330	< 330					< 330	< 330	
		35	< 330	< 330					< 330	< 330	
	PEB-17	0.5	< 330	< 330					< 330	< 330	
		15	< 330	< 330					< 330	< 330	
		25	< 330	< 330					< 330	< 330	
		35	< 330	< 330					< 330	< 330	

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	Pentachlorophenol	Phenol	Phenyl Disulfide	Phenyl Sulfide	Phosphorothioic acid, s-[2-[(1 (TIC)	Phthalic acid	p-Nitroaniline	Pyridine	S-methyl methanethiosulphonate (TIC)
26b	PEB-18	0.5	< 330	< 330					< 330	< 330	
		15	< 330	< 330					< 330	< 330	
		25	< 330	< 330					< 330	< 330	
		35	< 330	< 330					< 330	< 330	
	PEB-9	0.5	< 330	< 330					< 330	< 330	
		15	< 330	< 330					< 330	< 330	
		25	< 330	< 330					< 330	< 330	
		35	< 330	< 330					< 330	< 330	
36	BP-01	0	< 1700 U	< 340 U	< 340 U	< 340 U		< 1700 U	< 1700 U	< 690 U	
		10	< 1700 U	< 350 U	< 350 U	< 350 U		< 1700 U	< 1700 U	< 690 U	
		30	< 2800 U	< 570 U	< 570 U	< 570 U		< 2800 U	< 2800 U	< 1100 U	
	BP-02	0	< 1600 U	< 340 U	< 340 U	< 340 U		< 1600 U	< 1600 U	< 670 U	
		10	< 1700 U	< 340 U	< 340 U	< 340 U		< 1700 U	< 1700 U	< 690 U	
		30	< 3500 U	< 720 U	< 720 U	< 720 U		< 3500 U	< 3500 U	< 1400 U	
		40	< 3100 U	< 630 U	< 630 U	< 630 U			< 3100 U	< 1300 U	
	BP-03	0	< 1600 U	< 340 U	< 340 U	< 340 U		< 1600 UJ	< 1600 U	< 670 U	
		10	< 1800 U	< 360 U	< 360 U	< 360 U		< 1800 UJ	< 1800 U	< 730 U	
		30	< 3000 U	< 610 U	< 610 U	< 610 U		< 3000 U	< 3000 U	< 1200 U	
	BP-04	0	< 1600 U	< 330 U	< 330 U	< 330 U		< 1600 UJ	< 1600 U	< 670 U	
		10	< 1700 U	< 350 U	< 350 U	< 350 U		< 1700 UJ	< 1700 U	< 700 U	
		30	< 3000 U	< 630 U	< 630 U	< 630 U		< 3000 U	< 3000 U	< 1300 U	
	BP-05	0	< 1600 U	< 330 U	< 330 U	< 330 U		< 1600 UJ	< 1600 U	< 670 U	
		10	< 1700 U	< 360 U	< 360 U	< 360 U		< 1700 UJ	< 1700 U	< 710 U	
		30	< 3100 U	< 640 U	< 640 U	< 640 U		< 3100 UJ-	< 3100 U	< 1300 U	
		40	< 3800 U	< 770 U	< 770 U	< 770 U		< 3800 UJ-	< 3800 U	< 1500 U	
	BP-06	0	< 1600 U	< 330 U	< 330 U	< 330 U		< 1600 U	< 1600 U	< 670 U	
		10	< 2900 U	< 600 U	< 600 U	< 600 U		< 2900 U	< 2900 U	< 1200 U	
		30	< 3200 U	< 660 U	< 660 U	< 660 U		< 3200 U	< 3200 U	< 1300 U	
		40	< 3700 U	< 770 U	< 770 U	< 770 U		< 3700 U	< 3700 U	< 1500 U	
	BP-07	0	< 1600 U	< 340 U	< 340 U	< 340 U		< 1600 U	< 1600 U	< 670 U	
		10	< 1700 U	< 360 U	< 360 U	< 360 U		< 1700 U	< 1700 U	< 720 U	
		30	< 3000 U	< 620 U	< 620 U	< 620 U		< 3000 U	< 3000 U	< 1200 U	
		40	< 2100 UJ-	< 440 UJ-	< 440 UJ-	< 440 UJ-		< 2100 UJ-	< 2100 UJ-	< 880 UJ-	
	BP-08	0	< 1600 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-		< 1600 UJ-	< 1600 UJ-	< 670 UJ-	
		10	< 1700 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-		< 1700 UJ-	< 1700 UJ-	< 710 UJ-	
		30	< 3900 UJ-	< 810 UJ-	< 810 UJ-	< 810 UJ-		< 3900 UJ-	< 3900 UJ-	< 1600 UJ-	
		40	< 3200 UJ-	< 670 UJ-	< 670 UJ-	< 670 UJ-		< 3200 UJ-	< 3200 UJ-	< 1300 UJ-	

TABLE D1-10
SEMI-VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	Pentachlorophenol	Phenol	Phenyl Disulfide	Phenyl Sulfide	Phosphorothioic acid, s-[2-[(1 (TIC)	Phthalic acid	p-Nitroaniline	Pyridine	S-methyl methanethiosulphonate (TIC)
36	BP-09	0	< 1600 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-		< 1600 UJ-	< 1600 UJ-	< 670 UJ-	
		10	< 1700 UJ-	< 360 UJ-	< 360 UJ-	< 360 UJ-	7700	< 1700 UJ-	< 1700 UJ-	< 710 UJ-	
		20									
		30	< 4400 UJ-	< 900 UJ-	< 900 UJ-	< 900 UJ-		< 4400 UJ-	< 4400 UJ-	< 1800 UJ-	740
		40	< 3300 UJ-	< 680 UJ-	< 680 UJ-	< 680 UJ-		< 3300 UJ-	< 3300 UJ-	< 1400 UJ-	
	BP-10	0	< 1600 UJ-	< 330 UJ-	< 330 UJ-	< 330 UJ-		< 1600 UJ-	< 1600 UJ-	< 670 UJ-	
		10	< 1700 UJ-	< 340 UJ-	< 340 UJ-	< 340 UJ-		< 1700 UJ-	< 1700 UJ-	< 690 UJ-	
		30	< 3200 UJ-	< 650 UJ-	< 650 UJ-	< 650 UJ-		< 3200 UJ-	< 3200 UJ-	< 1300 UJ-	
		40	< 5300 UJ-	< 1100 UJ-	< 1100 UJ-	< 1100 UJ-		< 5300 UJ-	< 5300 UJ-	< 2200 UJ-	

All results in μg/kg.

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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DVSR	Location	Depth (ft bgs)	1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethylene	1,1-Dichloropropene	1,2,3-Trichlorobenzene	1,2,3-Trichloropropane	1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene
10a/13a	B-15	0	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
		5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5.6	< 5	12	< 5
		20	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
		30	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
	B-16	0	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
		5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
		20	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
		30	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5.8	< 5	< 5	< 5
26a	EB-1	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		10	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
		30	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
	EB-2	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		10	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
	EB-3	5	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
		10	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
	EB-7	5	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
		10	< 120	< 120	< 120	< 120	< 120	< 120	< 120	< 620	< 120	< 620	< 120
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
	EB-8	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		10	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		20	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		30	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
26b	EB-3	0.5										< 330	
		15	R	R	R	R	R	R	R	R	R	< 330	R
		25	R	R	R	R	R	R	R	R	R	< 330	R
		35	R	R	R	R	R	R	R	R	R	R	R

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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DVSR	Location	Depth (ft bgs)	1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethylene	1,1-Dichloropropene	1,2,3-Trichlorobenzene	1,2,3-Trichloropropane	1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene
26b	EB-7	0.5										< 330	
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25 UJ	< 5
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
	EB-8	0.5										< 330	
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		35										< 330	
	PEB-11	0.5										< 330	
		15	R	R	R	R	R	R	R	R	R	< 330	R
		25	R	R	R	R	R	R	R	R	R	< 330	R
		35	R	R	R	R	R	R	R	R	R	< 330	R
	PEB-13	0.5										< 330	
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
	PEB-17	0.5										< 330	
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
	PEB-18	0.5										< 330	
		15	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
		25	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 25 UJ	< 5 UJ	< 25 UJ	< 5 UJ
	PEB-9	0.5										< 330	
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 25	< 5	< 25	< 5
36	BP-01	0											
		10											
		30	< 8.6 U	< 8.6 U	< 8.6 UJ	< 8.6 UJ	< 8.6 U	< 8.6 U	< 8.6 U	< 8.6 UJ	< 8.6 U	< 8.6 UJ	< 8.6 U
	BP-02	0											
		10											
		30	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 UJ-	< 11 UJ-	< 11 U	< 11 UJ-	< 11 U
		40	< 9.8 U	< 9.8 U	< 9.8 UJ	< 9.8 UJ	< 9.8 U	< 9.8 U	< 9.8 U	< 9.8 UJ	< 9.8 U	< 9.8 UJ	< 9.8 U
	BP-03	0											
		10											

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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DVSR	Location	Depth (ft bgs)	1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethylene	1,1-Dichloropropene	1,2,3-Trichlorobenzene	1,2,3-Trichloropropane	1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene
36		20	< 7.5 U	< 7.5 U	< 7.5 UJ	< 7.5 UJ	< 7.5 U	< 7.5 U	< 7.5 U	< 7.5 UJ	< 7.5 U	< 7.5 UJ	< 7.5 U
		30	< 9.3 U	< 9.3 U	< 9.3 UJ	< 9.3 UJ	< 9.3 U	< 9.3 U	< 9.3 U	< 9.3 UJ	< 9.3 U	< 9.3 UJ	< 9.3 U
	BP-04	0											
		10											
		30	< 9.5 U	< 9.5 U	< 9.5 UJ	< 9.5 UJ	< 9.5 U	< 9.5 U	< 9.5 U	5.5 J+	< 9.5 U	< 9.5 UJ	< 9.5 U
	BP-05	0											
		10											
		30	< 9.7 U	< 9.7 U	< 9.7 UJ	< 9.7 UJ	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 UJ	< 9.7 U	< 9.7 UJ	< 9.7 U
		40	< 12 U	< 12 U	< 12 UJ	< 12 UJ	< 12 U	< 12 U	< 12 U	3.7 J+	< 12 U	5.5 J+	< 12 U
	BP-06	0											
		10	< 9.1 U	< 9.1 U	< 9.1 UJ	< 9.1 UJ	< 9.1 U	< 9.1 U	< 9.1 U	< 9.1 UJ	< 9.1 U	< 9.1 UJ	< 9.1 U
		30	< 10 U	< 10 U	< 10 UJ	< 10 UJ	< 10 U	< 10 U	< 10 U	< 10 UJ	< 10 U	< 10 UJ	< 10 U
		40	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U
	BP-07	0											
		10											
		30	< 9.4 U	< 9.4 U	< 9.4 UJ	< 9.4 UJ	< 9.4 U	< 9.4 U	< 9.4 U	< 9.4 UJ	< 9.4 U	< 9.4 UJ	< 9.4 U
		40	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U
	BP-08	0											
		10											
		20	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U
		30	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U
		40	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
	BP-09	0											
		10											
		20	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U
		30	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-
		40	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-
	BP-10	0											
		10											
		30	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-
		40	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-

All results in µg/kg.

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
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BORROW AREA, CLARK COUNTY, NEVADA
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DVSR	Location	Depth (ft bgs)	1,2-Dibromo-3-chloropropane (DBCP)	1,2-Dibromoethane	1,2-Dichlorobenzene	1,2-Dichloroethane	1,2-Dichloroethylene	1,2-Dichloropropane	1,3,5- Trichlorobenzene	1,3,5-Trimethylbenzene	1,3-Dichlorobenzene	1,3-Dichloropropane	1,4-Dichlorobenzene
10a/13a	B-15	0	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		5	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		20	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		30	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
	B-16	0	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		5	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		20	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		30	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
26a	EB-1	5	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		10	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		30	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	EB-2	5	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		10	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	EB-3	5	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		10	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	EB-7	5	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		10	< 120	< 120	< 120	< 120		< 120		< 120	< 120	< 120	< 120
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	EB-8	5	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		10	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		20	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		30	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		35	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
26b	EB-3	0.5			< 330						< 330		< 330
		15	R	R	< 330	R		R		R	< 330	R	< 330
		25	R	R	< 330	R		R		R	< 330	R	< 330
		35	R	R	R	R		R		R	R	R	R

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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DVSR	Location	Depth (ft bgs)	1,2-Dibromo-3-chloropropane (DBCP)	1,2-Dibromoethane	1,2-Dichlorobenzene	1,2-Dichloroethane	1,2-Dichloroethylene	1,2-Dichloropropane	1,3,5- Trichlorobenzene	1,3,5-Trimethylbenzene	1,3-Dichlorobenzene	1,3-Dichloropropane	1,4-Dichlorobenzene
26b	EB-7	0.5			< 330						< 330		< 330
		15	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		25	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		35	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
	EB-8	0.5			< 330						< 330		< 330
		15	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		25	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		35			< 330						< 330		< 330
	PEB-11	0.5			< 330						< 330		< 330
		15	R	R	< 330	R		R		R	< 330	R	< 330
		25	R	R	< 330	R		R		R	< 330	R	< 330
		35	R	R	< 330	R		R		R	< 330	R	< 330
	PEB-13	0.5			< 330						< 330		< 330
		15	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		25	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		35	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
	PEB-17	0.5			< 330						< 330		< 330
		15	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		25	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		35	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
	PEB-18	0.5			< 330						< 330		< 330
		15	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		25	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	PEB-9	0.5			< 330						< 330		< 330
		15	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		25	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
		35	< 5	< 5	< 5	< 5		< 5		< 5	< 5	< 5	< 5
36	BP-01	0											
		10											
		30	< 17 UJ		< 8.6 U	< 8.6 UJ	< 17 U	< 8.6 U	< 8.6 U	< 8.6 U	< 8.6 U	< 8.6 U	< 8.6 UJ
	BP-02	0											
		10											
		30	< 22 U		< 11 UJ-	< 11 UJ	< 22 U	< 11 U	< 11	< 11 U	< 11 UJ-	< 11 UJ	< 11 UJ-
		40	< 20 UJ		< 9.8 U	< 9.8 UJ	< 20 U	< 9.8 U	< 9.8 U	< 9.8 U	< 9.8 U	< 9.8 U	< 9.8 UJ
	BP-03	0											
		10											

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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DVSR	Location	Depth (ft bgs)	1,2-Dibromo-3-chloropropane (DBCP)	1,2-Dibromoethane	1,2-Dichlorobenzene	1,2-Dichloroethane	1,2-Dichloroethylene	1,2-Dichloropropane	1,3,5- Trichlorobenzene	1,3,5-Trimethylbenzene	1,3-Dichlorobenzene	1,3-Dichloropropane	1,4-Dichlorobenzene
36		20	< 15 UJ		< 7.5 U	< 7.5 UJ	< 15 U	< 7.5 U	< 7.5 U	< 7.5 U	< 7.5 U	< 7.5 U	< 7.5 UJ
		30	< 19 UJ		< 9.3 U	< 9.3 UJ	< 19 U	< 9.3 U	< 9.3 U	< 9.3 U	< 9.3 U	< 9.3 U	< 9.3 UJ
	BP-04	0											
		10											
		30	< 19 UJ		< 9.5 U	< 9.5 UJ	< 19 U	< 9.5 U	< 9.5 U	< 9.5 U	< 9.5 U	< 9.5 U	< 9.5 UJ
	BP-05	0											
		10											
		30	< 19 UJ		< 9.7 U	< 9.7 UJ	< 19 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 UJ
		40	< 23 UJ		< 12 U	2.1 J+	< 23 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 UJ
	BP-06	0											
		10	< 18 UJ		< 9.1 U	< 9.1 UJ	< 18 U	< 9.1 U	< 9.1 U	< 9.1 U	< 9.1 U	< 9.1 U	< 9.1 UJ
		30	< 20 UJ		< 10 U	< 10 UJ	< 20 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 UJ
		40	< 23 U		< 12 U	< 12 U	< 23 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U
	BP-07	0											
		10											
		30	< 19 UJ		< 9.4 U	< 9.4 UJ	< 19 U	< 9.4 U	< 9.4 U	< 9.4 U	< 9.4 U	< 9.4 U	< 9.4 UJ
		40	< 13 U		< 6.6 U	< 6.6 U	< 13 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U
	BP-08	0											
		10											
		20	< 22 U		< 11 U	< 11 U	< 22 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U
		30	< 24 U		< 12 U	< 12 U	< 24 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U
		40	< 20 U		< 10 U	< 10 U	< 20 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
	BP-09	0											
		10											
		20	< 19 U		< 9.7 U	< 9.7 U	< 19 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U
		30	< 27 UJ-		< 14 UJ-	< 14 UJ-	< 27 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-
		40	< 21 UJ-		< 10 UJ-	< 10 UJ-	< 21 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-
	BP-10	0											
		10											
		30	< 20 UJ-		< 9.9 UJ-	< 9.9 UJ-	< 20 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-
		40	< 33 UJ-		< 16 UJ-	< 16 UJ-	< 33 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-

All results in µg/kg.

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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DVSR	Location	Depth (ft bgs)	1-Nonanal	2,2,3-Trimethylbutane	2,2-Dichloropropane	2,2-Dimethylpentane	2,3-Dimethylpentane	2,4-Dimethylpentane	2-Chloroethyl vinyl ether	2-Chlorotoluene	2-Nitropropane	2-Phenylbutane	3,3-dimethylpentane
10a/13a	B-15	0			< 10					< 5		< 5	
		5			< 10					< 5		< 5	
		20			< 10					< 5		< 5	
		30			< 10					< 5		< 5	
	B-16	0			< 10					< 5		< 5	
		5			< 10					< 5		< 5	
		20			< 10					< 5		< 5	
		30			< 10					< 5		< 5	
26a	EB-1	5			< 5				R	< 5		< 5	
		10			< 5				R	< 5		< 5	
		20			< 5 UJ				R	< 5 UJ		< 5 UJ	
		30			< 5				R	< 5		< 5	
		35			< 5 UJ				R	< 5 UJ		< 5 UJ	
	EB-2	5			< 5				R	< 5		< 5	
		10			< 5				R	< 5		< 5	
		20			< 5 UJ				R	< 5 UJ		< 5 UJ	
		30			< 5 UJ				R	< 5 UJ		< 5 UJ	
		35			< 5 UJ				< 5 UJ	< 5 UJ		< 5 UJ	
	EB-3	5			< 5 UJ				R	< 5 UJ		< 5 UJ	
		10			< 5 UJ				R	< 5 UJ		< 5 UJ	
		20			< 5 UJ				< 5 UJ	< 5 UJ		< 5 UJ	
		30			< 5 UJ				R	< 5 UJ		< 5 UJ	
		35			< 5 UJ					< 5 UJ		< 5 UJ	
	EB-7	5			< 5 UJ				R	< 5 UJ		< 5 UJ	
		10			< 120				R	< 120		< 120	
		20			< 5 UJ				R	< 5 UJ		< 5 UJ	
		30			< 5 UJ				R	< 5 UJ		< 5 UJ	
		35			< 5 UJ					< 5 UJ		< 5 UJ	
	EB-8	5			< 5				< 5	< 5		< 5	
		10			< 5				< 5	< 5		< 5	
		20			< 5				< 5	< 5		< 5	
		30			< 5				< 5	< 5		< 5	
		35			< 5				< 5	< 5		< 5	
26b	EB-3	0.5											
		15			R				R	R		R	
		25			R				R	R		R	
		35			R				R	R		R	

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	1-Nonanal	2,2,3-Trimethylbutane	2,2-Dichloropropane	2,2-Dimethylpentane	2,3-Dimethylpentane	2,4-Dimethylpentane	2-Chloroethyl vinyl ether	2-Chlorotoluene	2-Nitropropane	2-Phenylbutane	3,3-dimethylpentane
26b	EB-7	0.5											
		15			< 5				< 5	< 5		< 5	
		25			< 5				< 5	< 5		< 5	
		35			< 5				< 5	< 5		< 5	
	EB-8	0.5											
		15			< 5				< 5	< 5		< 5	
		25			< 5				< 5	< 5		< 5	
		35											
	PEB-11	0.5											
		15			R				R	R		R	
		25			R				R	R		R	
		35			R				R	R		R	
	PEB-13	0.5											
		15			< 5				8.9 J+	< 5		< 5	
		25			< 5				< 5	< 5		< 5	
		35			< 5				< 5	< 5		< 5	
	PEB-17	0.5											
		15			< 5				< 5	< 5		< 5	
		25			< 5				< 5	< 5		< 5	
		35			< 5				< 5	< 5		< 5	
	PEB-18	0.5											
		15			< 5 UJ				< 5 UJ	< 5 UJ		< 5 UJ	
		25			< 5 UJ				< 5 UJ	< 5 UJ		< 5 UJ	
		35			< 5 UJ				< 5 UJ	< 5 UJ		< 5 UJ	
	PEB-9	0.5											
		15			< 5				< 5	< 5		< 5	
		25			< 5				< 5	< 5		< 5	
		35			< 5				< 5	< 5		< 5	
36	BP-01	0											
		10											
		30	< 17 U	< 8.6 U	< 8.6 U	< 8.6 U	< 8.6 U	< 8.6 U		< 8.6 U	< 17 UJ	< 8.6 U	< 8.6 U
	BP-02	0											
		10											
		30	< 22 U	< 11 UJ-	< 11 UJ	< 11 UJ-	< 11 UJ-	< 11 UJ-		< 11 UJ-	< 22 UJ	< 11 U	< 11 UJ-
		40	< 20 U	< 9.6 U	< 9.8 U	< 9.6 U	< 9.6 U	< 9.6 U		< 9.8 U	< 20 UJ	< 9.8 U	< 9.6 U
	BP-03	0											
		10											

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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DVSR	Location	Depth (ft bgs)	1-Nonanal	2,2,3-Trimethylbutane	2,2-Dichloropropane	2,2-Dimethylpentane	2,3-Dimethylpentane	2,4-Dimethylpentane	2-Chloroethyl vinyl ether	2-Chlorotoluene	2-Nitropropane	2-Phenylbutane	3,3-dimethylpentane
36		20	< 15 U	< 7.5 U	< 7.5 U	< 7.5 U	< 7.5 U	< 7.5 U		< 7.5 U	< 15 UJ	< 7.5 U	< 7.5 U
		30	< 19 U	< 9.3 U	< 9.3 U	< 9.3 U	< 9.3 U	< 9.3 U		< 9.3 U	< 19 UJ	< 9.3 U	< 9.3 U
	BP-04	0											
		10											
		30	< 19 U	< 9.5 U	< 9.5 U	< 9.5 U	< 9.5 U	< 9.5 U		< 9.5 U	< 19 UJ	< 9.5 U	< 9.5 U
	BP-05	0											
		10											
		30	< 19 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U		< 9.7 U	< 19 UJ	< 9.7 U	< 9.7 U
		40	< 23 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U		< 12 U	< 23 UJ	< 12 U	< 12 U
	BP-06	0											
		10	< 18 U	< 9.1 U	< 9.1 U	< 9.1 U	< 9.1 U	< 9.1 U		< 9.1 U	< 18 UJ	< 9.1 U	< 9.1 U
		30	< 20 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U		< 10 U	< 20 UJ	< 10 U	< 10 U
		40	< 23 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U		< 12 U	< 23 UJ	< 12 U	< 12 U
	BP-07	0											
		10											
		30	< 19 U	< 9.4 U	< 9.4 U	< 9.4 U	< 9.4 U	< 9.4 U		< 9.4 U	< 19 UJ	< 9.4 U	< 9.4 U
		40	13 J+	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U		< 6.6 U	< 13 UJ	< 6.6 U	< 6.6 U
	BP-08	0											
		10											
		20	< 22 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U		< 11 U	< 22 UJ	< 11 U	< 11 U
		30	< 24 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U		< 12 U	< 24 UJ	< 12 U	< 12 U
		40	< 20 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U		< 10 U	< 20 UJ	< 10 U	< 10 U
	BP-09	0											
		10											
		20	< 19 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U		< 9.7 U	< 19 UJ	< 9.7 U	< 9.7 U
		30	< 27 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-		< 14 UJ-	< 27 UJ-	< 14 UJ-	< 14 UJ-
		40	< 21 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-		< 10 UJ-	< 21 UJ-	< 10 UJ-	< 10 UJ-
	BP-10	0											
		10											
		30	< 20 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-		< 9.9 UJ-	< 20 UJ-	< 9.9 UJ-	< 9.9 UJ-
		40	< 33 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-		< 16 UJ-	< 33 UJ-	< 16 UJ-	< 16 UJ-

All results in µg/kg.

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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DVSR	Location	Depth (ft bgs)	3-ethylpentane	3-Methylhexane	4-Chlorothioanisole	4-Chlorotoluene	Acetone	Acetonitrile	Benzene	Bromobenzene	Bromodichloromethane	Bromomethane	Carbon disulfide
10a/13a	B-15	0				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		5				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		20				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		30				< 5	< 25		< 5	< 5	< 5	< 5	< 5
	B-16	0				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		5				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		20				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		30				< 5	< 25		< 5	< 5	< 5	< 5	< 5
26a	EB-1	5				< 5	< 25		< 5	< 5	< 5	< 5	< 5 UJ
		10				< 5	< 25		< 5	< 5	< 5	< 5	< 5 UJ
		20				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		30				< 5	< 25		< 5	< 5	< 5	< 5	< 5 UJ
		35				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	EB-2	5				< 5	< 25		< 5	< 5	< 5	< 5	< 5 UJ
		10				< 5	< 25		< 5	< 5	< 5	< 5	< 5 UJ
		20				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		30				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	EB-3	5				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		10				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		20				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		30				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	EB-7	5				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		10				< 120	< 620		< 120	< 120	< 120	< 120	< 120
		20				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		30				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	EB-8	5				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		10				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		20				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		30				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		35				< 5	< 25		< 5	< 5	< 5	< 5	< 5
26b	EB-3	0.5											
		15				R	R		R	R	R	R	R
		25				R	R		R	R	R	R	R
		35				R	R		R	R	R	R	R

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	3-ethylpentane	3-Methylhexane	4-Chlorothioanisole	4-Chlorotoluene	Acetone	Acetonitrile	Benzene	Bromobenzene	Bromodichloromethane	Bromomethane	Carbon disulfide
26b	EB-7	0.5											
		15				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		25				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		35				< 5	< 25		< 5	< 5	< 5	< 5	< 5
	EB-8	0.5											
		15				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		25				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		35											
	PEB-11	0.5											
		15				R	58 J+		R	R	R	R	R
		25				R	52 J+		R	R	R	R	R
		35				R	R		R	R	R	R	R
	PEB-13	0.5											
		15				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		25				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		35				< 5	< 25		< 5	< 5	< 5	< 5	< 5
	PEB-17	0.5											
		15				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		25				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		35				< 5	< 25		< 5	< 5	< 5	< 5	< 5
	PEB-18	0.5											
		15				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		25				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35				< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	PEB-9	0.5											
		15				< 5	32 J+		< 5	< 5	< 5	< 5	< 5
		25				< 5	< 25		< 5	< 5	< 5	< 5	< 5
		35				< 5	< 25		< 5	< 5	< 5	< 5	< 5
36	BP-01	0			< 340 U								
		10			< 350 U								
		30	< 8.6 U	< 8.6 U	2.7 J+	< 8.6 U	70 J+	< 86 U	1.2 J+	< 8.6 U	< 8.6 U	< 17 U	1.7 J+
	BP-02	0			< 340 U								
		10			< 340 U								
		30	< 11 UJ-	< 11 UJ-	< 110 U	< 11 UJ-	62 J-	< 110 UJ-	1.3 J-	< 11 UJ-	< 11 U	< 22 UJ-	2 J-
		40	< 9.6 U	< 9.6 U	< 96 U	< 9.8 U	37 J+	< 98 U	1 J+	< 9.8 U	< 9.8 U	< 20 U	< 9.8 U
	BP-03	0			< 340 U								
		10			< 360 U								

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
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BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	3-ethylpentane	3-Methylhexane	4-Chlorothioanisole	4-Chlorotoluene	Acetone	Acetonitrile	Benzene	Bromobenzene	Bromodichloromethane	Bromomethane	Carbon disulfide
36		20	< 7.5 U	< 7.5 U	< 75 U	< 7.5 U	67 J+	< 75 U	1.2 J+	< 7.5 U	< 7.5 U	< 15 U	1 J+
		30	< 9.3 U	< 9.3 U	< 93 U	< 9.3 U	100 J+	< 93 U	1.4 J+	< 9.3 U	< 9.3 U	< 19 U	1.7 J+
	BP-04	0			< 330 U								
		10			< 350 U								
		30	< 9.5 U	< 9.5 U	< 95 U	< 9.5 U	50 J+	< 95 U	1.6 J+	< 9.5 U	< 9.5 U	< 19 U	1.2 J+
	BP-05	0			< 330 U								
		10			< 360 U								
		30	< 9.7 U	< 9.7 U	< 97 U	< 9.7 U	34 J	< 97 U	1.3 J	< 9.7 U	< 9.7 U	< 19 U	1.3 J
		40	< 12 U	< 12 U	< 120 U	< 12 U	32 J+	< 120 U	< 12 U	< 12 U	< 12 U	< 23 U	< 12 U
	BP-06	0			< 330 U								
		10	< 9.1 U	< 9.1 U	< 91 U	< 9.1 U	100 J	< 91 U	1.2 J	< 9.1 U	< 9.1 U	< 18 U	2.4 J
		30	< 10 U	< 10 U	< 100 U	< 10 U	36 J	< 100 U	1 J	< 10 U	< 10 U	< 20 U	2.4 J
		40	< 12 U	< 12 U	< 120 U	< 12 U	39 J+	< 120 UJ	1.1 J+	< 12 U	< 12 U	< 23 U	< 12 U
	BP-07	0			< 340 U								
		10			< 360 U								
		30	< 9.4 U	< 9.4 U	< 94 U	< 9.4 U	44 J	< 94 U	1.1 J	< 9.4 U	< 9.4 U	< 19 U	1.1 J
		40	< 6.6 U	< 6.6 U	< 66 U	< 6.6 U	17 J+	< 66 UJ	< 6.6 U	< 6.6 U	< 6.6 U	< 13 U	0.75 J+
	BP-08	0			< 330 UJ-								
		10			< 360 UJ-								
		20	< 11 U	< 11 U	< 110 U	< 11 U	68 J+	< 110 UJ	1.3 J+	< 11 U	< 11 U	< 22 U	1.6 J+
		30	< 12 U	< 12 U	< 120 U	< 12 U	81 J+	< 120 UJ	< 12 U	< 12 U	< 12 U	< 24 U	1.6 J+
		40	< 10 U	< 10 U	< 100 U	< 10 U	58 J+	< 100 UJ	< 10 U	< 10 U	< 10 U	< 20 U	< 10 U
	BP-09	0			37 J-								
		10			< 360 UJ-								
		20	< 9.7 U	< 9.7 U	< 97 U	< 9.7 U	94 J+	< 97 UJ	0.89 J+	< 9.7 U	< 9.7 U	< 19 U	2.9 J+
		30	< 14 UJ-	< 14 UJ-	< 140 UJ-	< 14 UJ-	170 J+/-	< 140 UJ-	2.6 J+/-	< 14 UJ-	< 14 UJ-	< 27 UJ-	3 J+/-
		40	< 10 UJ-	< 10 UJ-	< 100 UJ-	< 10 UJ-	41 J+/-	< 100 UJ-	2 J+/-	< 10 UJ-	< 10 UJ-	< 21 UJ-	9.2 J+/-
	BP-10	0			< 330 UJ-								
		10			< 340 UJ-								
		30	< 9.9 UJ-	< 9.9 UJ-	< 99 UJ-	< 9.9 UJ-	55 J+/-	< 99 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 20 UJ-	14 J+/-
		40	< 16 UJ-	< 16 UJ-	< 160 UJ-	< 16 UJ-	52 J+/-	< 160 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 33 UJ-	3 J+/-

All results in µg/kg.

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Carbon tetrachloride	CFC-11	CFC-12	Chlorinated fluorocarbon (Freon 113)	Chlorobenzene	Chlorobromomethane	Chlorodibromomethane	Chloroethane	Chloroform	Chloromethane	cis-1,2-Dichloroethylene
10a/13a	B-15	0	< 5	< 10	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		5	< 5	< 10	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		20	< 5	< 10	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		30	< 5	< 10	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
	B-16	0	< 5	< 10	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		5	< 5	< 10	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		20	< 5	< 10	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		30	< 5	< 10	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
26a	EB-1	5	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		10	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		20	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		30	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		35	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	EB-2	5	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		10	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		20	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		30	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	EB-3	5	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		10	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		20	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		30	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	EB-7	5	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		10	< 120	< 120	< 120		< 120	< 120	< 120	< 120	< 120	< 120	< 120
		20	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		30	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	EB-8	5	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		10	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		20	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		30	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		35	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
26b	EB-3	0.5											
		15	R	R	R		R	R	R	R	R	R	R
		25	R	R	R		R	R	R	R	R	R	R
		35	R	R	R		R	R	R	R	R	R	R

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DVSR	Location	Depth (ft bgs)	Carbon tetrachloride	CFC-11	CFC-12	Chlorinated fluorocarbon (Freon 113)	Chlorobenzene	Chlorobromomethane	Chlorodibromomethane	Chloroethane	Chloroform	Chloromethane	cis-1,2-Dichloroethylene
26b	EB-7	0.5											
		15	< 5	< 5	< 5 UJ		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		25	< 5	< 5	< 5 UJ		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		35	< 5	< 5	< 5 UJ		< 5	< 5	< 5	< 5	< 5	< 5	< 5
	EB-8	0.5											
		15	< 5	< 5	< 5 UJ		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		25	< 5	< 5	< 5 UJ		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		35											
	PEB-11	0.5											
		15	R	R	R		R	R	R	R	R	R	R
		25	R	R	R		R	R	R	R	R	R	R
		35	R	R	R		R	R	R	R	R	R	R
	PEB-13	0.5											
		15	< 5	< 5 UJ	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		25	< 5	< 5 UJ	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		35	< 5	< 5 UJ	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
	PEB-17	0.5											
		15	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		25	< 5	< 5 UJ	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		35	< 5	< 5 UJ	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
	PEB-18	0.5											
		15	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		25	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ
	PEB-9	0.5											
		15	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		25	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
		35	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5
36	BP-01	0											
		10											
		30	< 8.6 U	< 8.6 U	< 17 U	< 8.6 U	< 8.6 U	< 8.6 U	< 8.6 U	< 8.6 U	< 8.6 U	< 17 U	< 8.6 U
	BP-02	0											
		10											
		30	< 11 U	< 11 UJ	< 21 UJ-	< 11 UJ	< 11 UJ-	< 11 U	< 11 U	< 11 UJ	< 11 U	< 22 UJ	< 11 U
		40	< 9.8 U	< 9.8 U	< 20 U	< 9.8 U	< 9.8 U	< 9.6 U	< 9.6 U	< 9.8 U	< 9.8 U	< 20 U	< 9.8 U
	BP-03	0											
		10											

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VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	Carbon tetrachloride	CFC-11	CFC-12	Chlorinated fluorocarbon (Freon 113)	Chlorobenzene	Chlorobromomethane	Chlorodibromomethane	Chloroethane	Chloroform	Chloromethane	cis-1,2-Dichloroethylene
36		20	< 7.5 U	< 7.5 UJ	< 15 U	< 7.5 U	< 7.5 U	< 7.5 U	< 7.5 U	< 7.5 U	0.85 J+	< 15 U	< 7.5 U
		30	< 9.3 U	< 9.3 UJ	< 19 U	< 9.3 U	< 9.3 U	< 9.3 U	< 9.3 U	2.6 J+	2.8 J+	< 19 U	< 9.3 U
	BP-04	0											
		10											
		30	< 9.5 U	< 9.5 UJ	< 19 U	< 9.5 U	< 9.5 U	< 9.5 U	< 9.5 U	< 9.5 U	1.6 J+	< 19 U	< 9.5 U
	BP-05	0											
		10											
		30	< 9.7 U	< 9.7 UJ	< 19 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	2.7 J	2.3 J	< 19 U	< 9.7 U
		40	< 12 U	< 12 UJ	< 23 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	19 J+	< 23 U	< 12 U
	BP-06	0											
		10	< 9.1 U	< 9.1 UJ	< 18 U	< 9.1 U	< 9.1 U	< 9.1 U	< 9.1 U	< 9.1 U	< 9.1 U	< 18 U	< 9.1 U
		30	< 10 U	< 10 UJ	< 20 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 20 U	< 10 U
		40	< 12 U	< 12 UJ	< 23 UJ	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 23 U	< 12 U
	BP-07	0											
		10											
		30	< 9.4 U	< 9.4 UJ	< 19 U	< 9.4 U	< 9.4 U	< 9.4 U	< 9.4 U	< 9.4 U	< 9.4 U	< 19 U	< 9.4 U
		40	< 6.6 U	< 6.6 UJ	< 13 UJ	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	1.1 J+	< 13 U	< 6.6 U
	BP-08	0											
		10											
		20	< 11 U	< 11 UJ	< 22 UJ	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U	< 22 U	< 11 U
		30	< 12 U	< 12 UJ	< 24 UJ	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 24 U	< 12 U
		40	< 10 U	18 J+	< 20 UJ	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 20 U	< 10 U
	BP-09	0											
		10											
		20	< 9.7 U	< 9.7 UJ	< 19 UJ	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	5.9 J+	< 9.7 U	< 19 U	< 9.7 U
		30	< 14 UJ-	< 14 UJ-	< 27 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	6.7 J+/-	< 14 UJ-	< 27 UJ-	< 14 UJ-
		40	< 10 UJ-	< 10 UJ-	< 21 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	3.8 J+/-	< 10 UJ-	< 21 UJ-	< 10 UJ-
	BP-10	0											
		10											
		30	< 9.9 UJ-	< 9.9 UJ-	< 20 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 20 UJ-	< 9.9 UJ-
		40	< 16 UJ-	15 J+/-	< 33 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 33 UJ-	< 16 UJ-

All results in µg/kg.

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VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	cis-1,3-Dichloropropylene	Cymene	Dibromomethane	Dichloromethane	Ethanol	Ethylbenzene	Hexachloro-1,3-butadiene	Hexachloroethane	Hexane, 2-methyl-	Isopropylbenzene	m,p-Xylene
10a/13a	B-15	0	< 5	< 5	< 5	< 5		< 5	< 5	< 500		< 5	< 5
		5	< 5	< 5	< 5	< 5		< 5	< 5	< 500		< 5	< 5
		20	< 5	< 5	< 5	< 5		< 5	< 5	< 500		< 5	< 5
		30	< 5	< 5	< 5	< 5		< 5	< 5	< 500		< 5	< 5
	B-16	0	< 5	< 5	< 5	< 5		< 5	< 5	< 500		< 5	< 5
		5	< 5	< 5	< 5	< 5		< 5	< 5	< 500		< 5	< 5
		20	< 5	< 5	< 5	< 5		< 5	< 5	< 500		< 5	< 5
		30	< 5	< 5	< 5	< 5		< 5	< 5	< 500		< 5	< 5
26a	EB-1	5	< 5	< 5	< 5	< 10		< 5	< 25			< 5	< 10 UJ
		10	5.6	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10 UJ
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ			< 5 UJ	< 10 UJ
		30	< 5	< 5	< 5	< 10		< 5	< 25			< 5	< 10 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ			< 5 UJ	< 10 UJ
	EB-2	5	< 5	< 5	< 5	< 10		< 5	< 25			< 5	< 10 UJ
		10	< 5	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10 UJ
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ			< 5 UJ	< 10 UJ
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ			< 5 UJ	< 10 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ			< 5 UJ	< 10 UJ
	EB-3	5	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ			< 5 UJ	< 10 UJ
		10	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ			< 5 UJ	< 10 UJ
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ			< 5 UJ	< 10 UJ
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ			< 5 UJ	< 10 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ	< 330		< 5 UJ	< 10 UJ
	EB-7	5	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ			< 5 UJ	< 10 UJ
		10	< 120	< 120	< 120	< 250		< 120	< 620			< 120	< 250 UJ
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ			< 5 UJ	< 10 UJ
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ	< 330		< 5 UJ	< 10 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 5 UJ	< 25 UJ			< 5 UJ	< 10 UJ
	EB-8	5	< 5	< 5	< 5	< 10		< 5	< 25			< 5	< 10
		10	< 5	< 5	< 5	< 10		< 5	< 25			< 5	< 10
		20	< 5	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10
		30	< 5	< 5	< 5	< 10		< 5	< 25			< 5	< 10
		35	< 5	< 5	< 5	< 10		< 5	< 25			< 5	< 10
26b	EB-3	0.5							< 330	< 330			
		15	R	R	R	15 J+		R	< 330	< 330		R	R
		25	R	R	R	13 J+		64 J-	< 330	< 330		R	R
		35	R	R	R	12 J-		R	R			R	R

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VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
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DVSR	Location	Depth (ft bgs)	cis-1,3-Dichloropropylene	Cymene	Dibromomethane	Dichloromethane	Ethanol	Ethylbenzene	Hexachloro-1,3-butadiene	Hexachloroethane	Hexane, 2-methyl-	Isopropylbenzene	m,p-Xylene
26b	EB-7	0.5							< 330	< 330			
		15	< 5	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10
		25	< 5	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10
		35	< 5	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10
	EB-8	0.5							< 330	< 330			
		15	< 5	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10
		25	< 5	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10
		35							< 330	< 330			
	PEB-11	0.5							< 330	< 330			
		15	R	R	R	16 J+		R	< 330	< 330		R	R
		25	R	R	R	14 J+		R	< 330	< 330		R	R
		35	R	R	R	21 J+		R	< 330	< 330		R	R
	PEB-13	0.5							< 330	< 330			
		15	< 5	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10
		25	< 5	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10
		35	< 5	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10
	PEB-17	0.5							< 330	< 330			
		15	< 5	< 5	< 5	< 10		< 10	< 25	< 330		< 5	< 10
		25	< 5	< 5	< 5	< 10		39	< 25	< 330		< 5	< 10
		35	< 5	< 5	< 5	11		< 5	< 25	< 330		< 5	< 10
	PEB-18	0.5							< 330	< 330			
		15	< 5 UJ	< 5 UJ	< 5 UJ	16 J-		< 25 UJ	< 25 UJ	< 330		< 5 UJ	< 10 UJ
		25	< 5 UJ	< 5 UJ	< 5 UJ	< 10 UJ		< 10 UJ	< 25 UJ	< 330		< 5 UJ	< 10 UJ
		35	< 5 UJ	< 5 UJ	< 5 UJ	16 J-		< 5 UJ	< 25 UJ	< 330		< 5 UJ	< 10 UJ
	PEB-9	0.5							< 330	< 330			
		15	< 5	< 5	< 5	18		< 5	< 25	< 330		< 5	< 10
		25	< 5	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10
		35	< 5	< 5	< 5	< 10		< 5	< 25	< 330		< 5	< 10
36	BP-01	0							< 340 U	< 340 U			
		10							< 350 U	< 350 U			
		30	< 8.6 U	< 8.6 U	< 8.6 U	< 8.6 U	< 86 U	0.95 J+	< 570 U	< 570 U	< 8.6 U	< 8.6 U	2 J+
	BP-02	0							< 340 U	< 340 U			
		10							< 340 U	< 340 U			
		30	< 11 UJ	< 11 UJ-	< 11 U	< 11 UJ-	< 110 U	1.3 J-	< 720 U	< 720 U	< 11 UJ-	< 11 UJ-	2.5 J-
		40	< 9.8 U	< 9.8 U	< 9.8 U	< 9.8 U	< 96 U	0.93 J+	< 630 U	< 630 U	< 9.6 U	< 9.8 U	2.1 J+
	BP-03	0							< 340 U	< 340 U			
		10							< 360 U	< 360 U			

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	cis-1,3-Dichloropropylene	Cymene	Dibromomethane	Dichloromethane	Ethanol	Ethylbenzene	Hexachloro-1,3-butadiene	Hexachloroethane	Hexane, 2-methyl-	Isopropylbenzene	m,p-Xylene
36		20	< 7.5 U	< 7.5 U	< 7.5 U	< 7.5 U	< 75 U	1 J+			< 7.5 U	< 7.5 U	1.8 J+
		30	< 9.3 U	< 9.3 U	< 9.3 U	< 9.3 U	< 93 U	0.81 J+	< 610 U	< 610 U	< 9.3 U	< 9.3 U	1.4 J+
	BP-04	0							< 330 U	< 330 U			
		10							< 350 U	< 350 U			
		30	< 9.5 U	< 9.5 U	< 9.5 U	< 9.5 U	< 95 U	0.76 J+	< 630 U	< 630 U	< 9.5 U	< 9.5 U	1.2 J+
	BP-05	0							< 330 U	< 330 U			
		10							< 360 U	< 360 U			
		30	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 97 U	1.1 J	< 640 U	< 640 U	< 9.7 U	< 9.7 U	2.2 J
		40	< 12 U	< 12 U	< 12 U	< 12 U	< 120 U	0.79 J+	< 770 U	< 770 U	< 12 U	< 12 U	< 12 U
	BP-06	0							< 330 U	< 330 U			
		10	< 9.1 U	< 9.1 U	< 9.1 U	< 9.1 U	< 91 U	1.2 J	< 600 U	< 600 U	< 9.1 U	< 9.1 U	2.5 J
		30	< 10 U	< 10 U	< 10 U	< 10 U	< 100 U	1.3 J	< 660 U	< 660 U	< 10 U	< 10 U	2.6 J
		40	< 12 U	< 12 U	< 12 U	< 12 U	< 120 U	1.2 J+	< 770 U	< 770 U	< 12 U	< 12 U	2.8 J+
	BP-07	0							< 340 U	< 340 U			
		10							< 360 U	< 360 U			
		30	< 9.4 U	< 9.4 U	< 9.4 U	< 9.4 U	< 94 U	1.1 J	< 620 U	< 620 U	< 9.4 U	< 9.4 U	1.9 J
		40	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 66 UJ-	< 6.6 U	< 440 UJ-	< 440 UJ-	< 6.6 U	< 6.6 U	0.8 J+
	BP-08	0							< 330 UJ-	< 330 UJ-			
		10							< 360 UJ-	< 360 UJ-			
		20	< 11 U	< 11 U	< 11 U	< 11 U	< 110 UJ-	< 11 U			< 11 U	< 11 U	< 11 U
		30	< 12 U	< 12 U	< 12 U	< 12 U	< 120 UJ-	< 12 U	< 810 UJ-	< 810 UJ-	< 12 U	< 12 U	< 12 U
		40	< 10 U	< 10 U	< 10 U	< 14 BJ+	< 100 UJ-	< 10 U	< 670 UJ-	< 670 UJ-	< 10 U	< 10 U	< 10 U
	BP-09	0							< 330 UJ-	< 330 UJ-			
		10							< 360 UJ-	< 360 UJ-			
		20	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 97 UJ-	< 9.7 U			< 9.7 U	< 9.7 U	< 9.7 U
		30	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 140 UJ-	< 14 UJ-	< 900 UJ-	< 900 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-
		40	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 100 UJ-	< 10 UJ-	< 680 UJ-	< 680 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-
	BP-10	0							< 330 UJ-	< 330 UJ-			
		10							< 340 UJ-	< 340 UJ-			
		30	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 99 UJ-	< 9.9 UJ-	< 650 UJ-	< 650 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-
		40	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ+/-	< 160 UJ-	< 16 UJ-	< 1100 UJ-	< 1100 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-

All results in µg/kg.

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	Methyl disulfide	Methyl ethyl ketone	Methyl iodide	Methyl isobutyl ketone	Methyl n-butyl ketone	MTBE (Methyl tert-butyl ether)	n-Butyl benzene	n-Heptane	n-Propyl benzene	o-Xylene	Styrene (monomer)
10a/13a	B-15	0		< 25	< 5	29	< 25	< 5	< 5		< 5	< 5	< 5
		5		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
		20		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
		30		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
	B-16	0		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
		5		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
		20		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
		30		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
26a	EB-1	5		R	< 5 UJ	R	170 J-	< 5	< 5		< 5	< 5	< 5
		10		R	< 5 UJ	R	640 J-	< 5	< 5		< 5	< 5	< 5
		20		R	< 5 UJ	R	640 J-	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
		30		R	< 5 UJ	R	R	< 5	< 5		< 5	< 5	< 5
		35		R	< 5 UJ	R	R	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
	EB-2	5		R	< 5 UJ	R	R	< 5	< 5		< 5	< 5	< 5
		10		R	< 5 UJ	R	R	< 5	< 5		< 5	< 5	< 5
		20		R	< 5 UJ	R	R	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
		30		R	< 5 UJ	R	R	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
		35		R	< 5 UJ	< 25 UJ	640 J+	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
	EB-3	5		R	< 5 UJ	R	R	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
		10		R	< 5 UJ	R	R	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
		20		R	< 5 UJ	< 25 UJ	< 25 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
		30		R	< 5 UJ	R	R	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
		35			< 5 UJ			< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
	EB-7	5		R	< 5 UJ	< 25 UJ	R	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
		10		R	< 120	< 620	R	< 120	< 120		< 120	< 120	< 120
		20		R	< 5 UJ	< 25 UJ	R	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
		30		< 25 UJ	< 5 UJ	< 25 UJ	630 J-	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
		35			< 5 UJ	< 25 UJ		< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
	EB-8	5		R	< 5	< 25	R	< 5	< 5		< 5	< 5	< 5
		10		R	< 5	< 25	R	< 5	< 5		< 5	< 5	< 5
		20		R	< 5	< 25	R	< 5	< 5		< 5	< 5	< 5
		30		R	< 5	< 25	R	< 5	< 5		< 5	< 5	< 5
		35		R	< 5	< 25	R	< 5	< 5		< 5	< 5	< 5
26b	EB-3	0.5											
		15		R	R	R	R	R	R		R	R	R
		25		R	R	R	R	R	R		R	R	R
		35		R	R	R	R	R	R		R	R	R

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
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BORROW AREA, CLARK COUNTY, NEVADA
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DVSR	Location	Depth (ft bgs)	Methyl disulfide	Methyl ethyl ketone	Methyl iodide	Methyl isobutyl ketone	Methyl n-butyl ketone	MTBE (Methyl tert-butyl ether)	n-Butyl benzene	n-Heptane	n-Propyl benzene	o-Xylene	Styrene (monomer)
26b	EB-7	0.5											
		15		< 25 UJ	< 5	< 25	< 25 UJ	< 5	< 5		< 5	< 5	< 5
		25		< 25 UJ	< 5	< 25	< 25 UJ	< 5	< 5		< 5	< 5	< 5
		35		< 25 UJ	< 5	< 25	R	< 5	< 5		< 5	< 5	< 5
	EB-8	0.5											
		15		< 25 UJ	< 5	< 25	< 25 UJ	< 5	< 5		< 5	< 5	< 5
		25		< 25 UJ	< 5	< 25	< 25 UJ	< 5	< 5		< 5	< 5	< 5
		35											
	PEB-11	0.5											
		15		R	R	R	R	R	R		R	R	R
		25		R	R	R	R	R	R		R	R	R
		35		R	R	R	R	R	R		R	R	R
	PEB-13	0.5											
		15		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
		25		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
		35		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
	PEB-17	0.5											
		15		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
		25		< 25	< 5	< 25	< 25	< 5	< 5		< 5	97	< 5
		35		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
	PEB-18	0.5											
		15		< 25 UJ	< 5 UJ	< 25 UJ	< 25 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
		25		< 25 UJ	< 5 UJ	< 25 UJ	< 25 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
		35		< 25 UJ	< 5 UJ	< 25 UJ	< 25 UJ	< 5 UJ	< 5 UJ		< 5 UJ	< 5 UJ	< 5 UJ
	PEB-9	0.5											
		15		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
		25		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
		35		< 25	< 5	< 25	< 25	< 5	< 5		< 5	< 5	< 5
36	BP-01	0											
		10											
		30	< 8.6 U	12 J+	2.9 J+	< 34 UJ	< 34 UJ	< 8.6 UJ	< 8.6 U	< 8.6 U	< 8.6 U	< 8.6 U	< 8.6 U
	BP-02	0											
		10											
		30	< 11 UJ	13 J-	< 11 U	< 43 UJ-	< 44 UJ	< 11 UJ	< 11 U	< 11 UJ-	< 11 UJ-	< 11 UJ-	< 11 U
		40	< 9.8 U	< 39 UJ	< 9.8 U	< 39 UJ	< 39 UJ	< 9.8 UJ	< 9.8 U	< 9.6 U	< 9.8 U	< 9.8 U	< 9.8 U
	BP-03	0											
		10											

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

DVSR	Location	Depth (ft bgs)	Methyl disulfide	Methyl ethyl ketone	Methyl iodide	Methyl isobutyl ketone	Methyl n-butyl ketone	MTBE (Methyl tert-butyl ether)	n-Butyl benzene	n-Heptane	n-Propyl benzene	o-Xylene	Styrene (monomer)
36		20	< 7.5 U	9.2 J+	< 7.5 U	< 30 UJ	< 30 UJ	< 7.5 UJ	< 7.5 U	< 7.5 U	< 7.5 U	< 7.5 U	< 7.5 U
		30	< 9.3 U	15 J+	3.7 J+	< 37 UJ	< 37 UJ	< 9.3 UJ	< 9.3 U	< 9.3 U	< 9.3 U	< 9.3 U	< 9.3 U
	BP-04	0											
		10											
		30	< 9.5 U	10 J+	< 9.5 U	< 38 UJ	< 38 UJ	< 9.5 UJ	< 9.5 U	< 9.5 U	< 9.5 U	< 9.5 U	< 9.5 U
	BP-05	0											
		10											
		30	< 9.7 U	8.3 J	< 9.7 U	< 39 UJ	< 39 UJ	< 9.7 UJ	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U
		40	< 12 U	< 47 UJ	< 12 U	< 47 UJ	< 47 UJ	< 12 UJ	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U
	BP-06	0											
		10	< 9.1 U	11 J	< 9.1 U	< 36 UJ	< 36 UJ	< 9.1 UJ	< 9.1 U	< 9.1 U	< 9.1 U	0.95 J	< 9.1 U
		30	< 10 U	3.8 J	< 10 U	< 40 UJ	< 40 UJ	< 10 UJ	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
		40	< 12 U	< 47 UJ	< 12 U	< 47 U	< 47 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U
	BP-07	0											
		10											
		30	< 9.4 U	4.2 J	< 9.4 U	< 38 UJ	< 38 UJ	< 9.4 UJ	< 9.4 U	< 9.4 U	< 9.4 U	< 9.4 U	< 9.4 U
		40	< 6.6 U	< 27 UJ	< 6.6 U	< 27 U	< 27 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	0.61 J+
	BP-08	0											
		10											
		20	< 11 U	11 J+	< 11 U	< 43 U	< 43 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U	< 11 U
		30	< 12 U	< 49 UJ	< 12 U	< 49 U	< 49 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U	< 12 U
		40	< 10 U	< 40 UJ	< 10 U	< 40 U	< 40 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
	BP-09	0											
		10											
		20	< 9.7 U	20 J+	< 9.7 U	< 39 U	< 39 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U
		30	< 14 UJ-	57 J+/-	< 14 UJ-	< 55 UJ-	< 55 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-
		40	< 10 UJ-	7 J+/-	< 10 UJ-	< 41 UJ-	< 41 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-
	BP-10	0											
		10											
		30	< 9.9 UJ-	6.6 J+/-	< 9.9 UJ-	< 40 UJ-	< 40 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-
		40	< 16 UJ-	< 66 UJ-	< 16 UJ-	< 66 UJ-	< 66 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-

All results in µg/kg.

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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DVSR	Location	Depth (ft bgs)	tert-Butyl benzene	Tetrachloroethylene	Toluene	trans-1,2-Dichloroethylene	trans-1,3-Dichloropropylene	Tribromomethane	Trichloroethylene	Vinyl acetate	Vinyl chloride	Xylenes (total)
10a/13a	B-15	0	< 5	< 5	< 5	< 5	< 5	< 5	< 5		< 5	
		5	< 5	< 5	< 5	< 5	< 5	< 5	< 5		< 5	
		20	< 5	< 5	< 5	< 5	< 5	< 5	< 5		< 5	
		30	< 5	< 5	< 5	< 5	< 5	< 5	< 5		< 5	
	B-16	0	< 5	< 5	< 5	< 5	< 5	< 5	< 5		< 5	
		5	< 5	< 5	< 5	< 5	< 5	< 5	< 5		< 5	
		20	< 5	< 5	< 5	< 5	< 5	< 5	< 5		< 5	
		30	< 5	< 5	< 5	< 5	< 5	< 5	< 5		< 5	
26a	EB-1	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
		10	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
		30	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
	EB-2	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
		10	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
	EB-3	5	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
		10	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
	EB-7	5	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	R	< 5 UJ	
		10	< 120	< 120	< 120	< 120	< 120	< 120	< 120	R	< 120	
		20	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	R	< 5 UJ	
		30	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	R	< 5 UJ	
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	R	< 5 UJ	
	EB-8	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
		10	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
		20	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
		30	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
26b	EB-3	0.5										
		15	R	R	R	R	R	R	R	R	R	
		25	R	R	R	R	R	R	R	R	R	
		35	R	R	R	R	R	R	R	R	R	

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 23 of 24)

DVSR	Location	Depth (ft bgs)	tert-Butyl benzene	Tetrachloroethylene	Toluene	trans-1,2-Dichloroethylene	trans-1,3-Dichloropropylene	Tribromomethane	Trichloroethylene	Vinyl acetate	Vinyl chloride	Xylenes (total)
26b	EB-7	0.5										
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5 UJ	< 5	
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5 UJ	< 5	
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5 UJ	< 5	
	EB-8	0.5										
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5 UJ	< 5	
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5 UJ	< 5	
		35										
	PEB-11	0.5										
		15	R	R	R	R	R	R	R	R	R	
		25	R	R	R	R	R	R	R	R	R	
		35	R	R	R	R	R	R	R	R	R	
	PEB-13	0.5										
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 5	R	< 5	
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 5	R	< 5	
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 5	R	< 5	
	PEB-17	0.5										
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 5	R	< 5	
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 5	R	< 5	
	PEB-18	0.5										
		15	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
		25	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
		35	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	< 5 UJ	
	PEB-9	0.5										
		15	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
		25	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
		35	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
36	BP-01	0										
		10										
		30	< 8.6 U	< 8.6 U	5.2 J+	< 8.6 U	< 8.6 UJ	< 8.6 UJ	< 8.6 U	< 8.6 UJ	< 8.6 U	2.7 J+
	BP-02	0										
		10										
		30	< 11 UJ-	< 11 U	6.2 J-	< 11 U	< 11 UJ	< 11 UJ	< 11 UJ-	< 11 U	< 11 UJ	3.2 J-
		40	< 9.8 U	< 9.8 U	5.9 J+	< 9.8 U	< 9.8 UJ	< 9.8 UJ	< 9.8 U	< 9.8 UJ	< 9.8 U	2.8 J+
	BP-03	0										
		10										

TABLE D1-11
VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 24 of 24)

DVSR	Location	Depth (ft bgs)	tert-Butyl benzene	Tetrachloroethylene	Toluene	trans-1,2-Dichloroethylene	trans-1,3-Dichloropropylene	Tribromomethane	Trichloroethylene	Vinyl acetate	Vinyl chloride	Xylenes (total)
36		20	< 7.5 U	< 7.5 U	4.2 J+	< 7.5 U	< 7.5 UJ	< 7.5 UJ	< 7.5 U	< 7.5 UJ	< 7.5 U	2.4 J+
		30	< 9.3 U	< 9.3 U	3.2 J+	< 9.3 U	< 9.3 UJ	< 9.3 UJ	< 9.3 U	< 9.3 UJ	< 9.3 U	< 19 U
	BP-04	0										
		10										
		30	< 9.5 U	< 9.5 U	2.8 J+	< 9.5 U	< 9.5 UJ	< 9.5 UJ	< 9.5 U	< 9.5 UJ	< 9.5 U	< 19 U
	BP-05	0										
		10										
		30	< 9.7 U	< 9.7 U	5.5 J	< 9.7 U	< 9.7 UJ	< 9.7 UJ	< 9.7 U	< 9.7 UJ	< 9.7 U	3 J
		40	< 12 U	< 12 U	2.4 J+	< 12 U	< 12 UJ	< 12 UJ	< 12 U	< 12 UJ	< 12 U	< 23 U
	BP-06	0										
		10	< 9.1 U	< 9.1 U	5.8 J	< 9.1 U	< 9.1 UJ	< 9.1 UJ	< 9.1 U	< 9.1 UJ	< 9.1 U	3.5 J
		30	< 10 U	< 10 U	6.4 J	< 10 U	< 10 UJ	< 10 UJ	< 10 U	< 10 UJ	< 10 U	3.4 J
		40	< 12 U	< 12 U	6.7 J+	< 12 U	< 12 U	< 12 U	< 12 U	< 12 UJ	< 12 U	< 23 U
	BP-07	0										
		10										
		30	< 9.4 U	< 9.4 U	4.7 J	< 9.4 U	< 9.4 UJ	< 9.4 UJ	< 9.4 U	< 9.4 UJ	< 9.4 U	2.6 J
		40	< 6.6 U	< 6.6 U	1.7 J+	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 U	< 6.6 UJ	< 6.6 U	< 13 U
	BP-08	0										
		10										
		20	< 11 U	< 11 U	2.1 J+	< 11 U	< 11 U	< 11 U	< 11 U	< 11 UJ	< 11 U	< 22 U
		30	< 12 U	< 12 U	1.9 J+	< 12 U	< 12 U	< 12 U	< 12 U	< 12 UJ	< 12 U	< 24 U
		40	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 UJ	< 10 U	< 20 U
	BP-09	0										
		10										
		20	< 9.7 U	< 9.7 U	2.1 J+	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 U	< 9.7 UJ	< 9.7 U	< 19 U
		30	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 14 UJ-	< 27 UJ-
		40	< 10 UJ-	< 10 UJ-	2.2 J+/-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 10 UJ-	< 21 UJ-
	BP-10	0										
		10										
		30	< 9.9 UJ-	< 9.9 UJ-	1.6 J+/-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 9.9 UJ-	< 20 UJ-
		40	< 16 UJ-	< 16 UJ-	2.2 J+/-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 16 UJ-	< 33 UJ-

All results in µg/kg.

ATTACHMENT D-2

DATA USABILITY SUMMARY

APPENDIX D; ATTACHMENT D-2

USABILITY OF ANALYTICAL DATA FOR RISK ASSESSMENT SUMMARY

Evaluation of analytical data, in terms of usability for this assessment, was conducted using the criteria provided by the U.S. Environmental Protection Agency (USEPA) in the *Guidance for Data Usability in Risk Assessment (Parts A and B;* USEPA 1992a,b). These USEPA criteria include:

1. Reports – confirmation that report(s) relied upon are complete and appropriate for use in the risk assessment;
2. Documentation – confirmation that each analytical result is associated with a specific sample location and that the appropriate sampling procedure is documented;
3. Data Sources – confirmation that the analytical methods used are appropriate to identify the chemicals of potential concern for the media of interest;
4. Analytical Methods and Detection Limits – confirmation that analytical methods appropriately identify the chemical form or species and that the sample detection limit is at or below a concentration appropriate for the risk assessment application;
5. Data Review – confirmation that the quality of analytical results is assessed by a professional knowledgeable in field collection procedures and analytical chemistry and that data quality are adequate to estimate exposure concentrations; and
6. Data Quality Indicators – documentation that sampling and analysis data quality indicators (including precision, accuracy, holding time, and reproducibility) are evaluated using criteria specific to the risk assessment.

A complete evaluation of the analytical data was conducted. A summary of the data analysis relevant to usability criteria for risk assessment are provided in Table D2-1. Sample specific results are presented in Tables D2-2 through D2-12. (on DVD).

REFERENCES

U.S. Environmental Protection Agency (USEPA). 1992a. Guidance for Data Usability in Risk Assessment. Part A. Office of Emergency and Remedial Response, Washington D.C. Publication 9285.7-09A. PB92-963356. April.

U.S. Environmental Protection Agency (USEPA). 1992b. Guidance for Data Usability in Risk Assessment. Part B. Office of Emergency and Remedial Response, Washington D.C. Publication 9285.7-09B. PB92-963362. May.

Table D2-1. Data Usability Evaluation Summary

Data Usability Criteria	Evaluation Result
Reports	The Data Validation Summary Reports (DVSRs) for each of the datasets include laboratory analytical reports for soil samples (STL Laboratories, NEL Laboratories and EMS Laboratory). Summaries of previous investigations are provided in Section 2.4. The accompanying laboratory reports (see Appendix C), were considered complete for risk assessment purposes.
Documentation	The reports provided adequate information regarding sample results related to geographic location, chain-of-custody documentation and sampling procedures.
Data Sources	All analytical sample data results for soil were provided in adequate format and analyses were performed for a broad spectrum of analytes. Based on sample locations (spread randomly throughout the property) and the sample results, the data for VOCs, SVOCs, metals and other inorganics, radionuclides, dioxins/furans, asbestos, organic acids, PCBs, PAHs, and pesticides, were deemed representative of site conditions and potential receptor exposures.
Analytical Method and Detection Limit	**Soil Matrix Samples:** EPA Method 8260B meets characterization criteria for VOCs in soil. EPA Method 8270C meets characterization criteria for SVOCs in soil. EPA Method 8082 meets characterization criteria for PCBs in soil. EPA Method 8290 meets characterization criteria for dioxins/furans in soil. EPA Method 8310 meets characterization criteria for PAHs in soil. EPA Method 8081A meets characterization criteria for organochlorine pesticides in soil. EPA Methods 901.1/HASL AM02/903.0/904.0/HASL 300/A-01R meet characterization criteria for radionuclides in soil. EPA Methods 6010B/6020/7470/7471A meet characterization criteria for metals in soil. EPA Method 7196 meets characterization criteria for hexavalent chromium in soil. The Modified Elutriator Method meets characterization criteria for asbestos in soil. EPA Method 314.0 meets characterization criteria for perchlorate in soil. EPA Method 8150B meets characterization criteria for chlorinated herbicides in soil. EPA EPA Method 8141A meets characterization criteria for organophosphorus pesticides in soil. Method 335.4 meets characterization criteria for total cyanide in soil. The range of detection limits achieved in field samples was compared to USEPA Region 9 industrial PRGs (USEPA 2004a). A number of chemicals had non-detectable results with detection limits above industrial PRGs: 2,3,7,8-tetrachlorodibenzo-p-dioxin, benzo(a)pyrene, dibenzo(a,h)anthracene, cobalt-60, lead-210, uranium-235, 3,3'-dichlorobenzidine, bis(2-chloroethyl) ether, hexachlorobenzene, N-nitrosodimethylamine, N-nitrosodi-n-propylamine, 1,2,3-trichloropropane, 1,2-dibromoethane, and trichloroethylene The detection limits exceeded PRGs by a factor(s) of 3.8 for 2,3,7,8-tetrachlorodibenzo-p-dioxin, 1.6 to 2.4 for benzo(a)pyrene, 1.6 to 2.4 for dibenzo(a,h)anthracene, 1.1 to 2.2 for cobalt-60, 1.1 to 32.7 for lead-210, 1.4 for uranium-235, 1.01 to 1.4 for 3,3'-dichlorobenzidine, 1.04 to 1.9 for bis(2-chloroethyl) ether, 1.02 for hexachlorobenzene, 9.8 to 14.8 for N-nitrosodimethylamine, 1.3 to 4.5 for N-nitrosodi-n-propylamine, 1.6 for 1,2,3-trichloropropane, 1.6 for 1,2-dibromoethane, and 1.1 for trichloroethylene. A single dioxin sample contained elevated reporting limits for 2,3,7,8-tetrachlorodibenzo-p-dioxin. The TEQ for sample BP-09 is 63 pg/g when the reporting limits for non-detect congeners are included. This exceeds the ATSDR screening target level of 50 pg/g. Dioxins were retained as COPCs due to this detection limit issue. For lead-210, the frequency and range of detected concentrations are very similar between the site and background. For N-nitrosodimethylamine and N-nitrosodi-n-propylamine, all of the detection limits are above the PRG value. This may lead to the potential for concentrations to be present at levels that exceed *de minimus* risk metrics. However, the detection limits for all other nitroso-amine type compounds are sufficiently low to detect concentrations of interest should nitroso-amine compounds have been present at the site, none have been detected, and there is no site history to suggest the compounds may have been utilized at the property. The available lines of evidence suggest that although the detection limits for N-nitrosodimethylamine and N-nitrosodi-n-propylamine are elevated, this should have minimal impact on the outcome of the risk assessment. Therefore, the detection limits are considered adequate for risk assessment purposes.

Table D2-1. Data Usability Evaluation Summary

Data Usability Criteria	Evaluation Result
Analytical Method and Detection Limit (Continued)	For asbestos, there is no regulatory limit to compare the detection limits of chrysotile and amphibole fibers for this method. For asbestos, the appropriate measure of adequate characterization is not a detection limit, but the analytical sensitivity. There was a single detection of short amphibole fibers. The short amphibole fibers are not used to calculate risks. However, based on the presence of amphibole at the site, risks due to amphibole fibers were calculated using the analytical sensitivity for the appropriate receptors. The analytical sensitivity is perhaps not low enough in regards to the amphibole fibers. No long fibers were detected, however, upper bound risks were greater than 10^{-6}.
Data Review	The quality of the analytical results were reviewed by MWH in each of the DVSRs. The data review included evaluation of completeness, laboratory precision, laboratory accuracy, blanks, adherence to method specification and QC limits, and method performance in sample matrix.
Data Quality Indicators	**Soil Matrix Data**: The quality control parameters were reported by the laboratory to be within acceptable laboratory limits with the following exceptions: Precision: RPDs calculated by the laboratory were generally within the laboratory's acceptance criteria; however, RPD exceedances occurred in at least one preparation batch for the following analytes: 2,4,5-T, 2,4,5-TP, 2,4-D, aluminum, dicamba, dichlorodifluoromethane, dichlorprop, dinitrobutyl alcohol, phosphorus (as P), 2,4-dinitrophenol, endosulfan II, endosulfan sulfate, methoxychlor, ethanol, 1,2,3,4,7,8,9-heptachlorodibenzofuran, 4,4'-DDE, endrin aldehyde, and titanium. See the following tables for sample specific review of data usability. Based on both the laboratory's and ERM review there does not appear to be any significant data usability issues resulting from the MS/MSD results. Accuracy – Spike Recoveries: Matrix spike evaluation reports were included in all sample lots for analyses of metals, radionuclide, dioxin/furans, VOCs, SVOCs, PCBs, PAHs, and organochlorine pesticides except with the 2000 GES Borrow Area investigation. Matrix spike percent recovery was outside of the laboratory's recovery limits for the following SDGs: F6B240341 (metals, cyanide, dioxins and PAHs), F6B240362 (metals, cyanide and perchlorate) F6B240403 (metals, perchlorate) F6B280340(metals, perchlorate, organochlorine pesticides) L0306194 (metals, organochlorine pesticides, VOCs, SVOCs) L0306231 (metals, organochlorine pesticides, VOCs, SVOCs) L0306232 (metals) L0306230 (metals, SVOCs) L0306252 (metals, organochlorine pesticides, VOCs, SVOCs) L0306289 (metals, VOCs, SVOCs) L0306250 (metals) L0306300 (metals, organochlorine pesticides, VOCs) L0306291 (metals, organochlorine pesticides) L0304003 (SVOCs) L0304004 (organochlorine pesticides, SVOCs) L0304005 (SVOCs) The following list contains the analytes impacted (qualified) by the variances in the matrix spike recoveries: 1,2,4-trichlorobenzene, 2-hexanone, 2,3,7,8-tetrachlorodibenzofuran, 4,4'-DDE, acenaphthylene, aluminum, antimony, barium, calcium, chromium (total), copper, cyanide (total), dichlorodifluoromethane, dieldrin, endosulfan I, endrin aldehyde, heptachlor, iron, manganese, magnesium, nickel, niobium, octachlorodibenzodioxin, perchlorate, phosphorus (as P), silicon, strontium, thallium, titanium, tungsten, vanadium, vinyl acetate, zinc, and zirconium. Most of the spike recoveries that were outside control limits are slightly outside the control limits and only represent a minor potential to underestimate risks. As such these results were

Table D2-1. Data Usability Evaluation Summary

<table>
<tr><th>Data Usability Criteria</th><th>Evaluation Result</th></tr>
<tr><td>Data Quality Indicators (Continued)</td><td>considered for use in the risk assessment. Only the matrix spike results for total cyanide, 4,4'-DDE, endosulfan I, endrin aldehyde, and heptachlor show the potential for a significant underestimation of a soil concentration at locations BP-01 (cyanide), BP-02 (cyanide), BP-03 (cyanide), BP-04 (cyanide), and BP-09 (pesticides). However, the inability to recover measurable levels of these constituents is likely due to matrix interferences. The associated results were rejected and not used in the risk assessment. With the exception of those analyses noted, no MS/MSD evaluations were flagged by the laboratory due to percent recovery outside of the laboratory's acceptance criteria. ERM, therefore, believes that MS/MSD evaluations meet the requirements of the accuracy parameter. See the following tables for sample specific review of data usability.

Accuracy – Blanks: Accuracy is also evaluated by comparing results for the analysis of blank samples to results for investigative samples. 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. Contaminant concentrations in blanks should be less than detection or reporting limits. The following are analytes that were detected in blanks that were within five times detections in field samples, which resulted in field sample results being considered non-detects. For inorganic results which were greater than the reporting limit, results were qualified as estimated detections. Additionally, some results were considered biased high and qualified with a flag 'BJ' due to blank issues. For a complete list of data usability issues, see the following tables.

<table>
<tr><th colspan="3">2003 BRC Analytes</th></tr>
<tr><td>Vinyl Acetate</td><td>Chromium</td><td>Dibutyl phthalate</td></tr>
<tr><td>Asbestos</td><td></td><td></td></tr>
<tr><th colspan="3">2006 BRC Analytes</th></tr>
<tr><td>Arsenic</td><td>Boron</td><td>Dichloromethane</td></tr>
<tr><td>Mercury</td><td>Molybdenum</td><td>Niobium</td></tr>
<tr><td>Phosphorus</td><td>Radium 226</td><td>Radium 228</td></tr>
<tr><td>Silicon</td><td>Thallium</td><td>Tungsten</td></tr>
<tr><td>Vanadium</td><td>Zinc</td><td></td></tr>
</table>
</td></tr>
</table>

ATTACHMENT D-2 TABLES (on DVD)

ATTACHMENT D-3

DATA ADEQUACY EVALUATION

APPENDIX D; ATTACHMENT D-3
DATA ADEQUACY AND SAMPLE SIZE EVALUATION

Soil samples have been collected at the Borrow Area site to support a risk assessment. In the absence of complete specification of the data quality objectives (DQO) process prior to data collection, there is some question about the adequacy of the data to support a risk assessment. Note that a full DQO process is difficult to complete for a risk assessment, since traditional risk assessment involves summing upper confidence limits (UCLs) across more than one chemical, and the DQO process guidance is aimed at hypothesis testing to determine if the average concentration for a single chemical exceeds a risk-based threshold concentration. Nevertheless, sample size adequacy is discussed below in the context of separate hypothesis testing for each of four chemicals that drive, or are important to, the risk assessment. This follows the traditional approach to data quality assessment (DQA), which the U.S. Environmental Protection Agency (USEPA) promotes to confirm that DQOs were satisfied. In addition, an alternative approach that considers the probability of exceeding a threshold concentration given the data can also be performed. This approach offers simple probability statements using data-based estimates of the distributions of the sample mean. This procedure was not undertaken for this assessment.

The remainder of this attachment is organized into two sections. The first covers aspects related to the conceptual site model and whether the sample collection appears to be adequately representative. The second section addresses DQA using the traditional classical statistics-based DQO/DQA process.

The results suggest that, in general, the sample sizes are sufficient to support decision making for each of the four chemicals considered. Some care needs to be taken, however, because the conclusions are dependent on the choice of threshold concentrations. Overall, it seems reasonable to conclude that sufficient data have been collected.

C3-1. Conceptual Site Model

Statistical analysis is only one aspect considered when assessing sample size adequacy. For example, most statistical analysis is based on the assumption of random sampling, which is rarely fully satisfied in the sample design. Systematic sampling is often preferred because it provides greater geographic coverage. It is important to make sure that the data are fully representative of the populations about which decisions will be made. Other environmental factors such as fate and transport, exposure pathways, and receptor scenarios should be

considered. That is, statistical analysis has limitations to the evidence it can provide in the assessment of data adequacy. Common sense and experience must also be accounted for. The focus of this analysis was four chemicals that likely to be important in the risk assessment. The sample locations are reasonably spread out throughout the site. Samples have been collected at the surface and at multiple depths at each of these locations. The samples seem to adequately cover the area and volume of interest.

Background comparisons have also been performed. Although it is concluded that arsenic and radium-226 site concentrations are statistically greater than background, the differences do not visually appear large. Qualitatively, sample sizes could be considered adequate for arsenic and radium-226 given their similarity to background concentrations. Furthermore, hot spots do not seem to be evident based on the data, and were not considered likely. Under these circumstances, the sampling scheme seems appropriate.

For dioxins/furans (evaluated as TCDD toxic equivalency [TEQ]) and beta-BHC, background comparisons have not been performed. The dioxins/furans and beta-BHC data include numerous non-detect sample results, with a number of detected values at low concentrations. For dioxins/furans, this is consistent with past experience with data at industrial sites. It therefore seems logical to qualitatively conclude the samples collected adequately represent the distribution of dioxins/furans and beta-BHC concentrations in Borrow Area soils.

Note that an additional important assumption utilized for this analysis is that all samples collected within the defined Borrow Area boundary were used to support the risk assessment. That is, sub-areas were not defined for different receptor scenarios. This is important to the sample adequacy assessment presented below. Utilization of all sample locations assumed that there is one concentration population at the site for each chemical of potential concern (COPC) and that the risk assessment subsequently benefits from using all the available data. Application of this assumption is supported by the proposed bulk excavations and placement of material as fill for various projects as described in the main text of the report.

C3-2. Traditional DQA approach

This section presents sample size calculations for four analytes (radium-226, arsenic beta-BHC, and TCDD TEQ) at the Borrow Area site. The sample size calculations presented here use a formula that accommodates data that are not normally distributed. This test is based on comparing an average concentration to an analyte-specific threshold (*i.e.*, risk-based screening level [RBSL]). RBSLs were based on a cancer risk range of 1×10^{-6} to 1×10^{-4} and a non-cancer

hazard index of 1 used in this analysis. The examination of RBSLs spanning the USEPA acceptable cancer risk range of 10^{-4} to 10^{-6} was performed for the COPCs to provide additional lines of evidence in support of the data adequacy analysis.

The DQO process specifies a decision performance curve for 1-sided tests. In this process, a null and alternative hypothesis is specified. The null hypothesis is specified in terms of exceedance of a threshold concentration, and the alternative is specified as the complementary region. Given the arrangement of the null and alternative hypotheses as described, a decision performance curve has three ranges of interest. First, if the observed mean is greater than the threshold concentration, then the decision is clearly made that the threshold concentration is exceeded. In this case, sample size calculations are meaningless. The second region is specified because classical testing requires greater proof for the alternative hypothesis, so that if the observed mean concentration is slightly less than the threshold concentration this alone is not considered sufficient information to prove the alternative hypothesis. The burden of proof in classical hypothesis testing is on proving the alternative hypothesis. This is where specification of the Type II error tolerance and the subsequent gray region of the decision performance curve occur. If the observed mean concentration lies in the gray region, then the alternative hypothesis is not proven, and, this might be because there are insufficient data to make the decision. The third region appears at low mean concentrations below the gray region. If the observed mean concentration is in this region, the alternative hypothesis is considered proven, and there are enough data to support that conclusion.

Because of the asymmetry in the classical 1-sided hypothesis testing procedure, if the observed mean concentration is greater than the threshold concentration, there is no recourse for evaluating sample size adequacy. That is, the sample size is simply considered statistically sufficient. Statistically, the sample size calculations do not make sense since power cannot be defined for regions that do not satisfy the alternative hypothesis.

For the other two cases (mean in the gray region, and mean below the gray region), the data are used to estimate the variance or standard deviation, and, essentially, a comparison is made involving the prior variance upon which sample size was based if this DQO process was followed, and the variance of the collected data (posterior variance). In effect, the posterior variance moves the gray region. If the posterior variance is greater than the prior variance then the gray region is effectively widened; if the posterior variance is less than the prior variance then the gray region is effectively shrunk. In either case, determination of sample size adequacy then depends on the location of the sample mean. If it is in the posterior gray region then an

argument can be made that there are not enough data. If it is outside the gray region, then an argument can be made that there are enough data.

Note that this analysis is based on "observed power", which is a construct with which some statisticians disagree. It is also based on 1-sided hypothesis testing, which is another construct with which some statisticians take issue. For many reasons, the classical statistics based DQO process does not apply to all situations, but provides some indication of how the traditional classical statistics based DQO process and DQA work in concert.

A range of possible values of decision error tolerances is considered. In addition, RBSLs are not necessarily firmly defined, and different RBSLs must be considered because of the different receptor scenarios. For this analysis, RBSLs for the site-specific receptor termed the future off-site maintenance worker (the receptor with the highest chemical risks) were used. For radium-226, arsenic, beta-BHC and TCDD TEQ (*i.e.*, chemicals evaluated as carcinogens), three different RBSLs were evaluated for each. These RBSLs are based on cancer risks of 1×10^{-6}, 1×10^{-5}, and 1×10^{-4}.

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). The stakeholders should select the inputs associated with the specification of tolerable decision errors (significance level and power).

The significance level of the test (α) is interpreted as the tolerance for making a specific decision error – in this case declaring the average site concentration as less than the threshold when it is in fact greater. This is referred to as the Type I error. The power (β) of the test is the (additive) complement of the other type of decision error, termed the Type II error (power = 1 – [the probability of a Type II error]). Type II error must be specified at a concentration that is an acceptable distance from the threshold stated in the hypothesis test. An acceptable magnitude of difference from the mean is a quantity that should be agreed upon by all involved stakeholders. A Type II error occurs if for a given analyte, the average site concentration/activity is declared greater than the threshold when it is in fact less than the threshold. As one specifies power further away from the threshold stated in the hypothesis, fewer samples are needed to meet the specified tolerances for decision error.

Decision errors occur because the site is sampled rather than taking a census. Sampling does not always provide the correct answer, but the more samples that are taken the more likely the

correct decision will be made. The sample size calculation deals with the trade off between tolerance for decision errors and costs of taking samples. For example, as the tolerance for making a decision error decreases, the sample size will increase because there is less willingness to be wrong. In general, as the acceptable probability of decision error (both Type I and Type II) decreases, the number of samples needed increases. Additionally, as the point at which the Type II error is specified moves closer to the threshold stated in the hypothesis, the number of samples required increases.

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. This provides a general idea of the consequences (changes in the number of samples) of relaxing error tolerances. Decision error tolerances should, however, be specified according to the importance of the decisions being made. For example, if the proposed future land use is residential, this provides strong motivation to ensure that the site is not declared "clean" when in fact it is not. Hence the Type I error or significance level should be fairly small. Because in the case of Borrow Area soils, future use is to include fill material for commercial construction where significant contact is not anticipated, and placement is limited in that it may not occur in sensitive areas, perhaps a larger (α) Type I error or significance level can be tolerated. Furthermore, the parties (*e.g.*, developers) utilizing the material want to ensure that limiting use of the material is not performed unnecessarily; hence Type II error tolerance should not be too large (depending on the average concentration at which it is specified). Specification of these error terms should be performed by the stakeholders or by the project team.

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 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 is the number of samples

s is the estimated standard deviation of concentrations/activities

Δ is the width of the gray region (the difference between the threshold value in stated in the hypothesis and the point at which β is specified)

α is the significance level or Type I error tolerance

$\beta(\mu)$ Type II error tolerance

z is a quantile from the standard normal distribution

The Visual Sample Plan (VSP version 4.6d) was utilized to conduct these calculations. As an example, to compute the number of samples needed to determine if the average activity of radium-226 at the site, does not exceed the threshold of 0.026 pCi/g, the corresponding hypothesis test can be stated as follows:

$$H_o : \mu \geq 0.026 \text{ pCi/g of } {}^{226}\text{Ra}$$
$$H_A : \mu \leq 0.026 \text{ pCi/g of } {}^{226}\text{Ra}$$

That is, the null hypothesis is that the mean radium-226 activity exceeds the threshold, and the alternative hypothesis is that the mean does not exceed the threshold. The gray region is specified at one end by the point at which α is specified, *i.e.*, 0.026 pCi/g, and at the other end by a value of the mean (μ) at which the Type II error is specified.

The common default values that are used for α and β are 5% and 20%, however, EPA does not necessarily recommend using these default values, but recommends instead that the stakeholders establish appropriate values based on the decision error consequences. These common defaults do not address the width of the gray region or, hence, the possible average concentration at which the Type II error is specified. In the tables that follow, various combinations of input values are used, including: values of α of 5%, 10% and 15%; values of β of 15%, 20%, and 25%; and a gray region of width 10%, 20% and 30% of the action level. Note that as error rates increase, sample size decreases, as the size of the gray region increase, sample size decreases, and as variance increases sample size increases.

Random placement of the sample locations is also an assumption of the algorithm used. However, good spatial coverage rather than pure random placement is acceptable. This is common practice and is assumed to have little impact on the statistics, but considerable impact on common sense arguments for sampling coverage.

That describes the basic mathematics, but there are other assumptions that are required to complete the calculations. There are some statistical assumptions for the underlying hypothesis testing procedure regarding independence (lack of spatial correlation) and symmetry that are

more time consuming to verify up front, but these issues are often ignored for the purpose of sample size calculations.

Radium-226

Sample size calculations for radium-226 are presented in Tables D3-1 through D3-3. The mean radium-226 concentration is 2.0 pCi/g. RBSLs of interest are 0.026 pCi/g, 0.26 pCi/g and 2.6 pCi/g. Following the arguments made above, the 49 data points that are available for radium-226 are sufficient to support a decision that the mean concentration is greater than either of the first two threshold concentrations (RBSLs). Consequently, the sample sizes presented in Tables D3-1 and D3-2 are irrelevant. In addition, from a common sense perspective, 49 samples seem adequate given the reported mean concentration for both of these decisions. For the third threshold concentration (2.6 pCi/g), sample size calculations are more meaningful, and are presented in Table D3-3. It is clear from Table D3-3 that the 49 samples collected are sufficient to support an argument that the mean concentration is less than the threshold concentration.

In conclusion, the sample size is adequate for radium-226 based on this traditional classical statistics-based approach to DQOs and DQA. Sample sizes will only become questionable if the mean concentration is reported closer to, but still less than, the threshold of 2.6 pCi/g, or if the threshold concentration is changed.

Arsenic

Sample size calculations for arsenic are presented in Tables D3-4 through D3-6. The mean arsenic concentration is 7.0 mg/kg. RBSLs of interest are 4.2 mg/kg, 42 mg/kg and 420 mg/kg. Following the arguments made above, the 80 data points that are available for arsenic are sufficient to support a decision that the mean concentration is greater than the first threshold concentration (RBSLs). Consequently, the sample sizes presented in Table D3-4 are irrelevant. In addition, from a common sense perspective, 80 samples seem adequate given the reported mean concentration for both of these decisions. For the second and third threshold concentrations (42 and 420 mg/kg), sample size calculations are more meaningful, and are presented in Tables D3-5 and D3-6. It is clear from Tables D3-5 through D3-7 that the 80 samples already collected are sufficient to support an argument that the mean concentration is less than the threshold concentration in both cases.

In conclusion, the sample size is adequate for arsenic based on this traditional classical statistics-based approach to DQOs and DQA. Sample sizes will only become questionable if the mean

concentration is reported closer to, but still less than, the threshold of 4.2 mg/kg, or if the threshold concentrations are changed.

Beta-BHC

Sample size calculations for beta-BHC are presented in Tables D3-7 through D3-9. The mean beta-BHC concentration is 0.020 mg/kg. RBSLs of interest are 1.4 mg/kg, 14 mg/kg and 140 mg/kg. The arguments regarding sample size for beta-BHC are similar to those made for arsenic. In conclusion, the sample size is adequate for beta-BHC across a wide range of threshold concentrations, and will only become questionable if the threshold concentrations are changed.

TCDD TEQ (Dioxins/Furans)

Sample size calculations for dioxins/furans are presented in Tables D3-10 through D3-12. The mean TCDD TEQ concentration is 3.6 ng/kg (ppt – calculated from Table D-1 using one-half the detection limit for non-detects). RBSLs of interest are 18 pg/g, 180 pg/g and 1,800 pg/g. The arguments regarding sample size for dioxins/furans are similar to those made for arsenic. In conclusion, the sample size is adequate for dioxins/furans across a wide range of threshold concentrations, and will only become questionable if the threshold concentrations are changed.

Again, this analysis is based on this traditional classical statistics-based approach to DQOs and DQA. Assessment of sample sizes that are computed following this approach after data have been collected is questionable. One should also bear in mind that the sample size formulas presented here are based on normality. An adjustment multiplier of 1.16 is used to account for some skew in the data, but for dioxins/furans the skew is very large, and a different model than normality should probably be considered.

Table D3-1: Sample Size Results for Radium-226 with RBSL = 0.026 pCi/g (Future Off-Site Maintenance Worker)

		Number of Samples with s = 0.70 pCi/g		
Threshold = 0.026 pCi/g		**α = 5%**	**α = 10%**	**α = 15%**
Δ = 0.0026 pCi/g (10%)	**β = 15%**	>10,000	>10,000	>10,000
	β = 20%	>10,000	>10,000	>10,000
	β = 25%	>10,000	>10,000	>10,000
Δ = 0.0052 pCi/g (20%)	**β = 15%**	>10,000	>10,000	>10,000
	β = 20%	>10,000	>10,000	>10,000
	β = 25%	>10,000	>10,000	>10,000
Δ = 0.0078 pCi/g (30%)	**β = 15%**	>10,000	>10,000	>10,000
	β = 20%	>10,000	>10,000	>10,000
	β = 25%	>10,000	>10,000	>10,000

Table D3-2: Sample Size Results for Radium-226 with RBSL = 0.26 pCi/g (Future Off-Site Maintenance Worker)

		Number of Samples with s = 0.70 pCi/g		
Threshold = 0.26 pCi/g		**α = 5%**	**α = 10%**	**α = 15%**
Δ = 0.026 pCi/g (10%)	**β = 15%**	6047	4519	3614
	β = 20%	5201	3792	2967
	β = 25%	4525	3219	2462
Δ = 0.052 pCi/g (20%)	**β = 15%**	1513	1131	904
	β = 20%	1302	949	743
	β = 25%	1133	806	616
Δ = 0.078 pCi/g (30%)	**β = 15%**	674	503	403
	β = 20%	580	423	331
	β = 25%	505	359	275

Table D3-3: Sample Size Results for Radium-226 with RBSL = 2.6 pCi/g (Future Off-Site Maintenance Worker)

		Number of Samples with s = 0.70 pCi/g		
Threshold = 2.6 pCi/g		**α = 5%**	**α = 10%**	**α = 15%**
Δ = 0.26 pCi/g (10%)	**β = 15%**	63	47	37
	β = 20%	54	39	31
	β = 25%	47	34	26
Δ = 0.52 pCi/g (20%)	**β = 15%**	17	13	10
	β = 20%	15	11	9
	β = 25%	13	9	7
Δ = 0.78 pCi/g (30%)	**β = 15%**	9	6	5
	β = 20%	8	6	4
	β = 25%	7	5	4

Table D3-4: Sample Size Results for Arsenic with RBSL = 4.2 mg/kg (Future Maintenance Worker Off-Site)

		Number of Samples with s = 5.3 mg/kg		
Threshold = 4.2 mg/kg		**α = 5%**	**α = 10%**	**α = 15%**
Δ = 0.42 mg/kg (10%)	**β = 15%**	1330	994	795
	β = 20%	1144	834	653
	β = 25%	996	708	542
Δ = 0.84 mg/kg (20%)	**β = 15%**	334	250	200
	β = 20%	288	210	164
	β = 25%	250	178	136
Δ = 1.26 mg/kg (30%)	**β = 15%**	150	112	87
	β = 20%	129	94	74
	β = 25%	112	80	61

Table D3-5: Sample Size Results for Arsenic with RBSL = 42 mg/kg (Future Maintenance Worker Off-Site)

		Number of Samples with s = 5.3 mg/kg		
Threshold = 42 mg/kg		**α = 5%**	**α = 10%**	**α = 15%**
Δ = 4.2 mg/kg (10%)	**β = 15%**	15	11	9
	β = 20%	13	10	8
	β = 25%	12	9	7
Δ = 8.4 mg/kg (20%)	**β = 15%**	5	4	3
	β = 20%	5	4	3
	β = 25%	5	3	2
Δ = 12.6 mg/kg (30%)	**β = 15%**	4	3	2
	β = 20%	3	2	2
	β = 25%	3	2	2

Table D3-6: Sample Size Results for Arsenic with RBSL = 420 mg/kg (Future Maintenance Worker Off-Site)

		Number of Samples with s = 5.3 mg/kg		
Threshold = 420 mg/kg		**α = 5%**	**α = 10%**	**α = 15%**
Δ = 42 mg/kg (10%)	**β = 15%**	2	2	1
	β = 20%	2	2	1
	β = 25%	2	2	1
Δ = 84 mg/kg (20%)	**β = 15%**	2	1	1
	β = 20%	2	1	1
	β = 25%	2	1	1
Δ = 126 mg/kg (30%)	**β = 15%**	2	1	1
	β = 20%	2	1	1
	β = 25%	2	1	1

Table D3-7: Sample Size Results for beta-BHC with RBSL = 1.4 mg/kg (Future Maintenance Worker Off-Site)

		Number of Samples with s = 0.058 mg/kg		
Threshold = 1.4 mg/kg		**α = 5%**	**α = 10%**	**α = 15%**
Δ = 1.8 pg/g (10%)	**β = 15%**	4	3	2
	β = 20%	3	2	2
	β = 25%	3	2	2
Δ = 3.6 pg/g (20%)	**β = 15%**	2	2	1
	β = 20%	2	2	1
	β = 25%	2	2	1
Δ = 5.4 pg/g (30%)	**β = 15%**	2	2	1
	β = 20%	2	2	1
	β = 25%	2	2	1

Table D3-8: Sample Size Results for beta-BHC with RBSL = 14 mg/kg (Future Maintenance Worker Off-Site)

		Number of Samples with s = 0.058 mg/kg		
Threshold = 14 mg/kg		**α = 5%**	**α = 10%**	**α = 15%**
Δ = 18 pg/g (10%)	**β = 15%**	2	1	1
	β = 20%	2	1	1
	β = 25%	2	1	1
Δ = 36 pg/g (20%)	**β = 15%**	2	1	1
	β = 20%	2	1	1
	β = 25%	2	1	1
Δ = 54 pg/g (30%)	**β = 15%**	2	1	1
	β = 20%	2	1	1
	β = 25%	2	1	1

Table D3-9: Sample Size Results for beta-BHC with RBSL = 140 mg/kg (Future Maintenance Worker Off-Site)

		Number of Samples with s = 0.058 mg/kg		
Threshold = 140 mg/kg		**α = 5%**	**α = 10%**	**α = 15%**
Δ = 180 pg/g (10%)	**β = 15%**	2	1	1
	β = 20%	2	1	1
	β = 25%	2	1	1
Δ = 360 pg/g (20%)	**β = 15%**	2	1	1
	β = 20%	2	1	1
	β = 25%	2	1	1
Δ = 540 pg/g (30%)	**β = 15%**	2	1	1
	β = 20%	2	1	1
	β = 25%	2	1	1

Table D3-10: Sample Size Results for TCDD TEQ with RBSL = 18 pg/g (Future Maintenance Worker Off-Site)

		Number of Samples with s = 6.6 pg/g		
Threshold = 18 pg/g		**α = 5%**	**α = 10%**	**α = 15%**
Δ = 1.8 pg/g (10%)	**β = 15%**	114	85	68
	β = 20%	98	72	56
	β = 25%	86	61	47
Δ = 3.6 pg/g (20%)	**β = 15%**	30	22	18
	β = 20%	26	19	15
	β = 25%	23	16	13
Δ = 5.4 pg/g (30%)	**β = 15%**	15	11	9
	β = 20%	13	9	7
	β = 25%	11	8	6

Table D3-11: Sample Size Results for TCDD TEQ with RBSL = 180 pg/g (Future Maintenance Worker Off-Site)

		Number of Samples with s = 6.6 pg/g		
Threshold = 180 pg/g		**α = 5%**	**α = 10%**	**α = 15%**
Δ = 18 pg/g (10%)	**β = 15%**	3	2	2
	β = 20%	3	2	2
	β = 25%	3	2	2
Δ = 36 pg/g (20%)	**β = 15%**	2	2	1
	β = 20%	2	2	1
	β = 25%	2	2	1
Δ = 54 pg/g (30%)	**β = 15%**	2	2	1
	β = 20%	2	2	1
	β = 25%	2	2	1

Table D3-12: Sample Size Results for TCDD TEQ with RBSL = 1,800 pg/g (Future Maintenance Worker Off-Site)

		Number of Samples with s = 6.6 pg/g		
Threshold = 1,800 pg/g		**α = 5%**	**α = 10%**	**α = 15%**
Δ = 180 pg/g (10%)	**β = 15%**	2	1	1
	β = 20%	2	1	1
	β = 25%	2	1	1
Δ = 360 pg/g (20%)	**β = 15%**	2	1	1
	β = 20%	2	1	1
	β = 25%	2	1	1
Δ = 540 pg/g (30%)	**β = 15%**	2	1	1
	β = 20%	2	1	1
	β = 25%	2	1	1

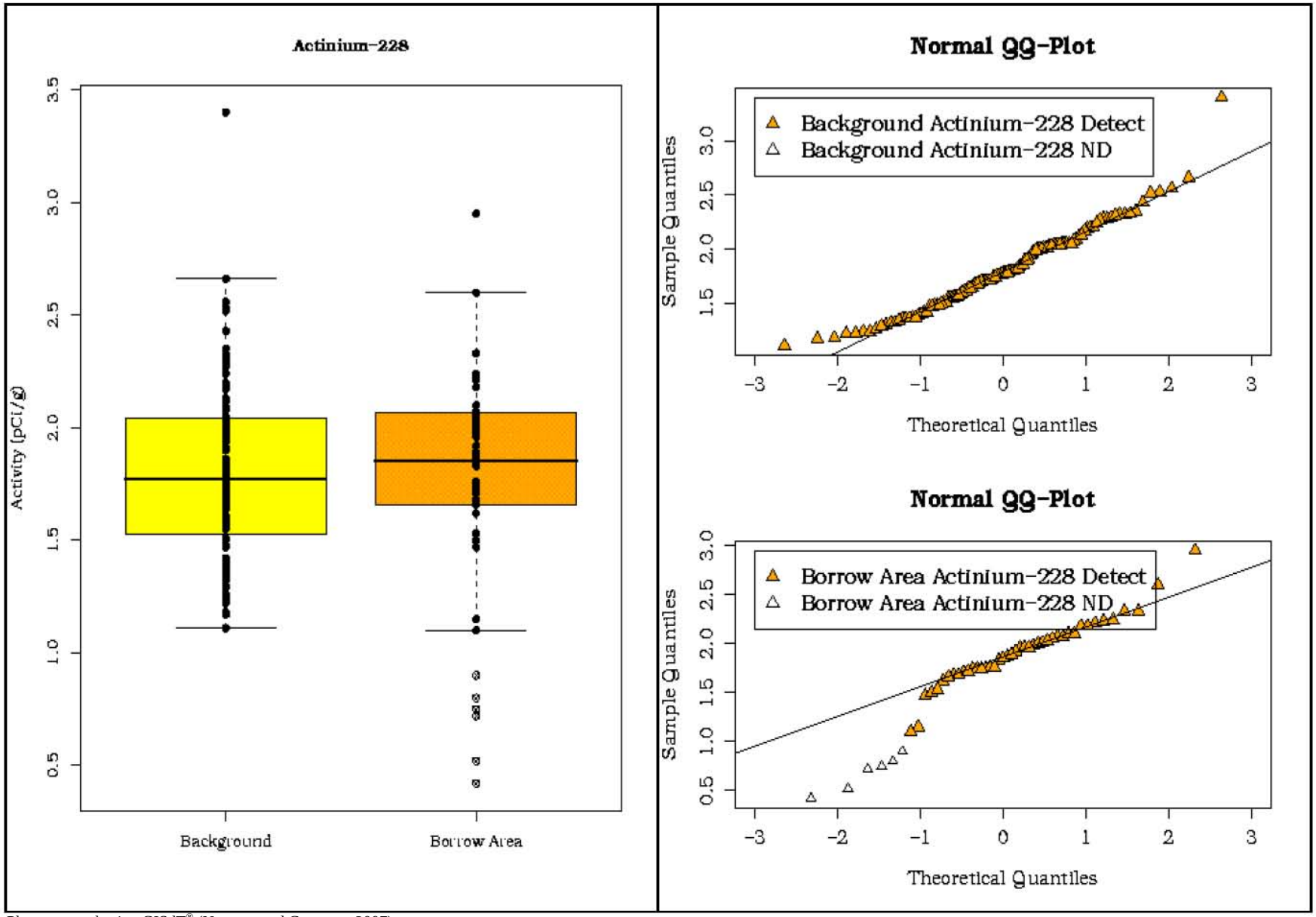
APPENDIX E

SOIL BACKGROUND AND COMPARISON STATISTICS

ATTACHMENT E-1

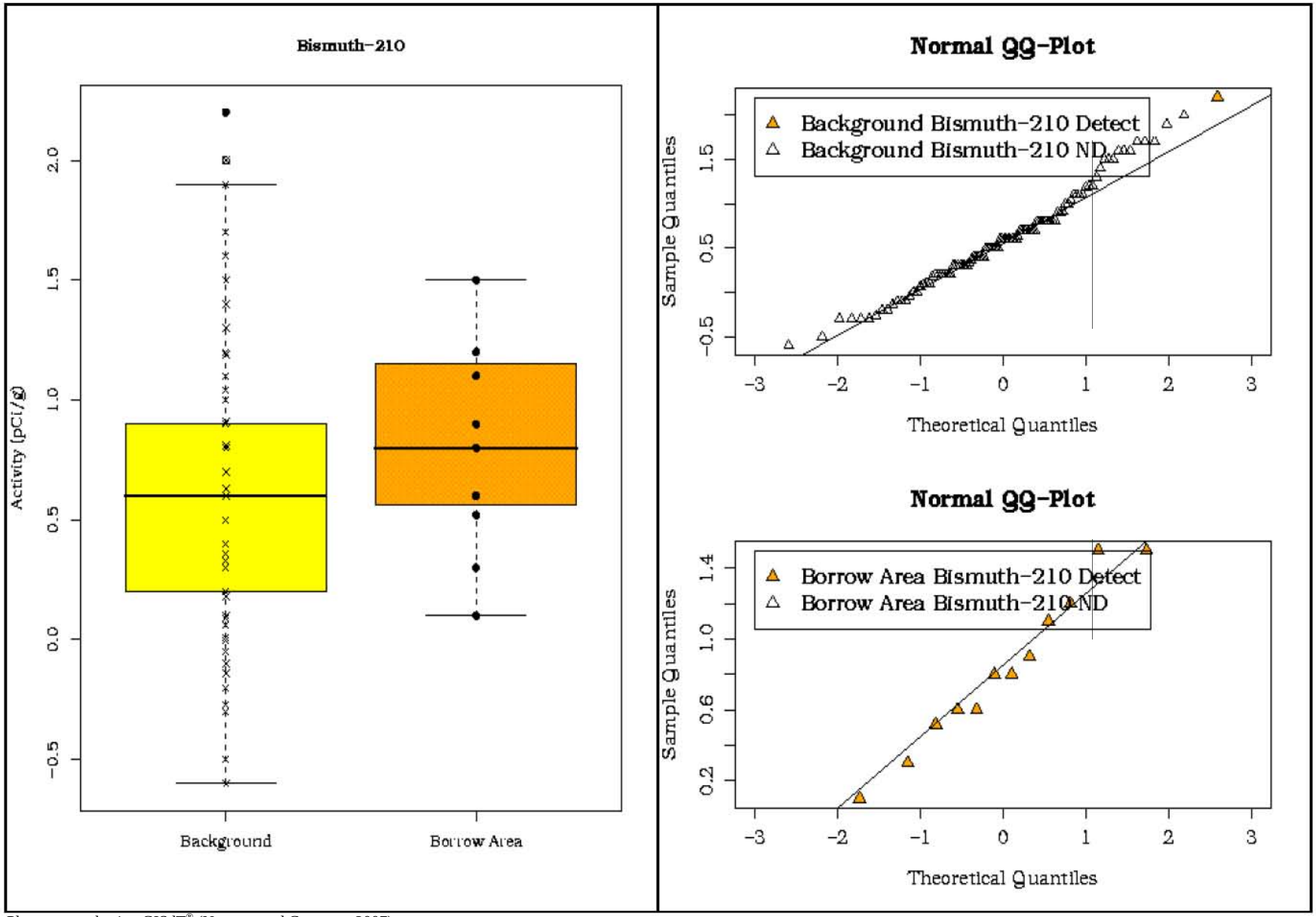
BOX PLOTS AND PROBABILITY PLOTS

BOXPLOTS AND NORMAL QQ PLOTS FOR RADIONUCLIDES



Plots prepared using GISdT® (Neptune and Company 2007).

BOXPLOTS AND NORMAL QQ PLOTS FOR RADIONUCLIDES



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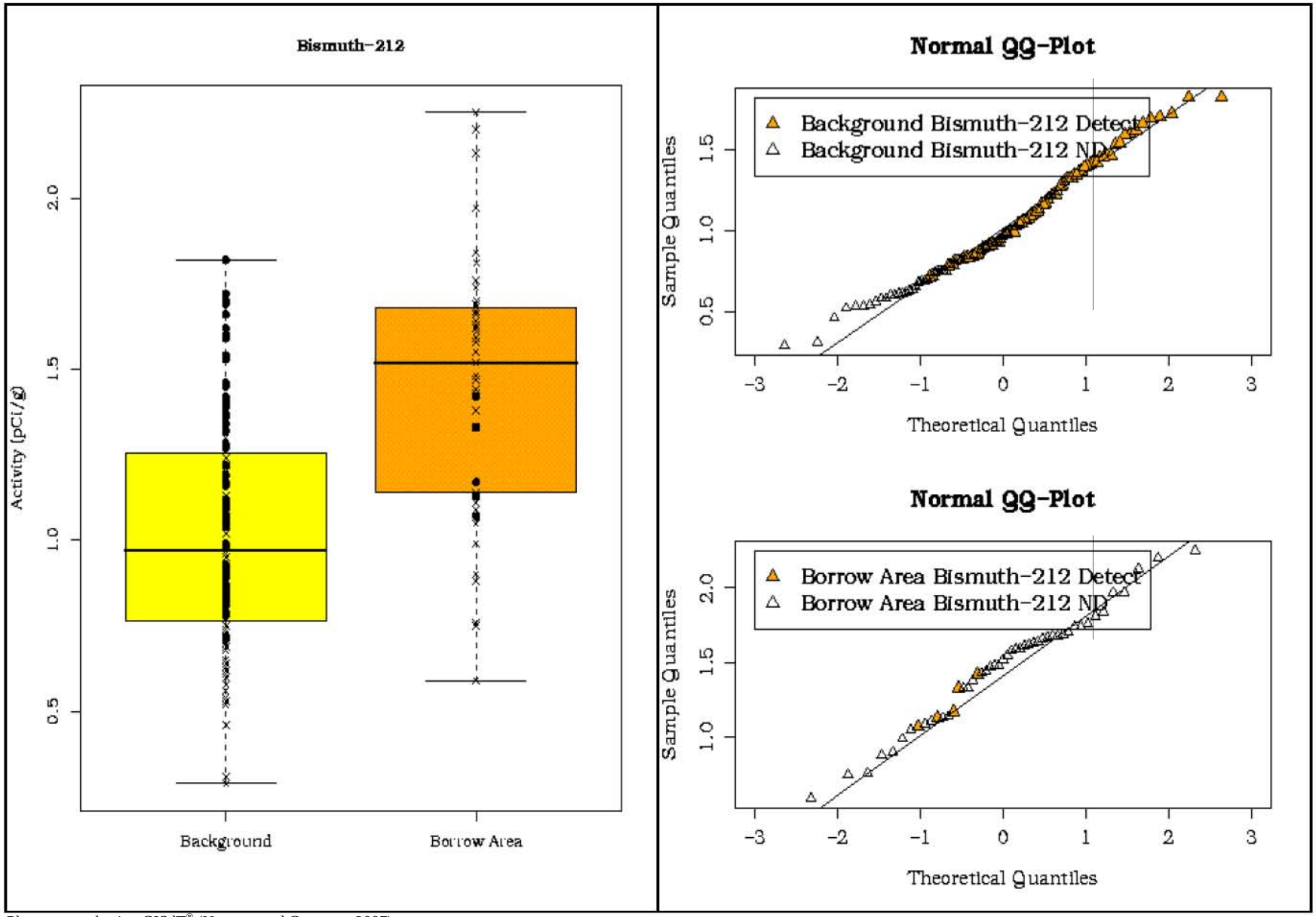

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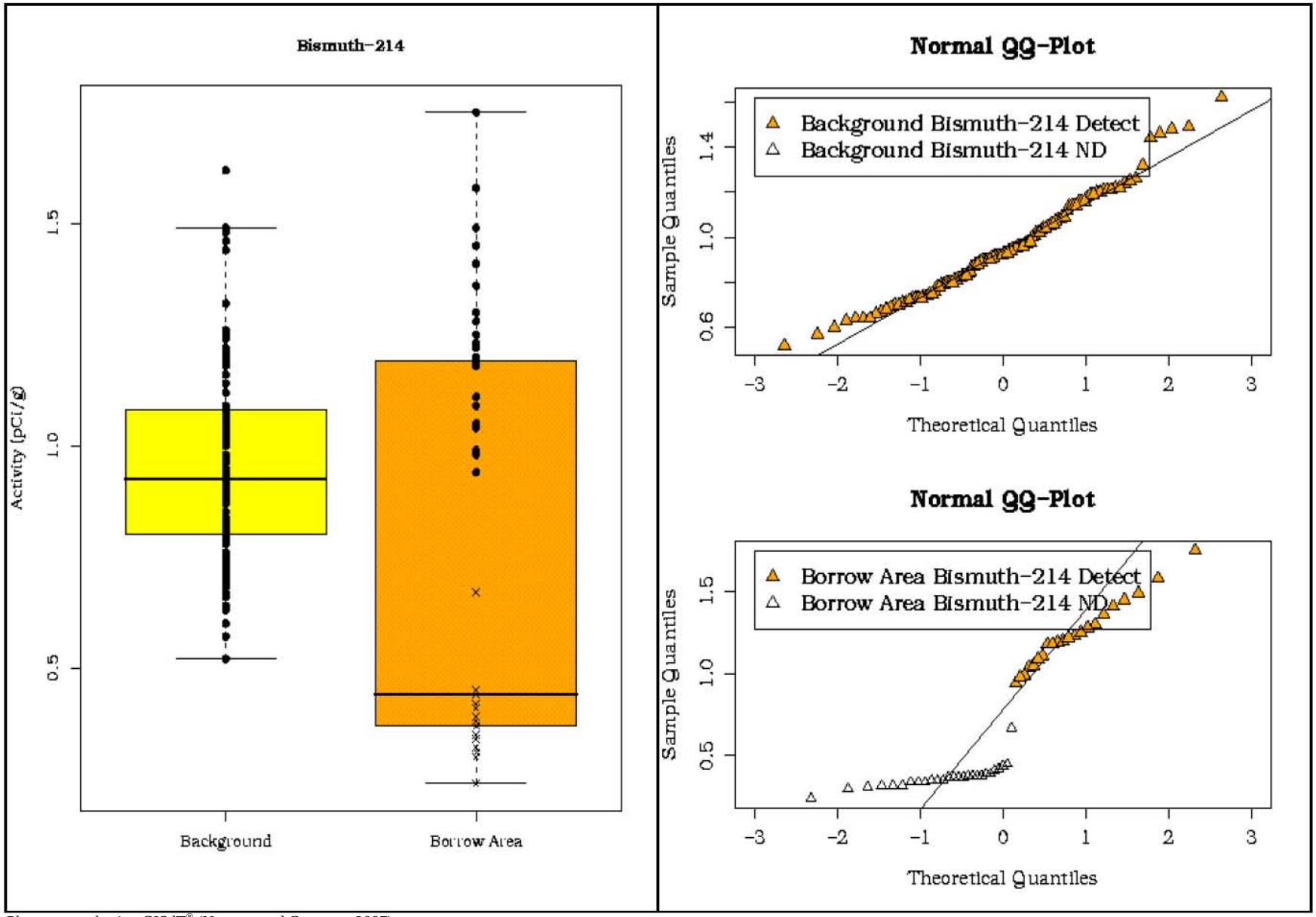

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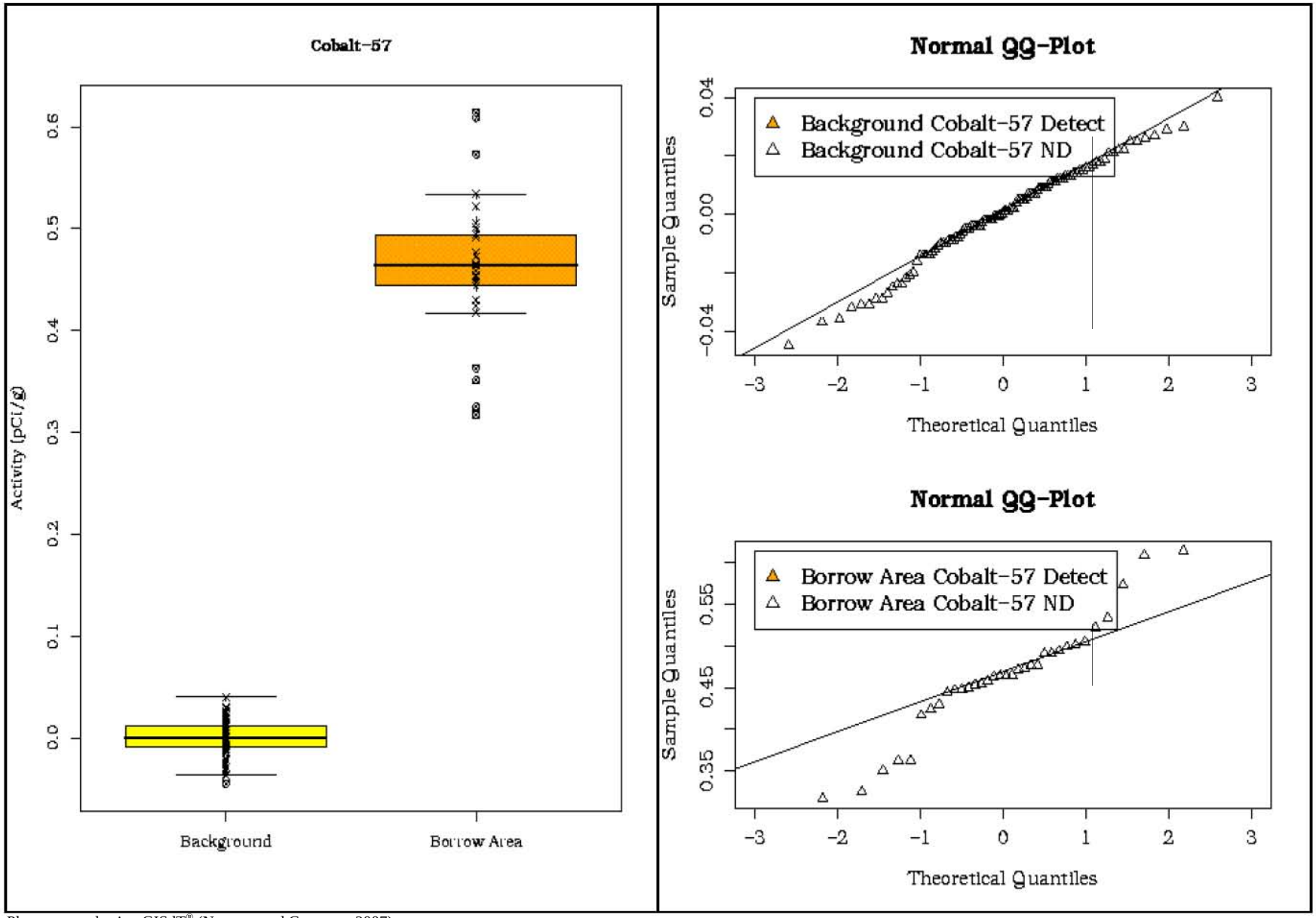

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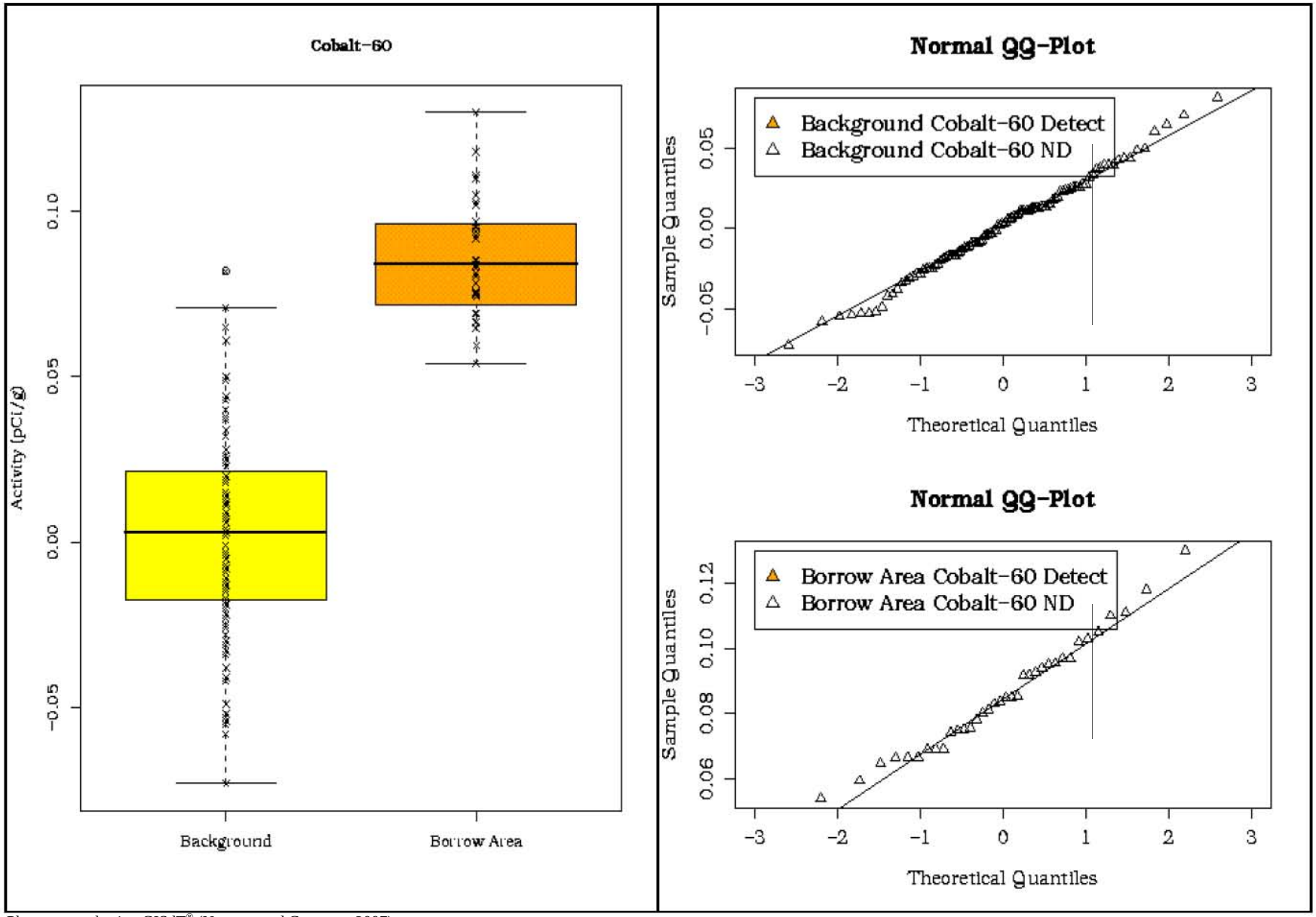

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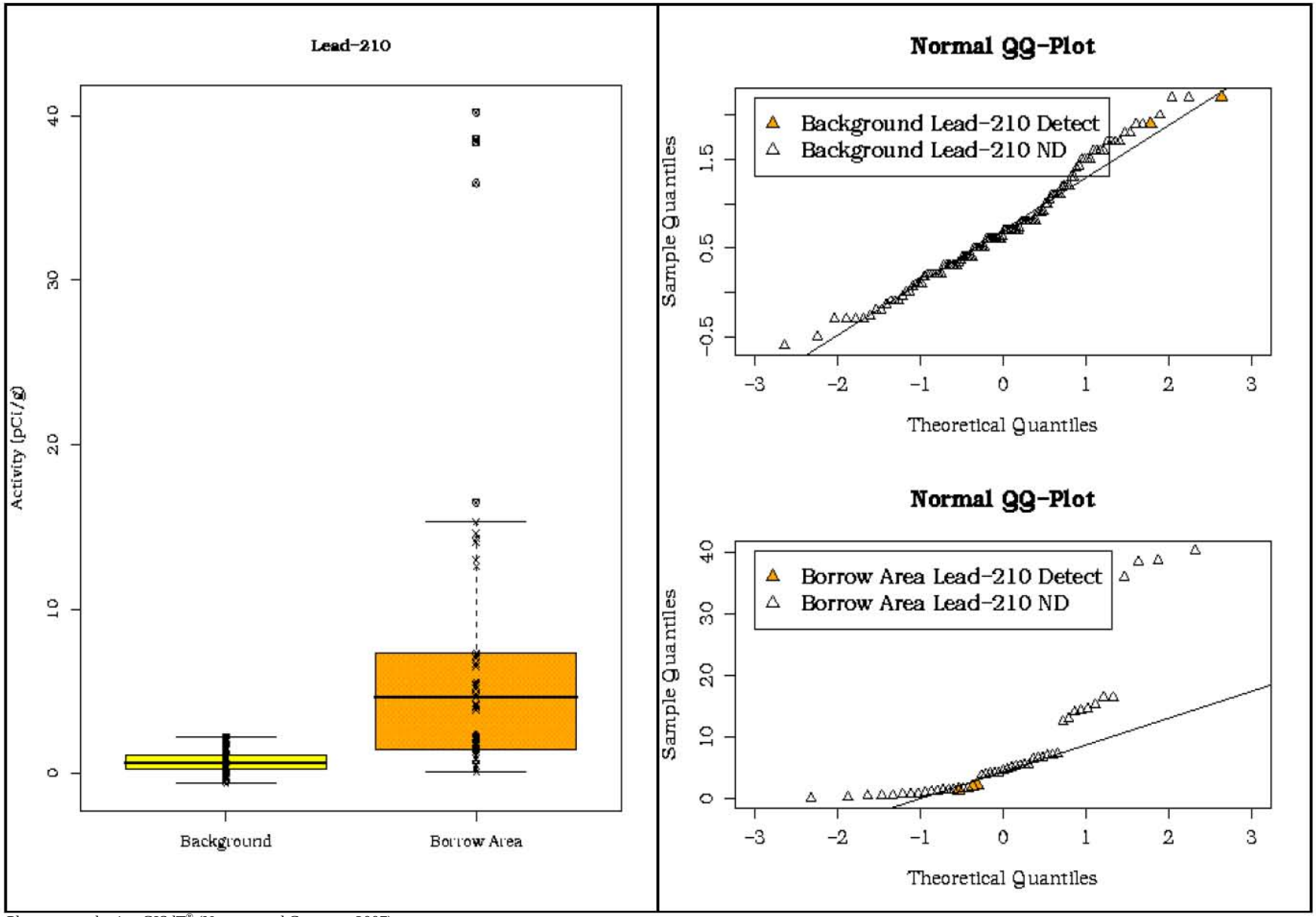

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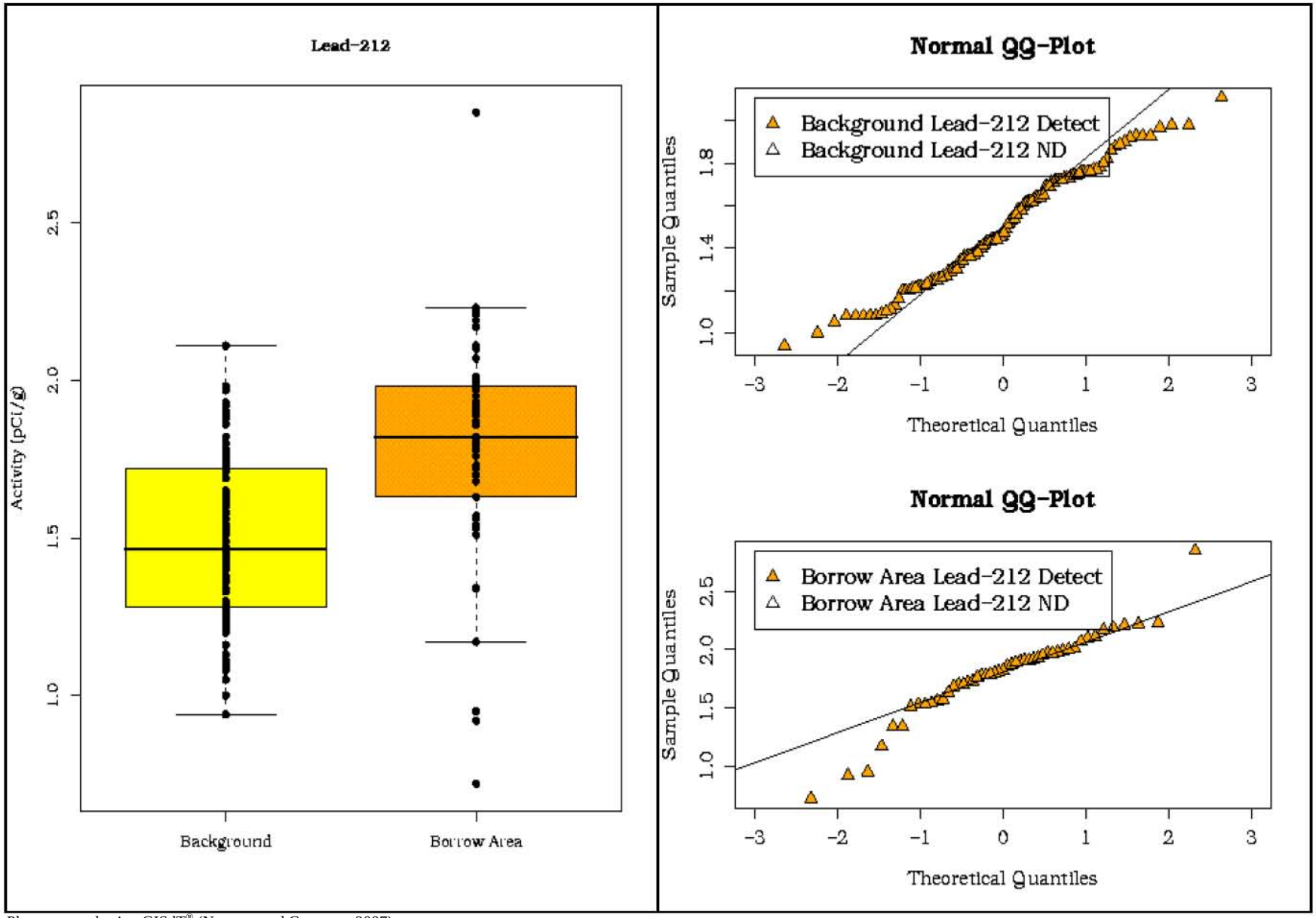

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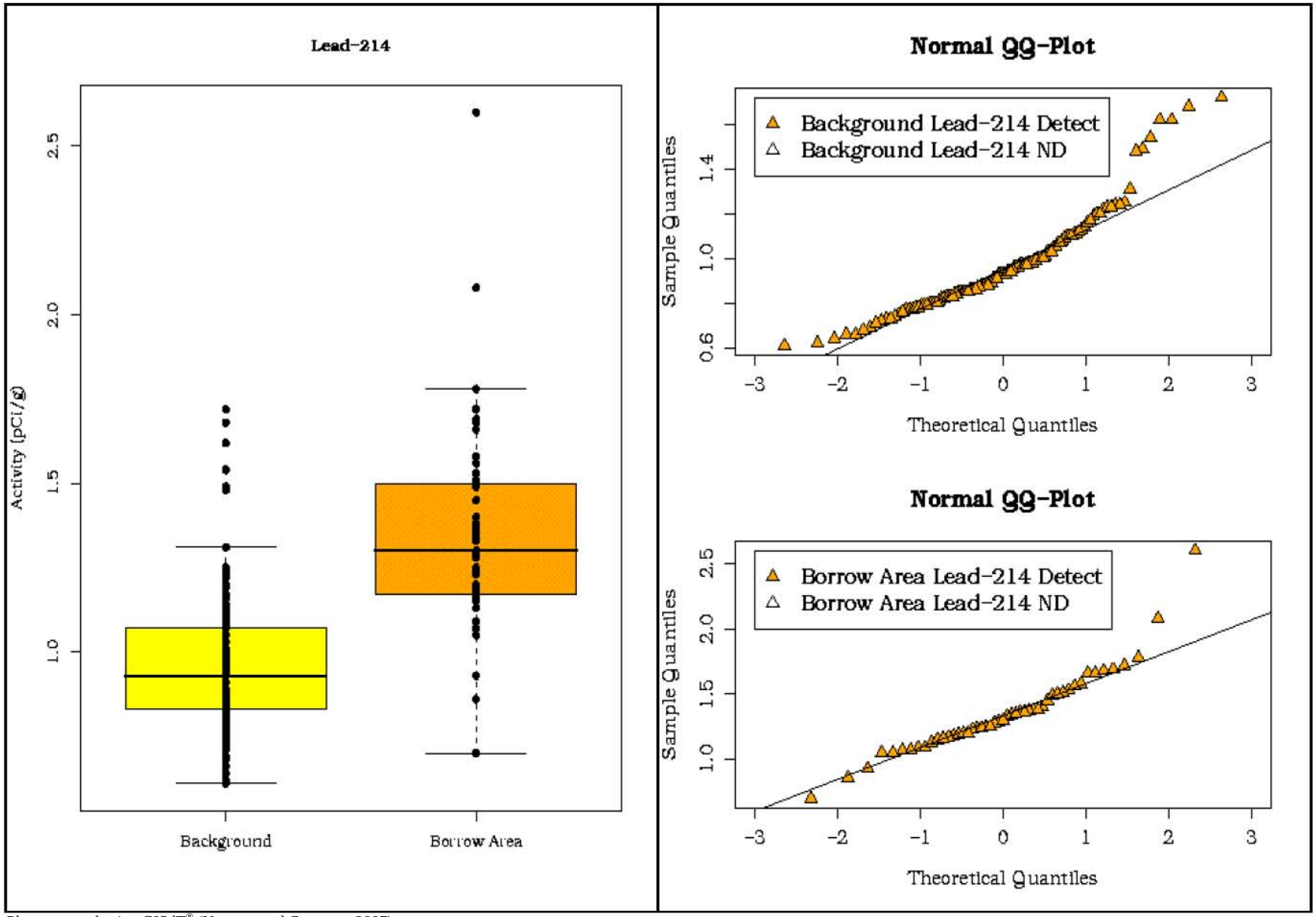
BOXPLOTS AND NORMAL QQ PLOTS FOR RADIONUCLIDES



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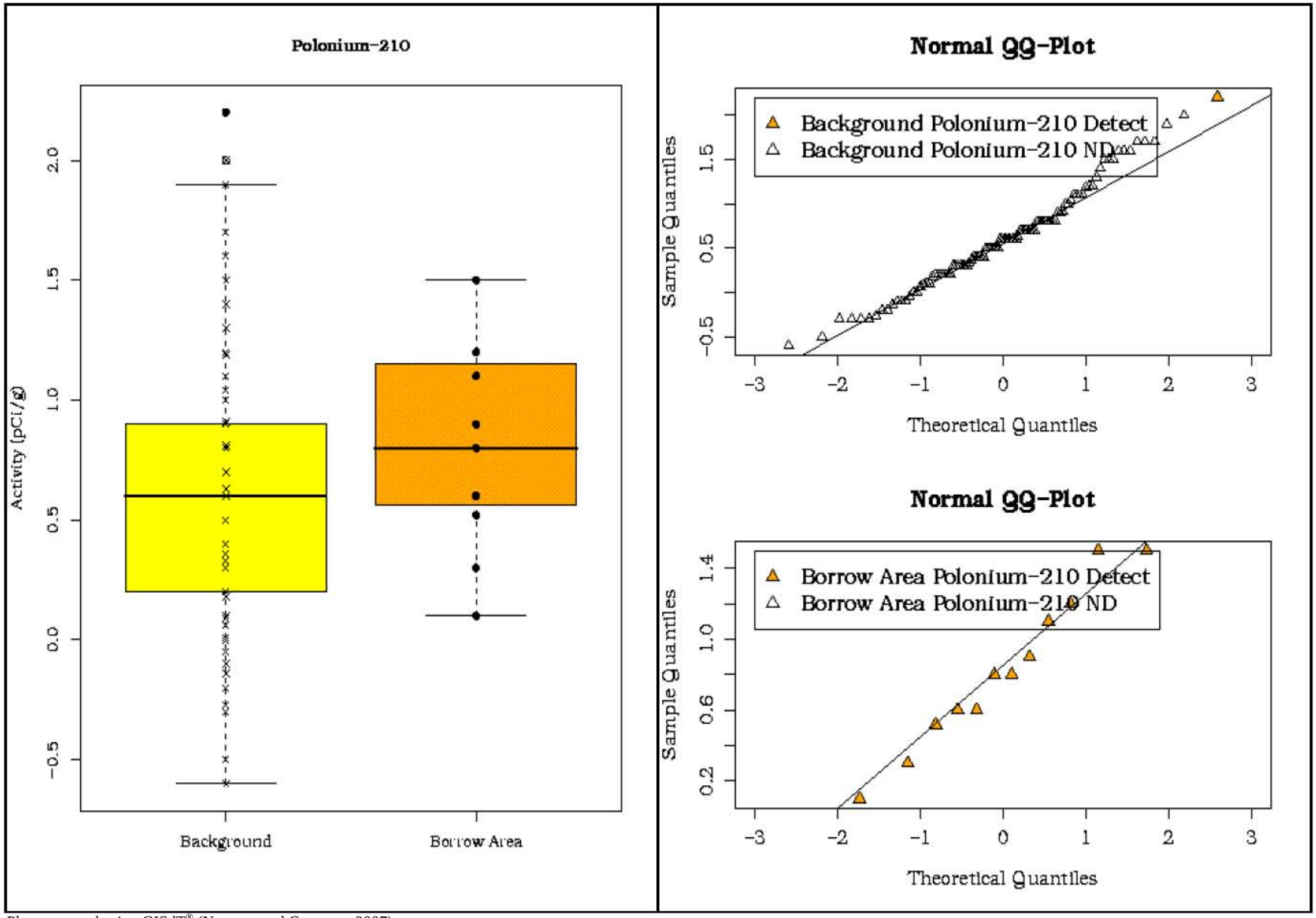

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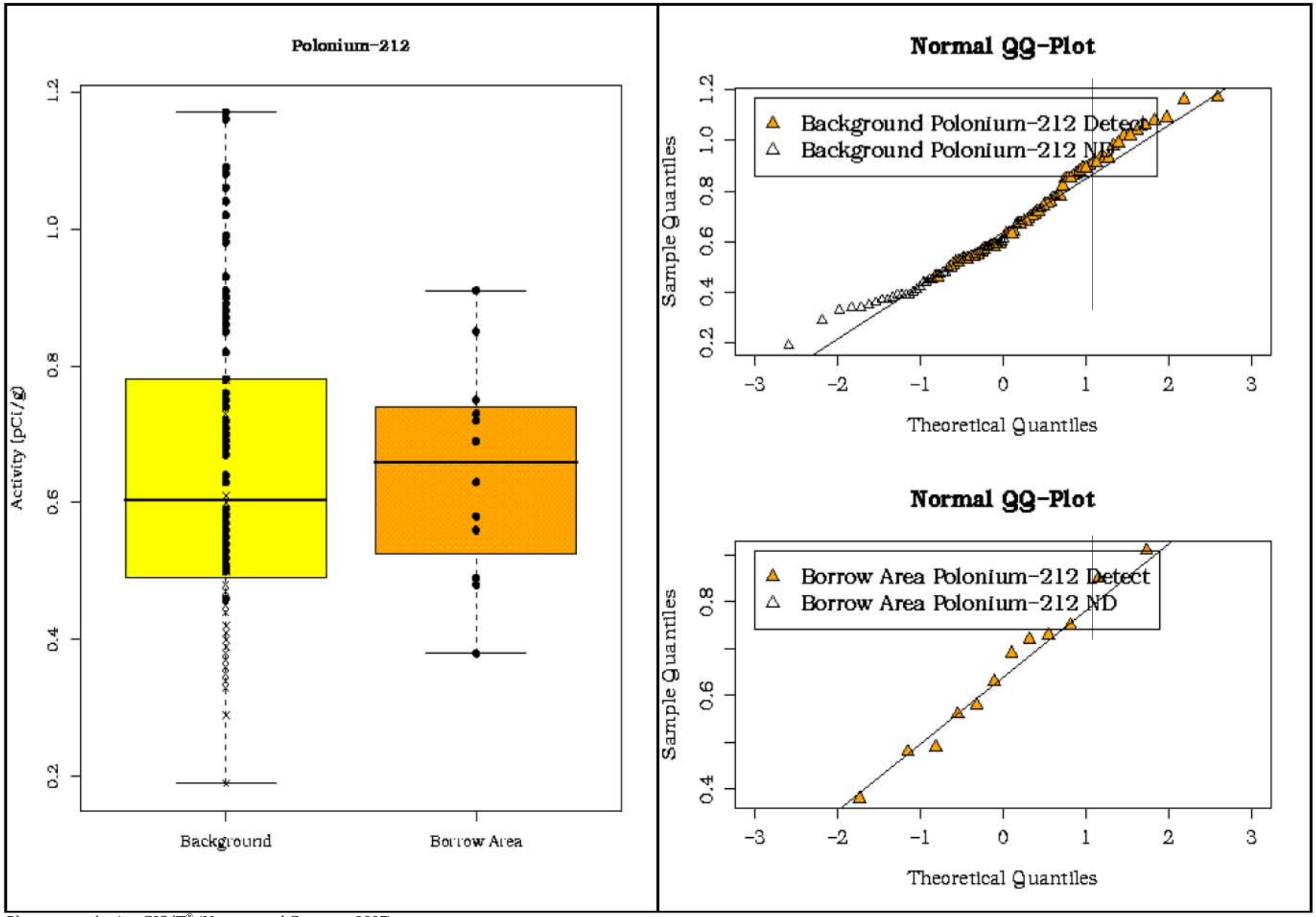

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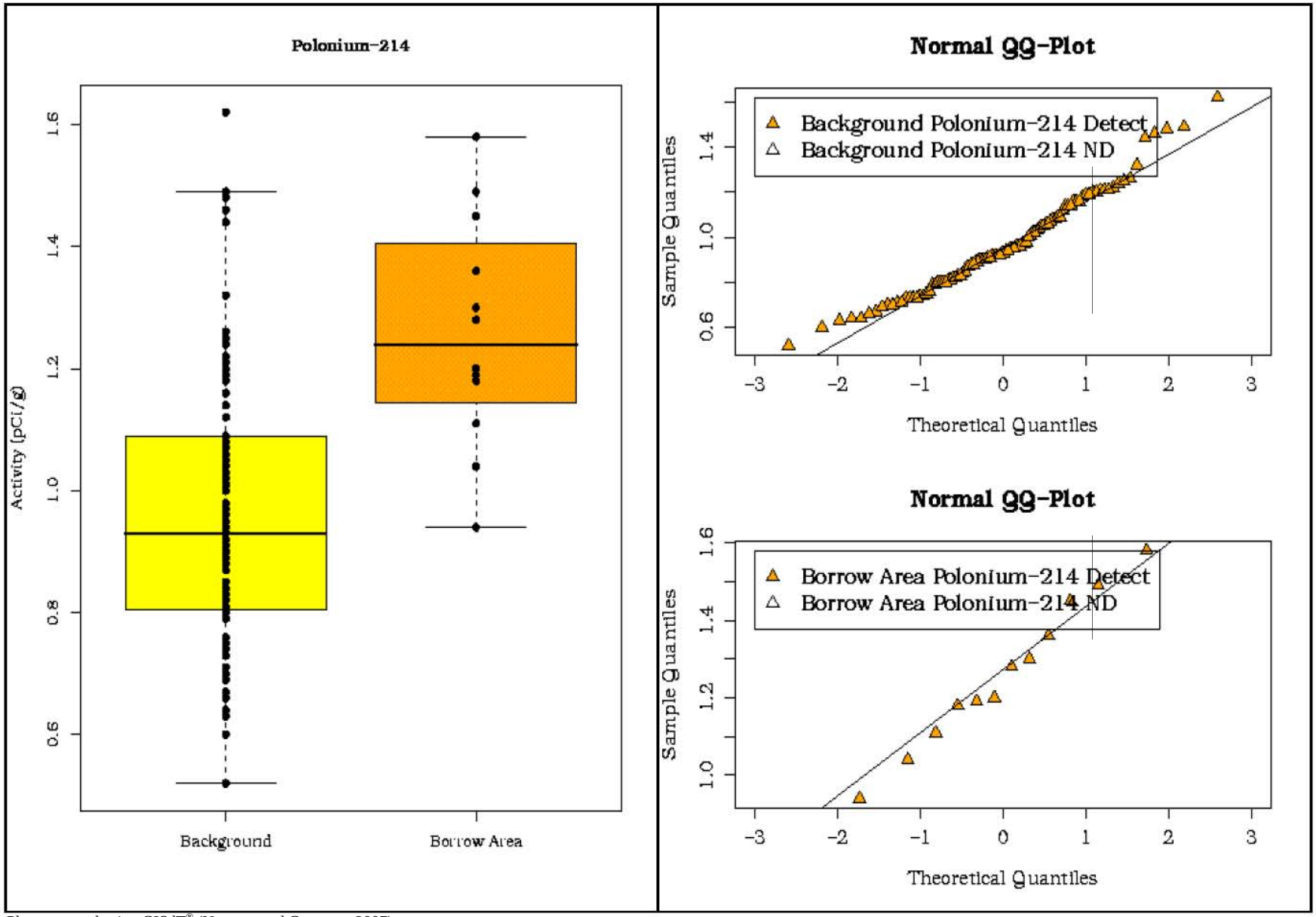
BOXPLOTS AND NORMAL QQ PLOTS FOR RADIONUCLIDES



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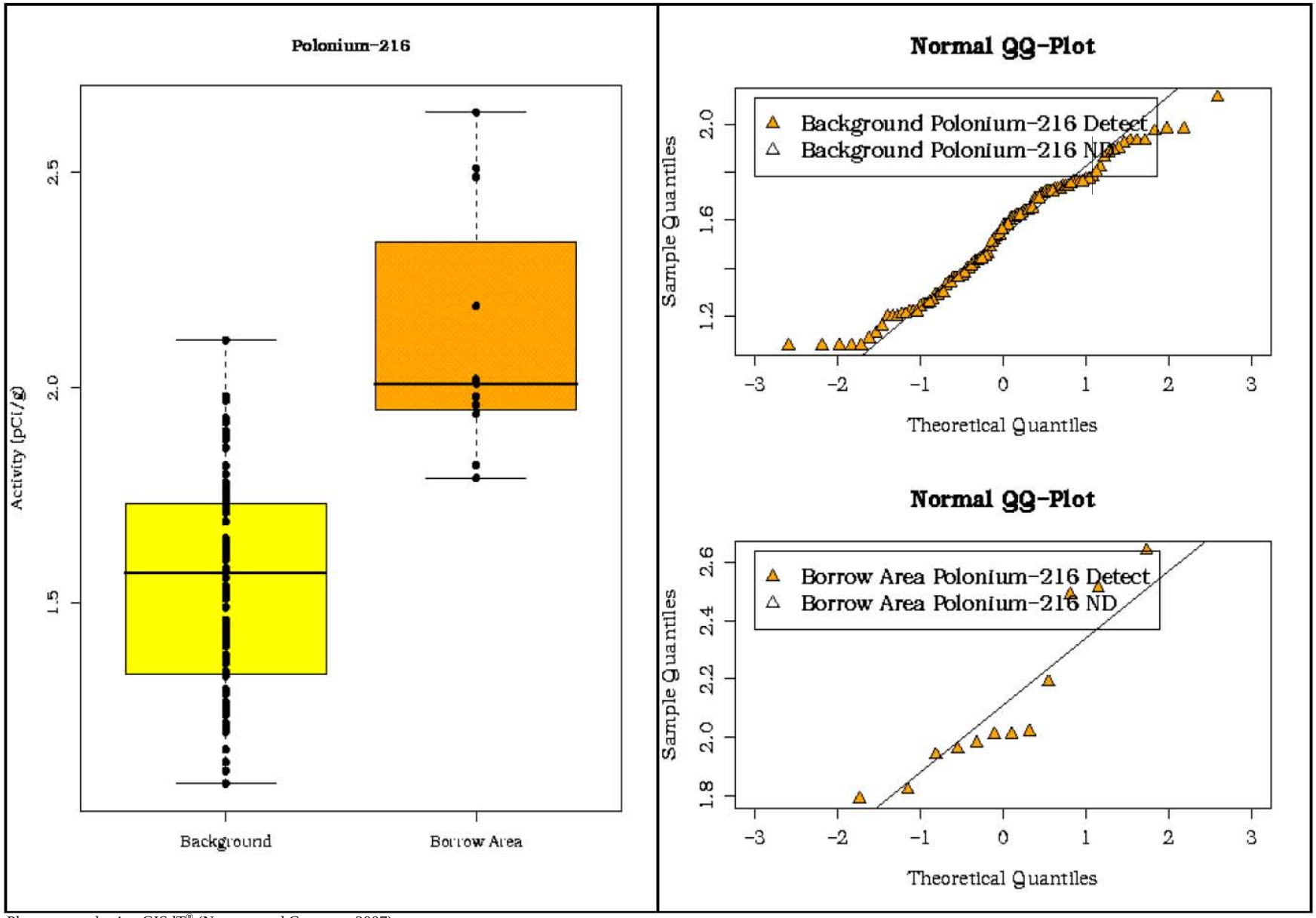
BOXPLOTS AND NORMAL QQ PLOTS FOR RADIONUCLIDES



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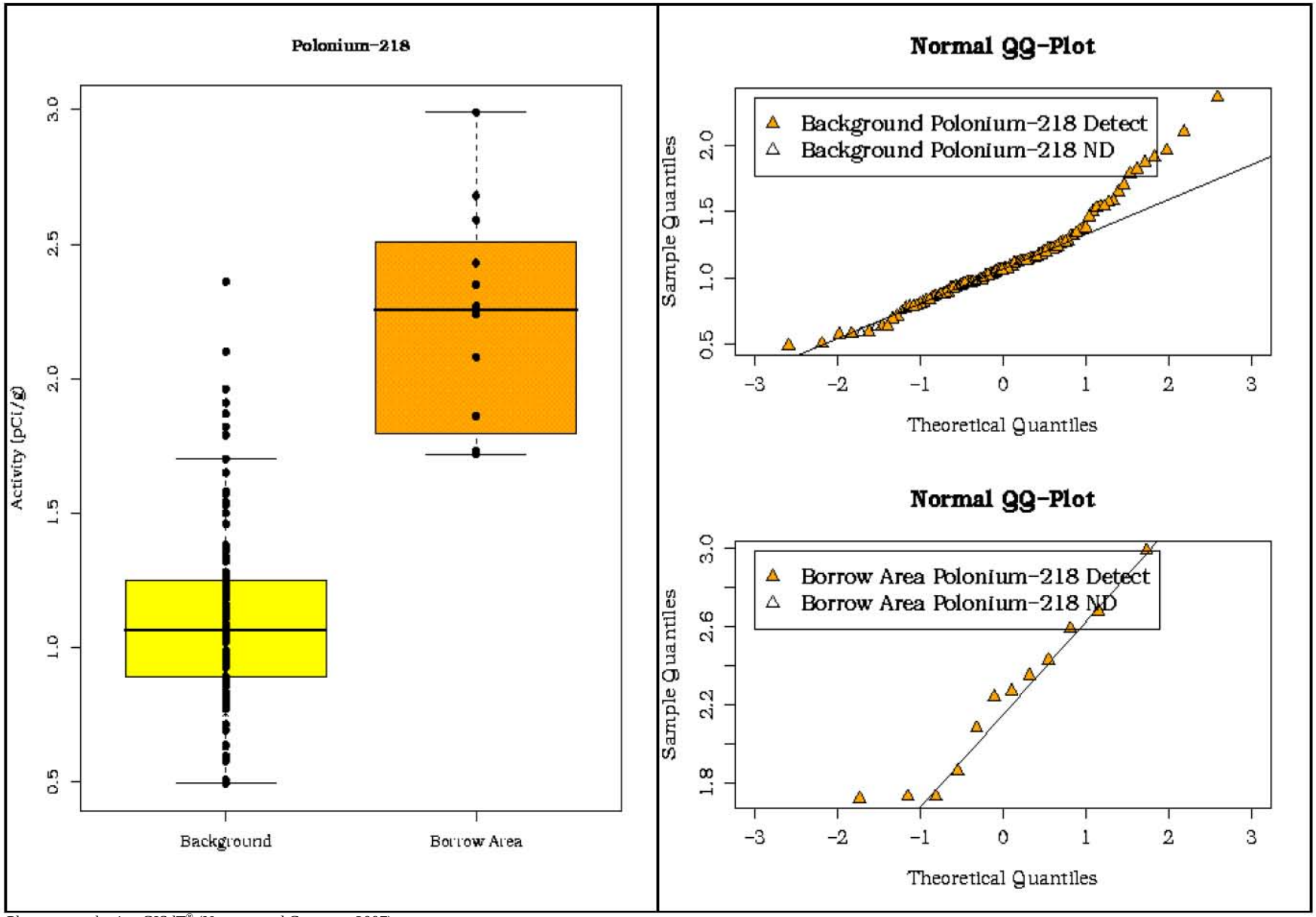
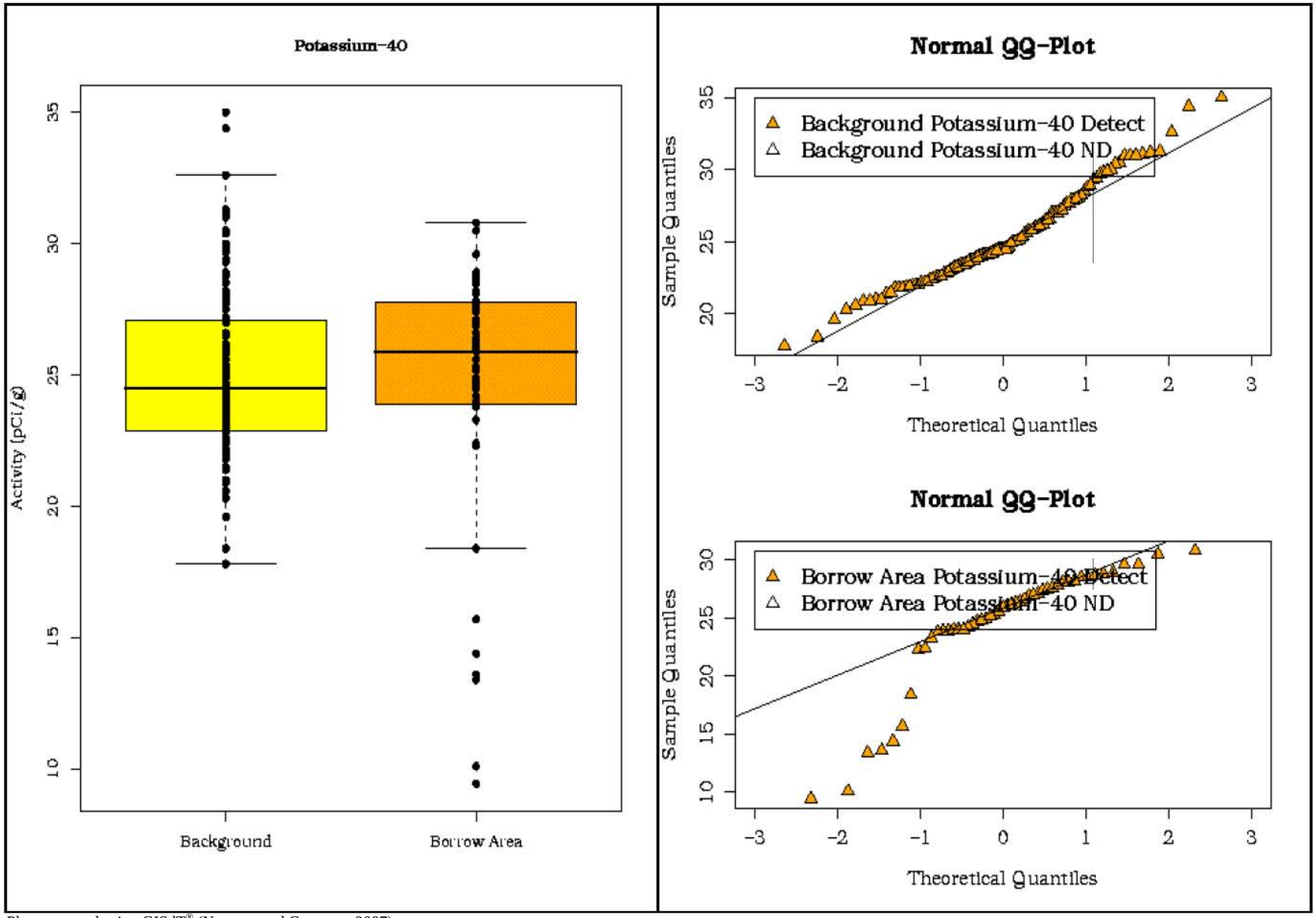
BOXPLOTS AND NORMAL QQ PLOTS FOR RADIONUCLIDES



Plots prepared using GISdT® (Neptune and Company 2007).

BOXPLOTS AND NORMAL QQ PLOTS FOR RADIONUCLIDES



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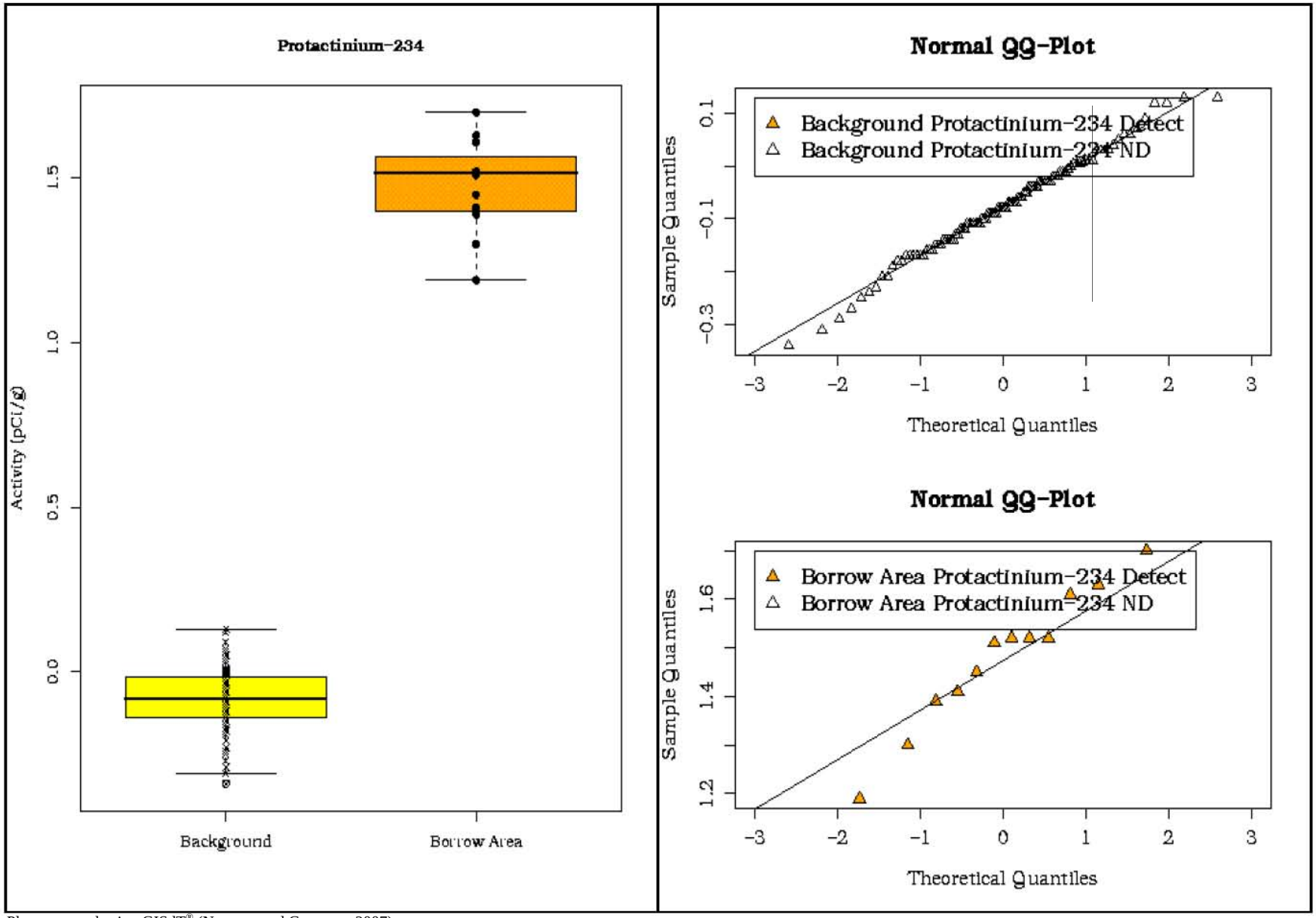

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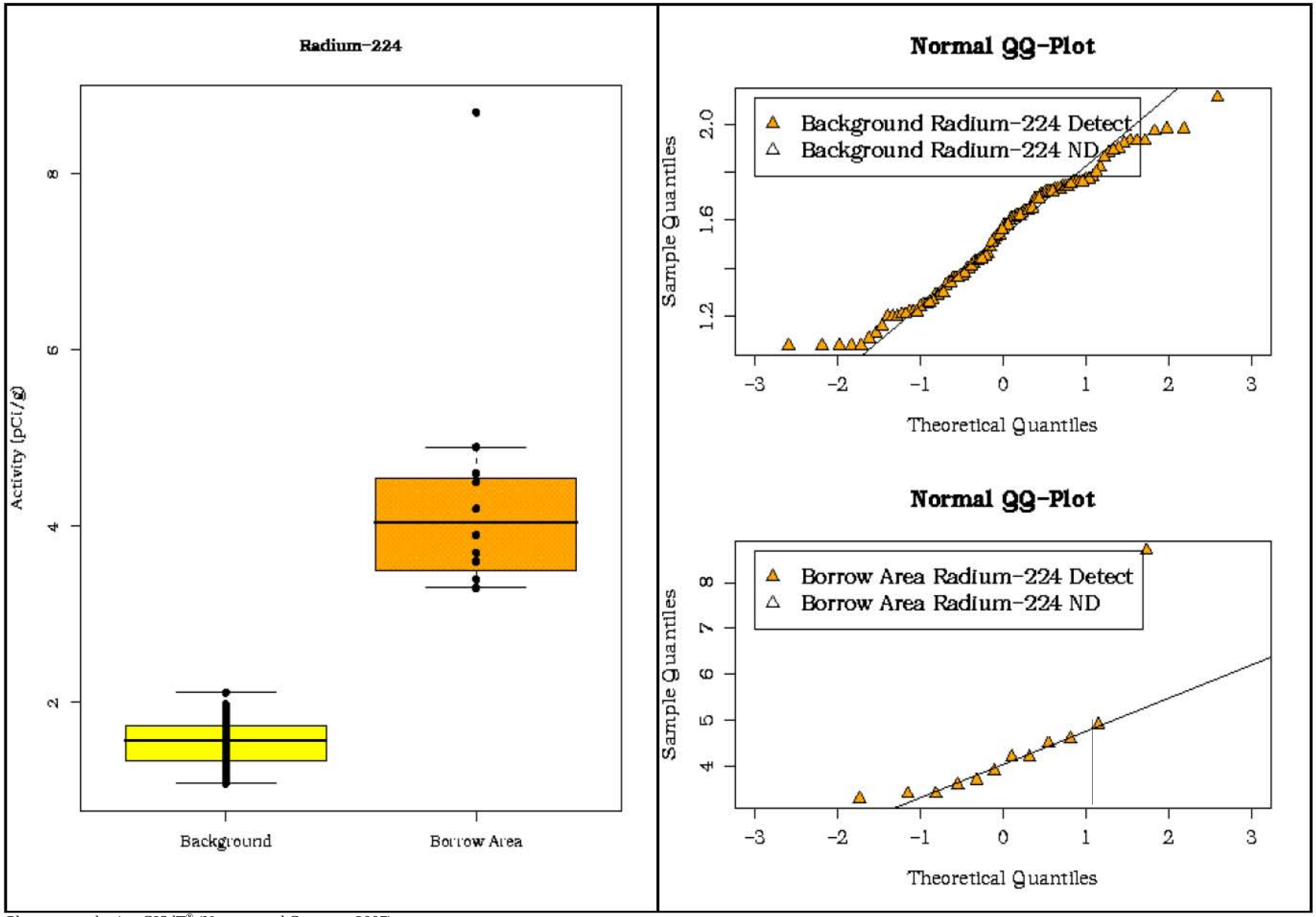

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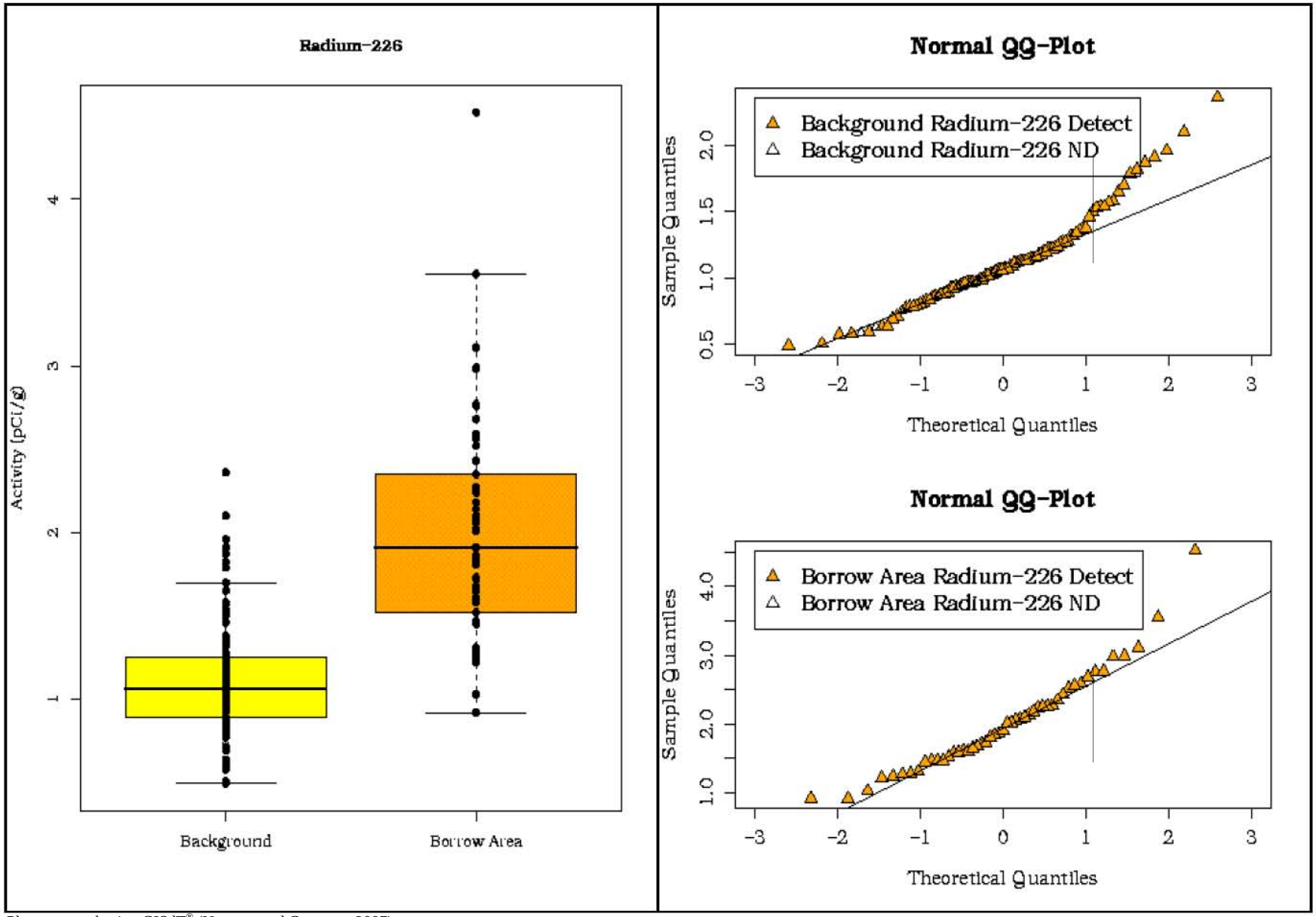

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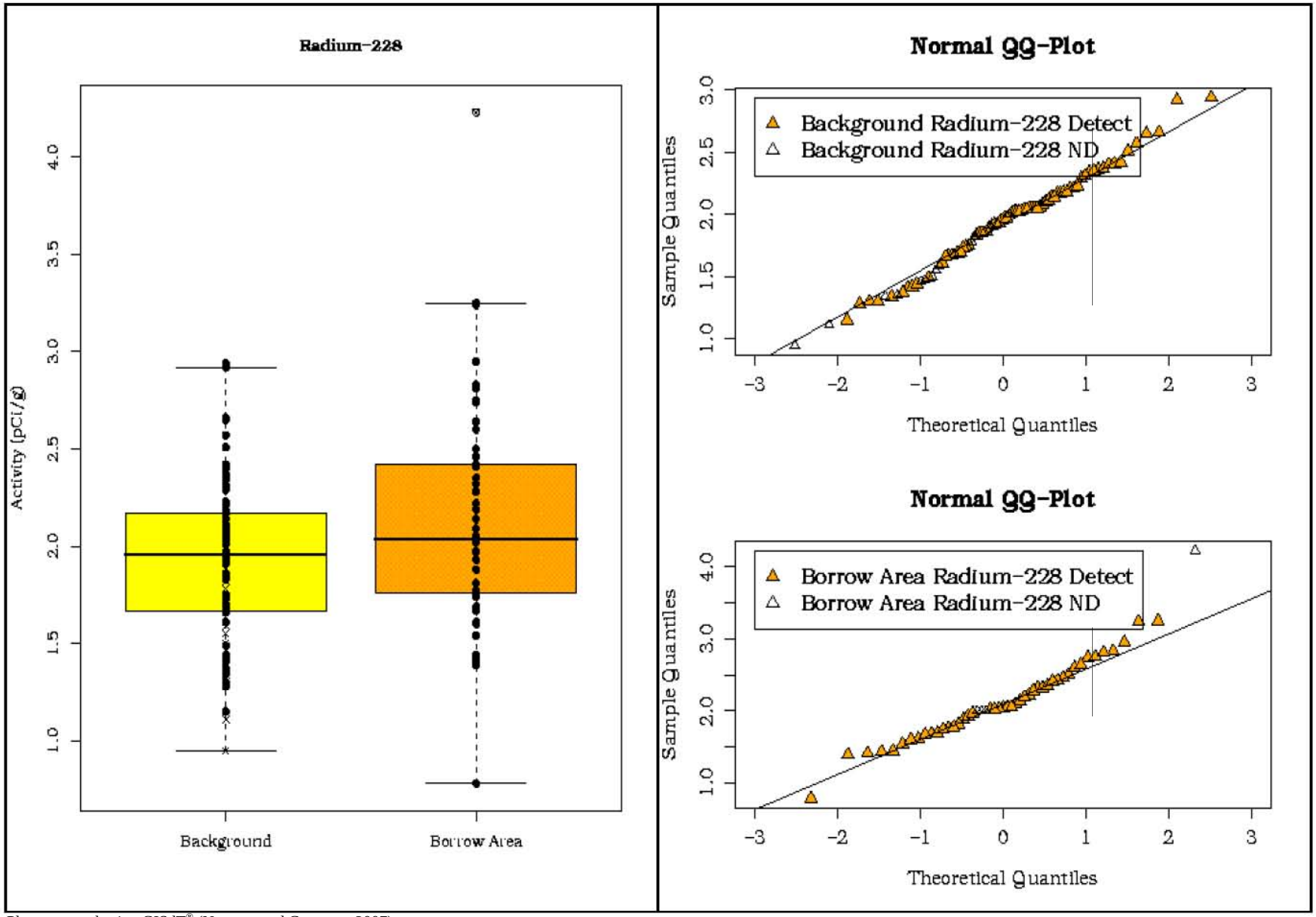

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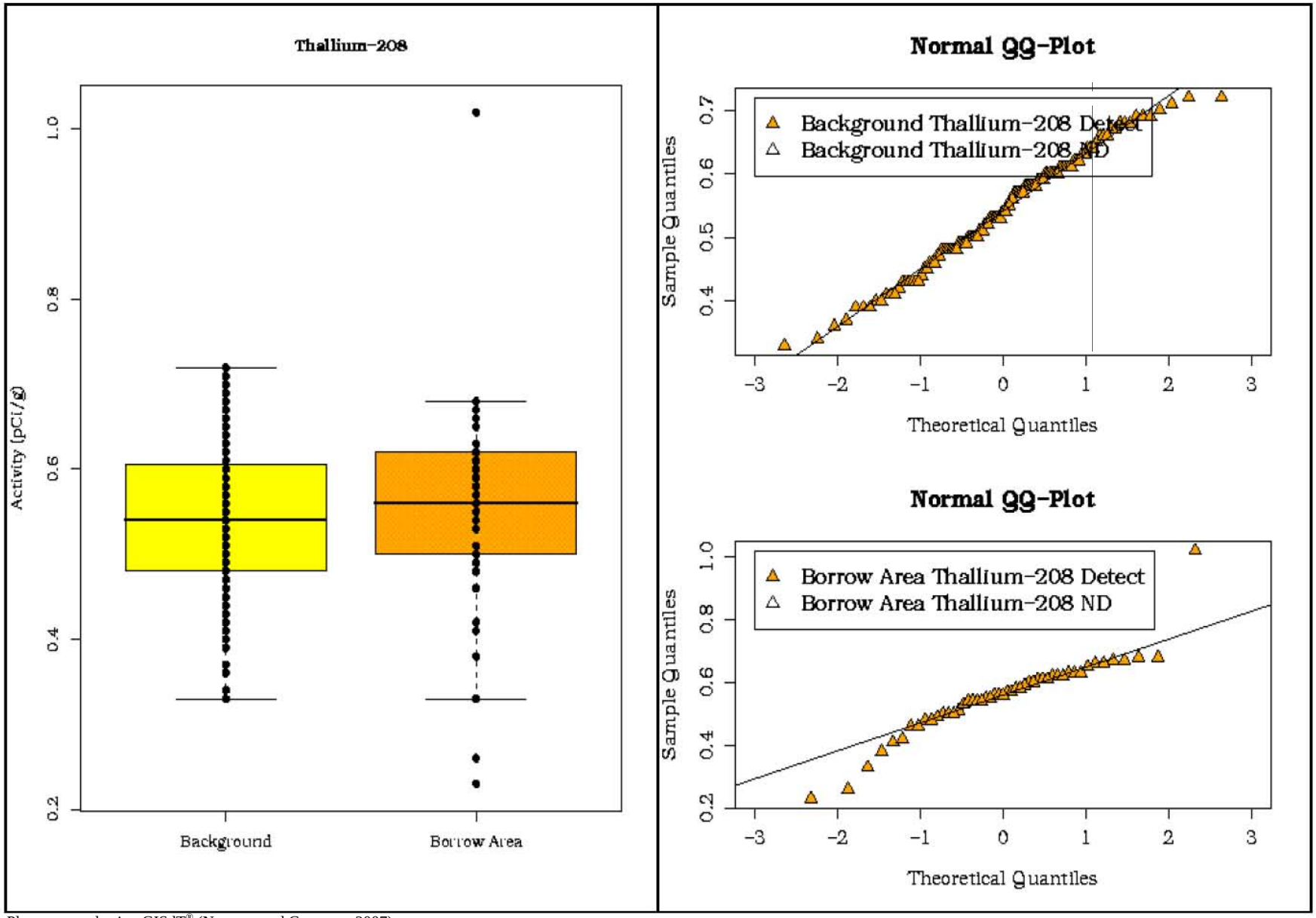

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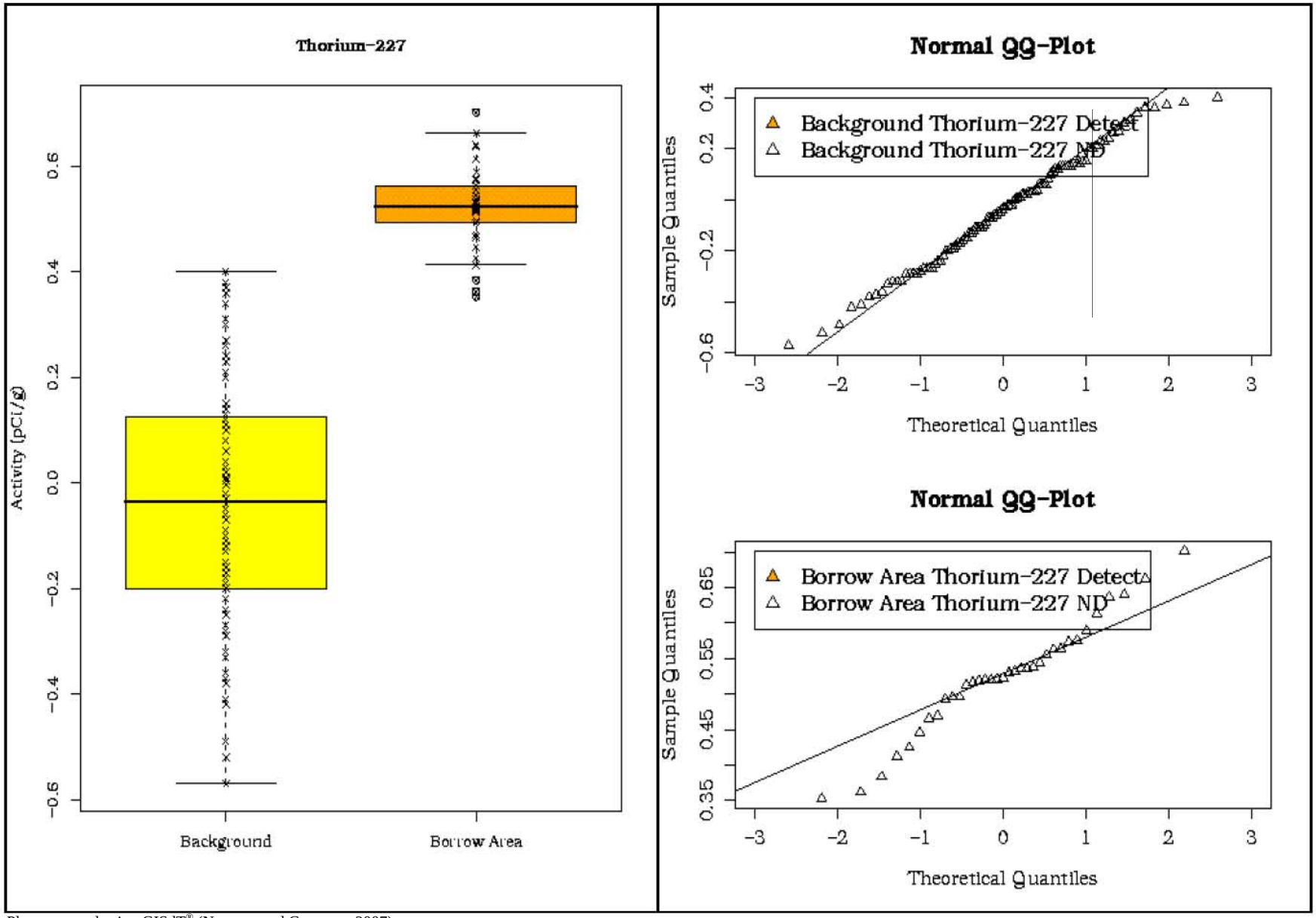

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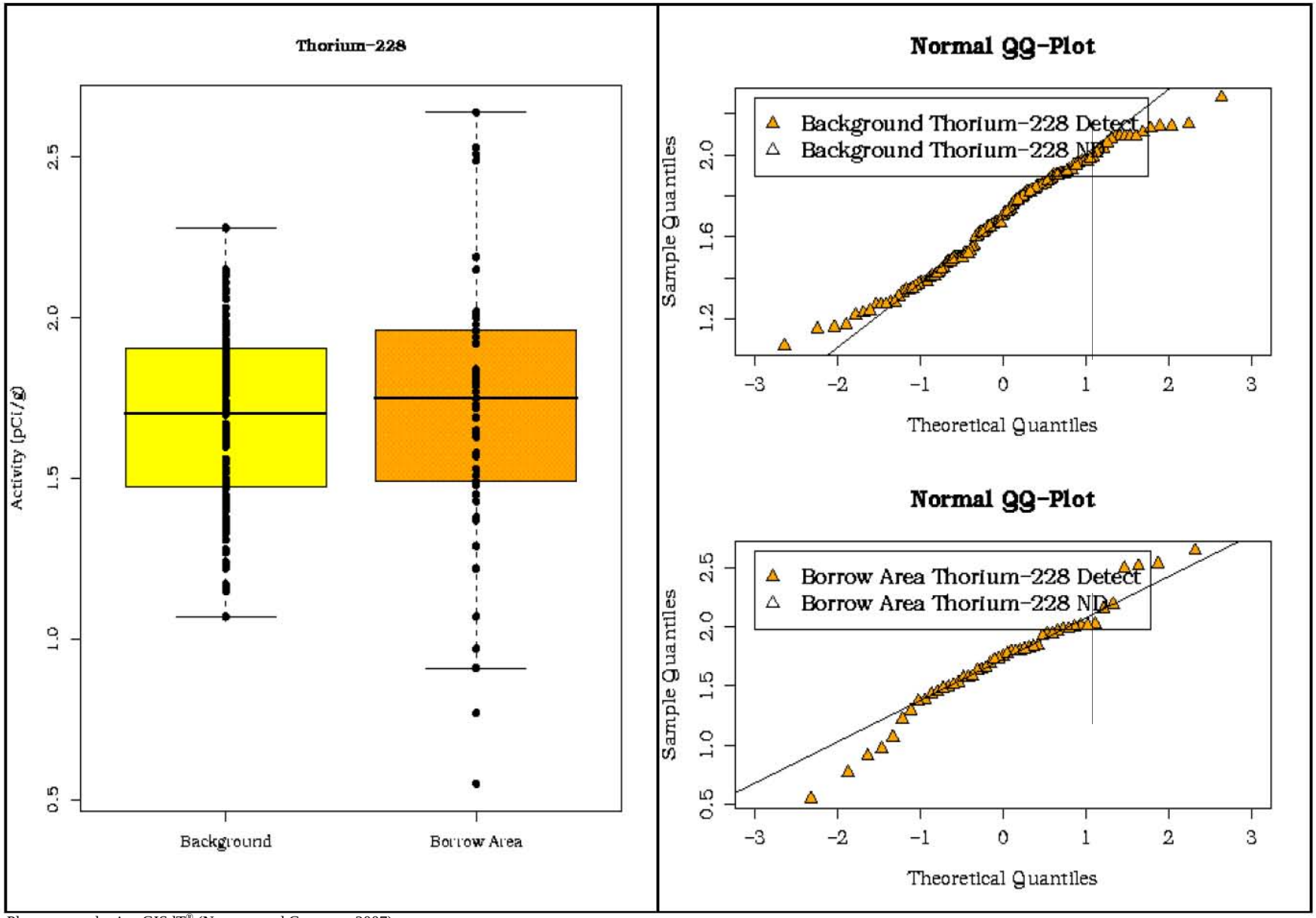

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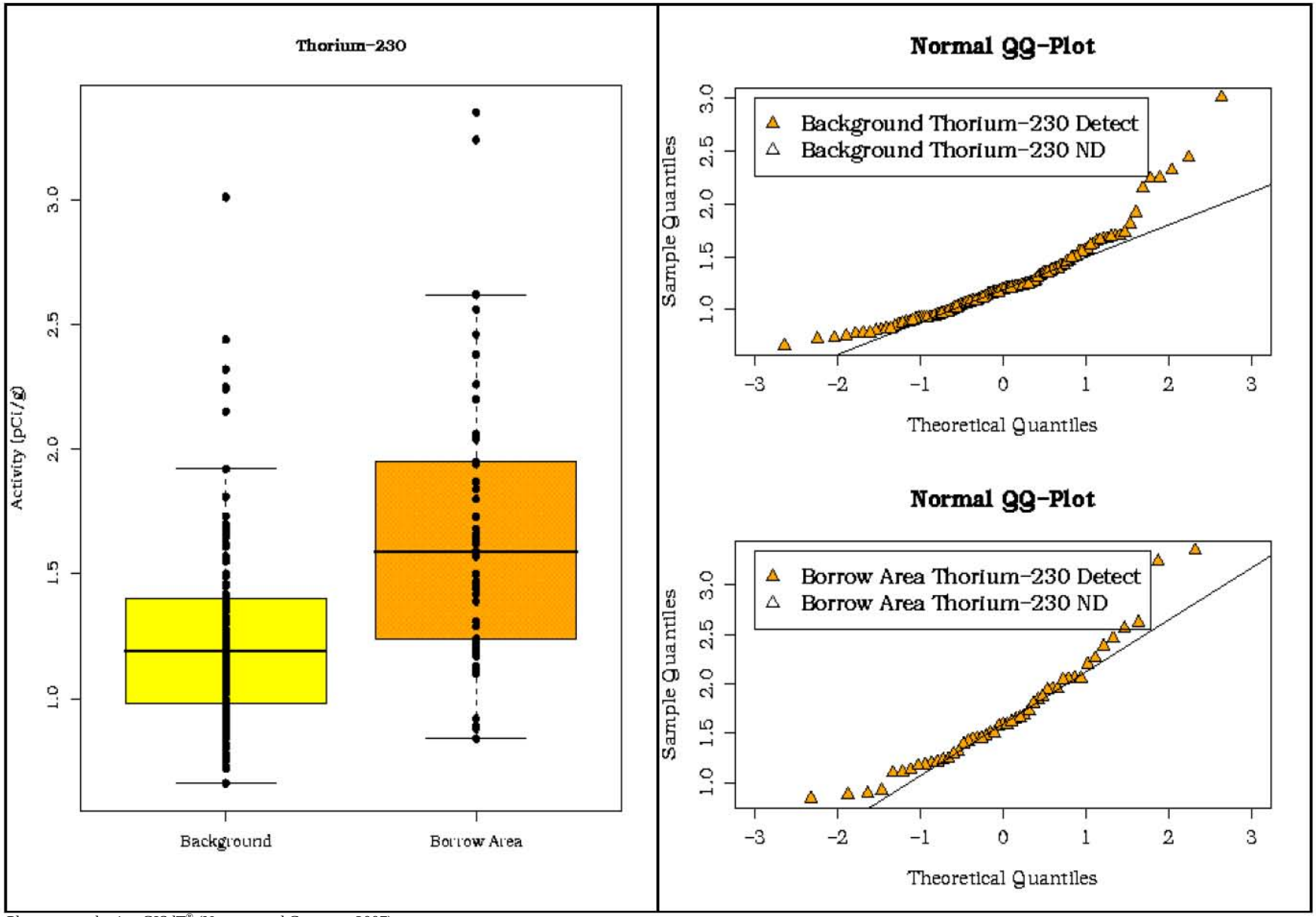

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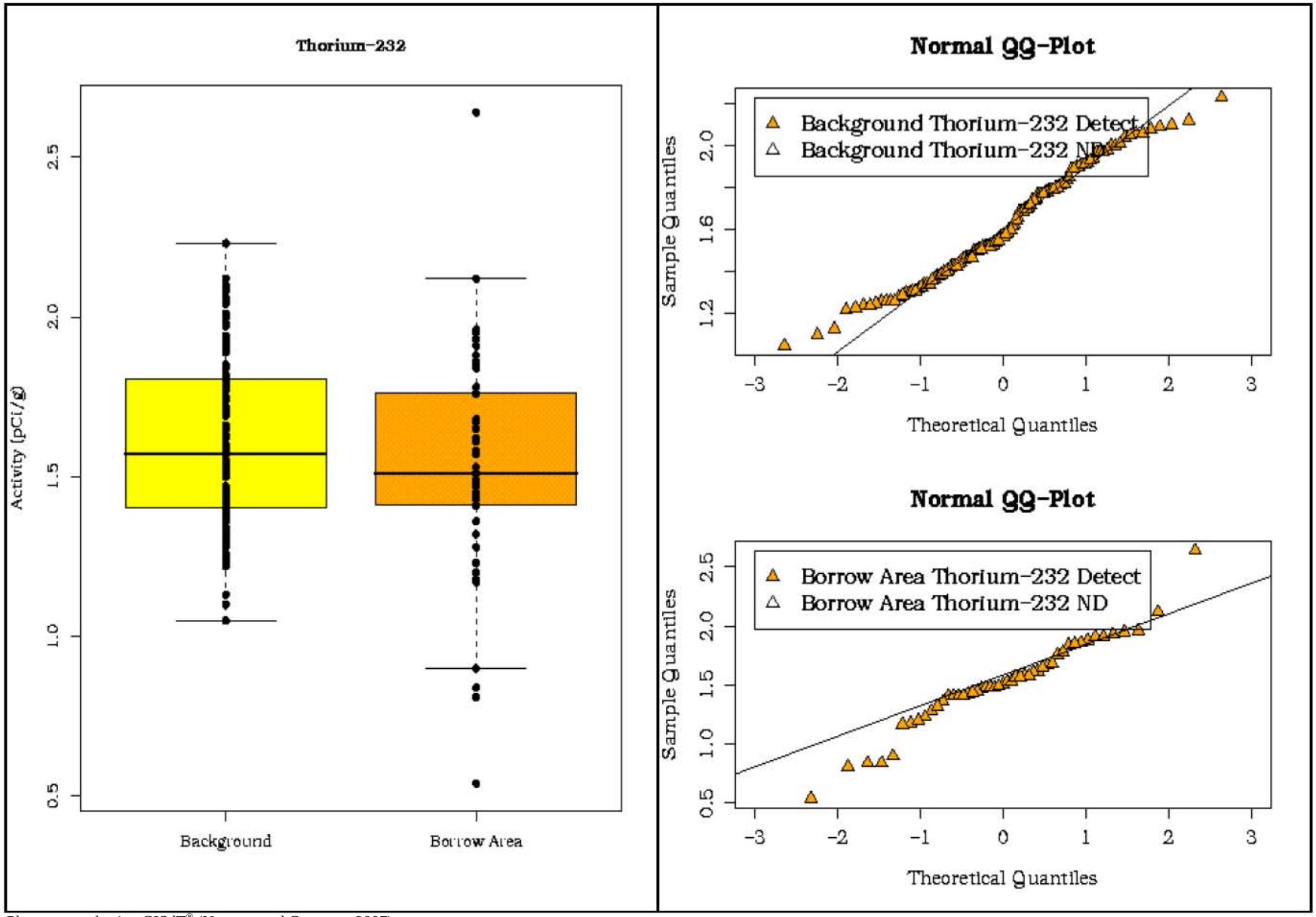

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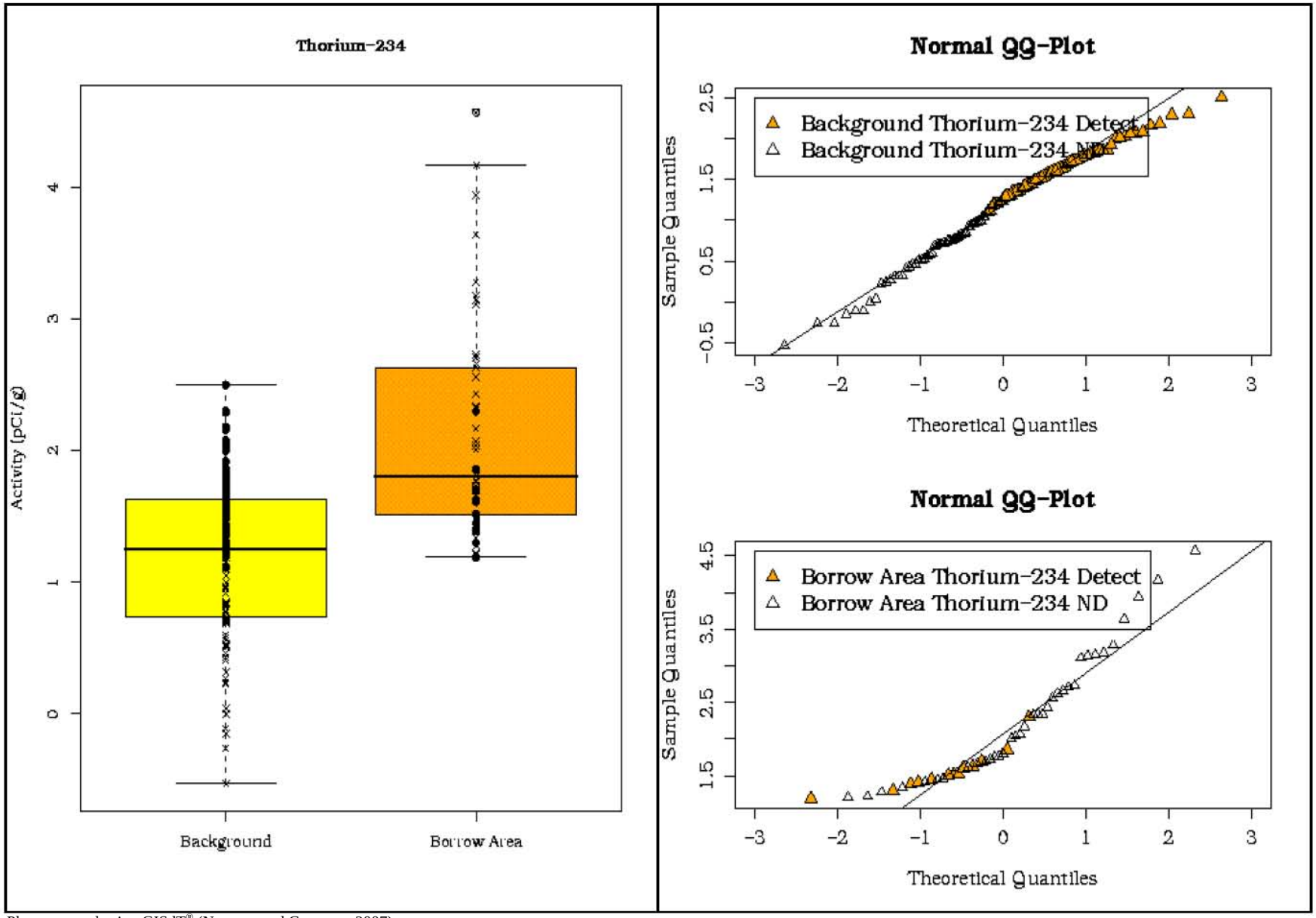

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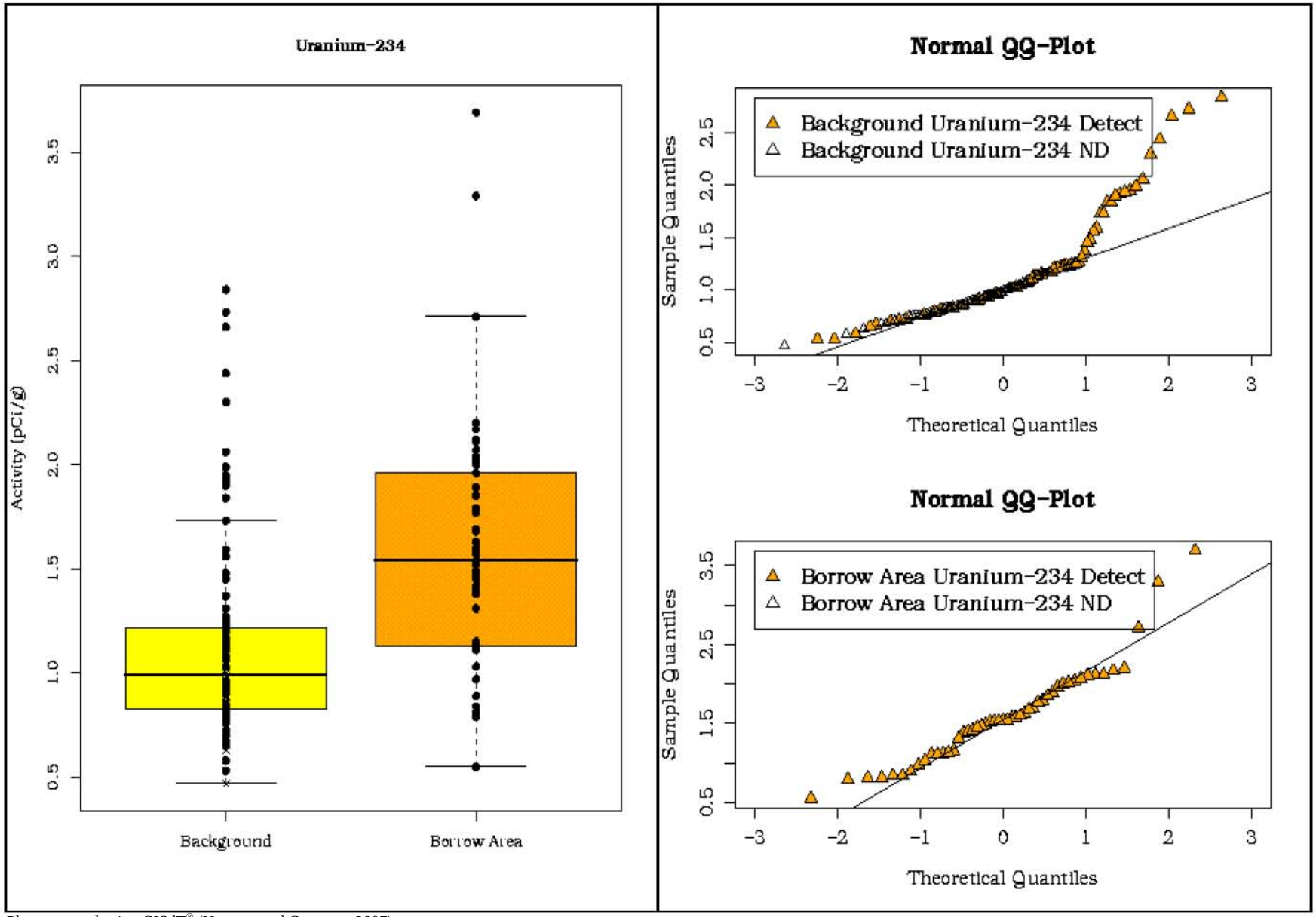

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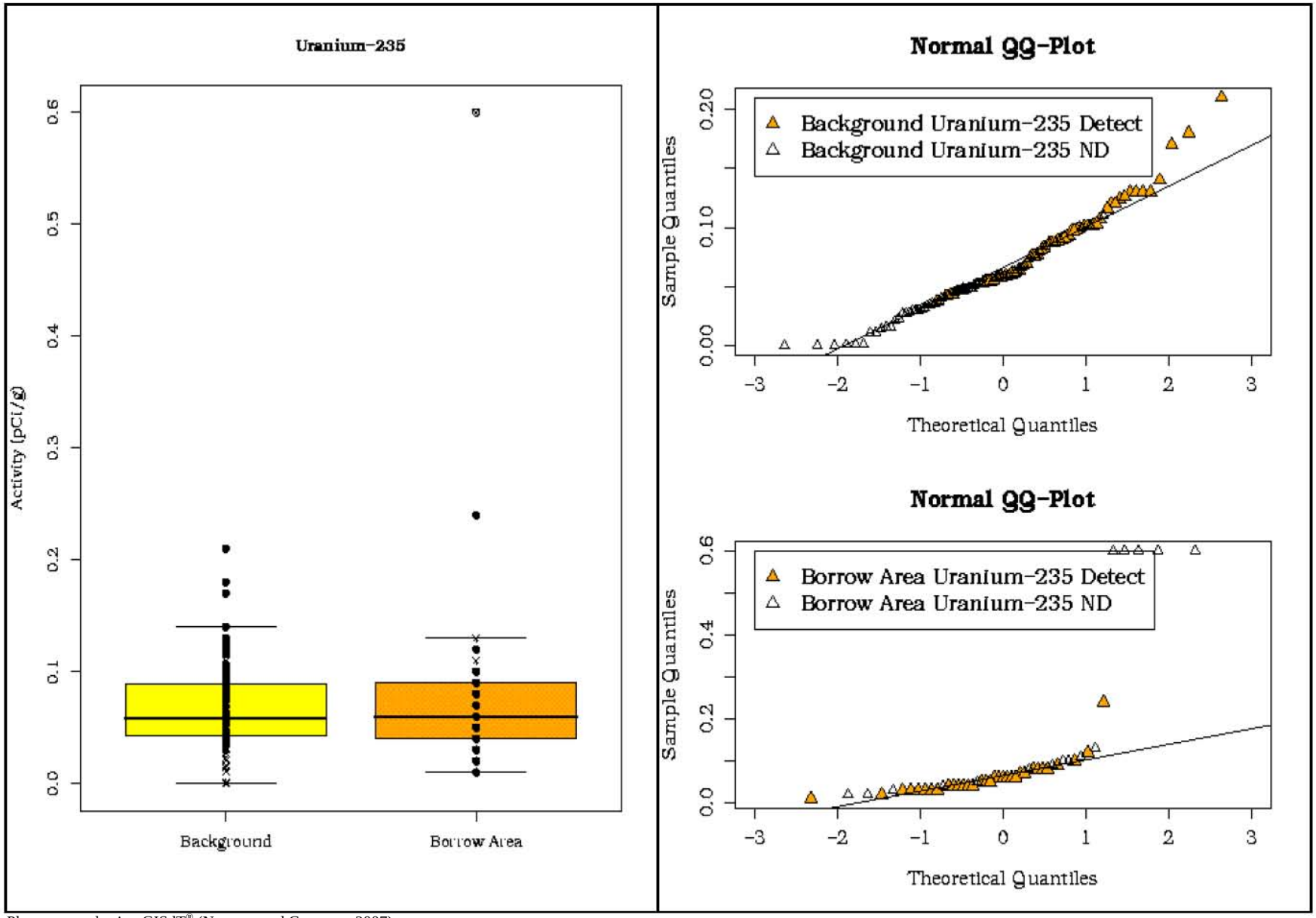

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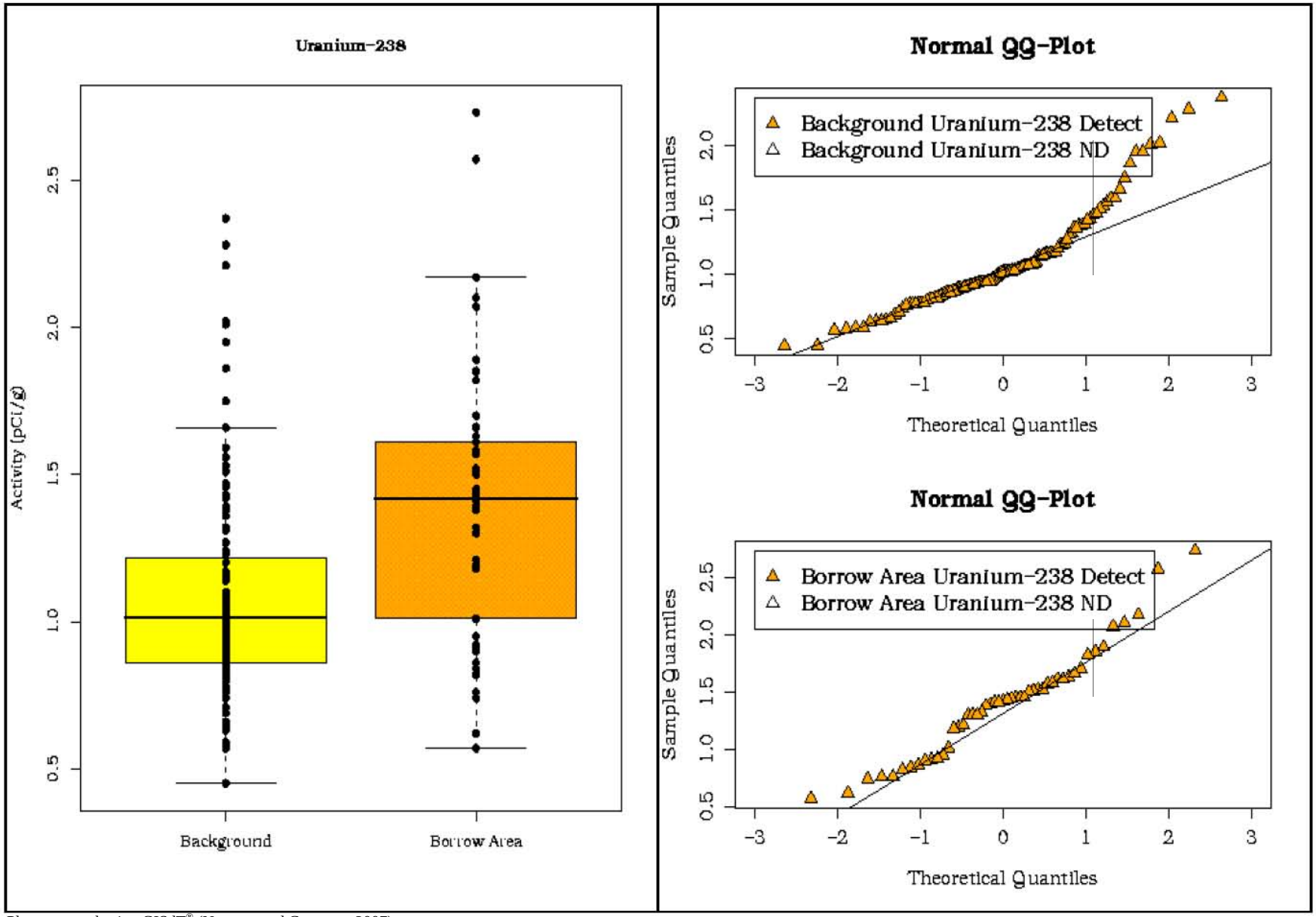

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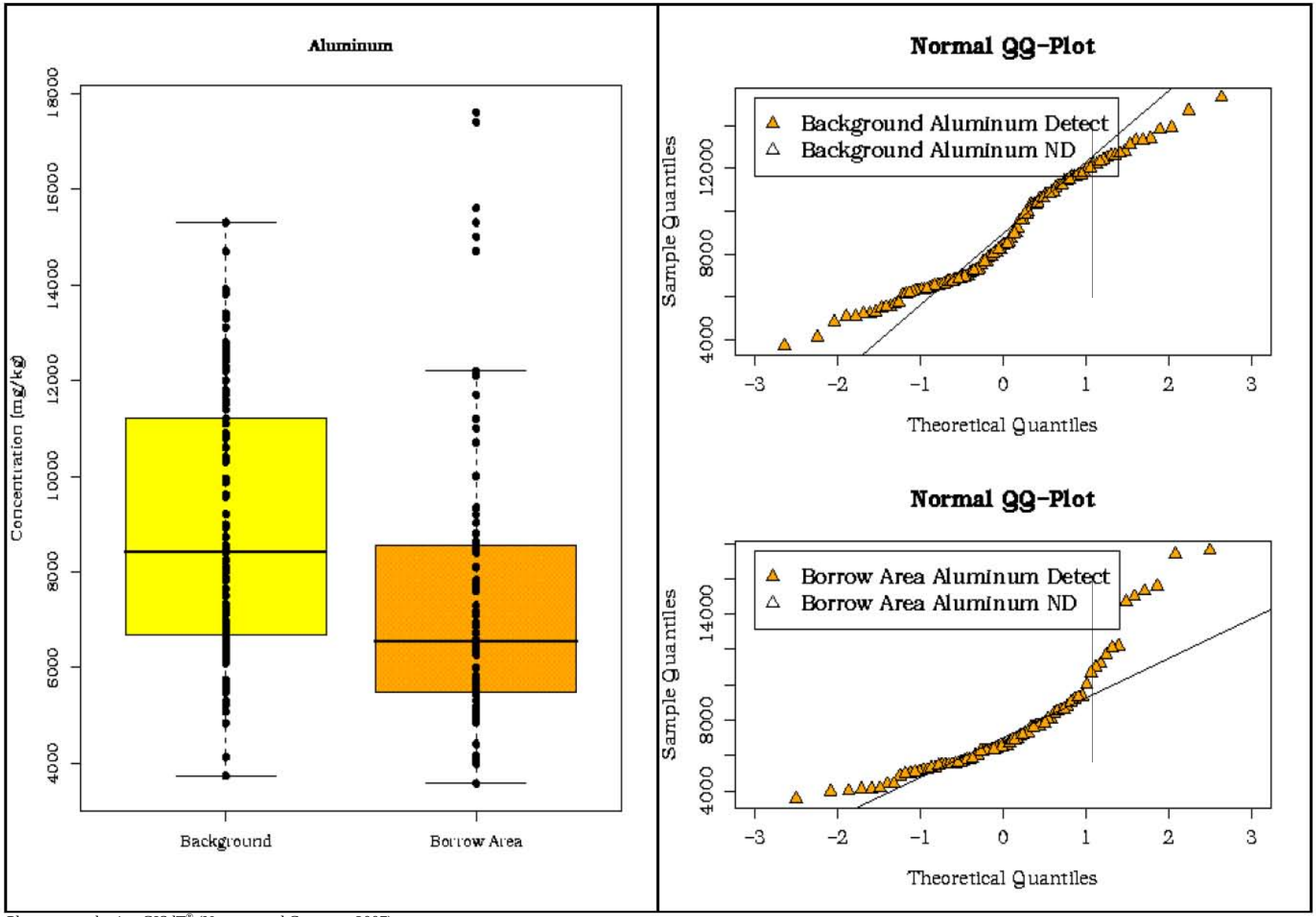
BOXPLOTS AND NORMAL QQ PLOTS FOR METALS – USING ½-DETECTION LIMIT FOR NON-DETECTS



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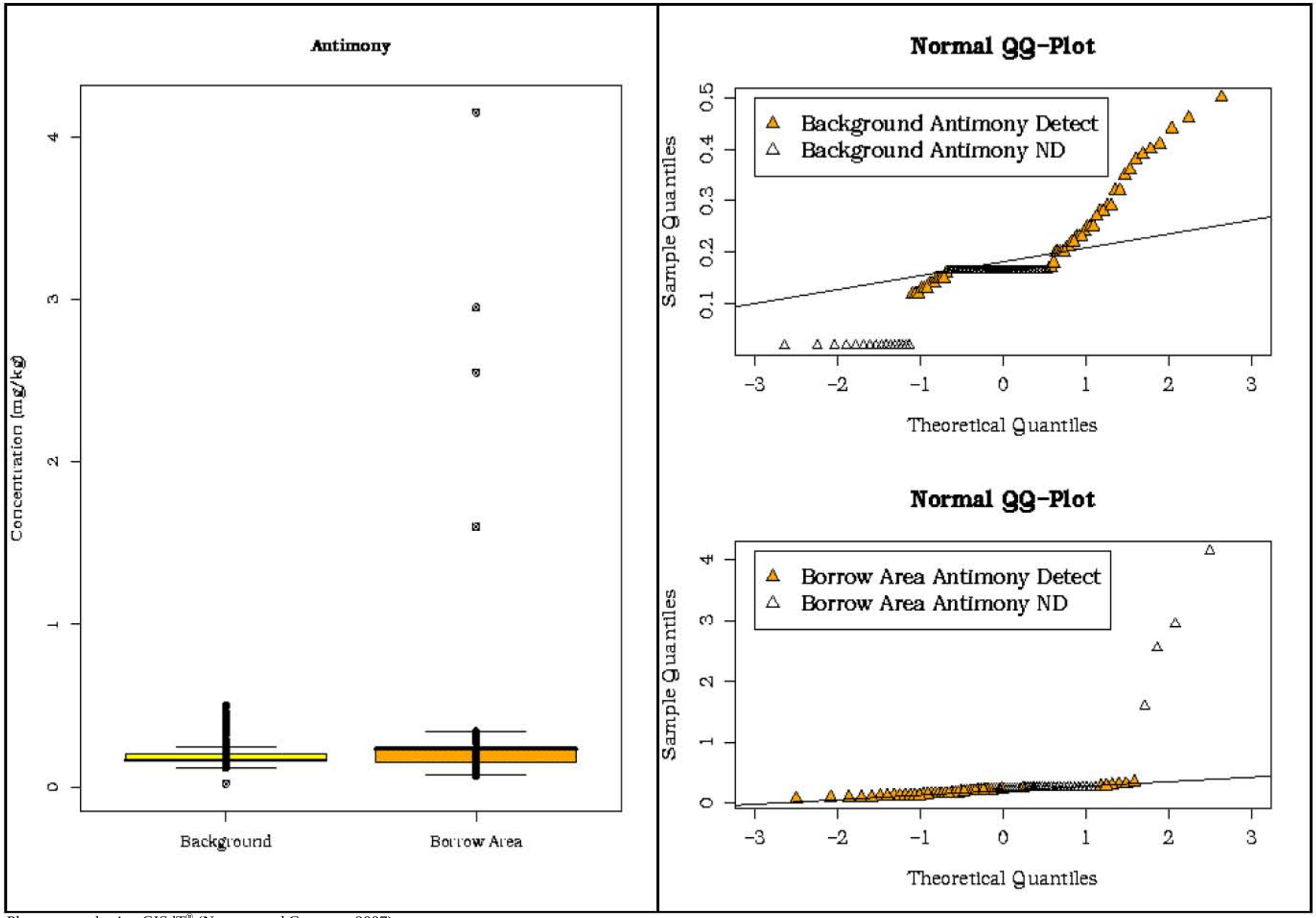

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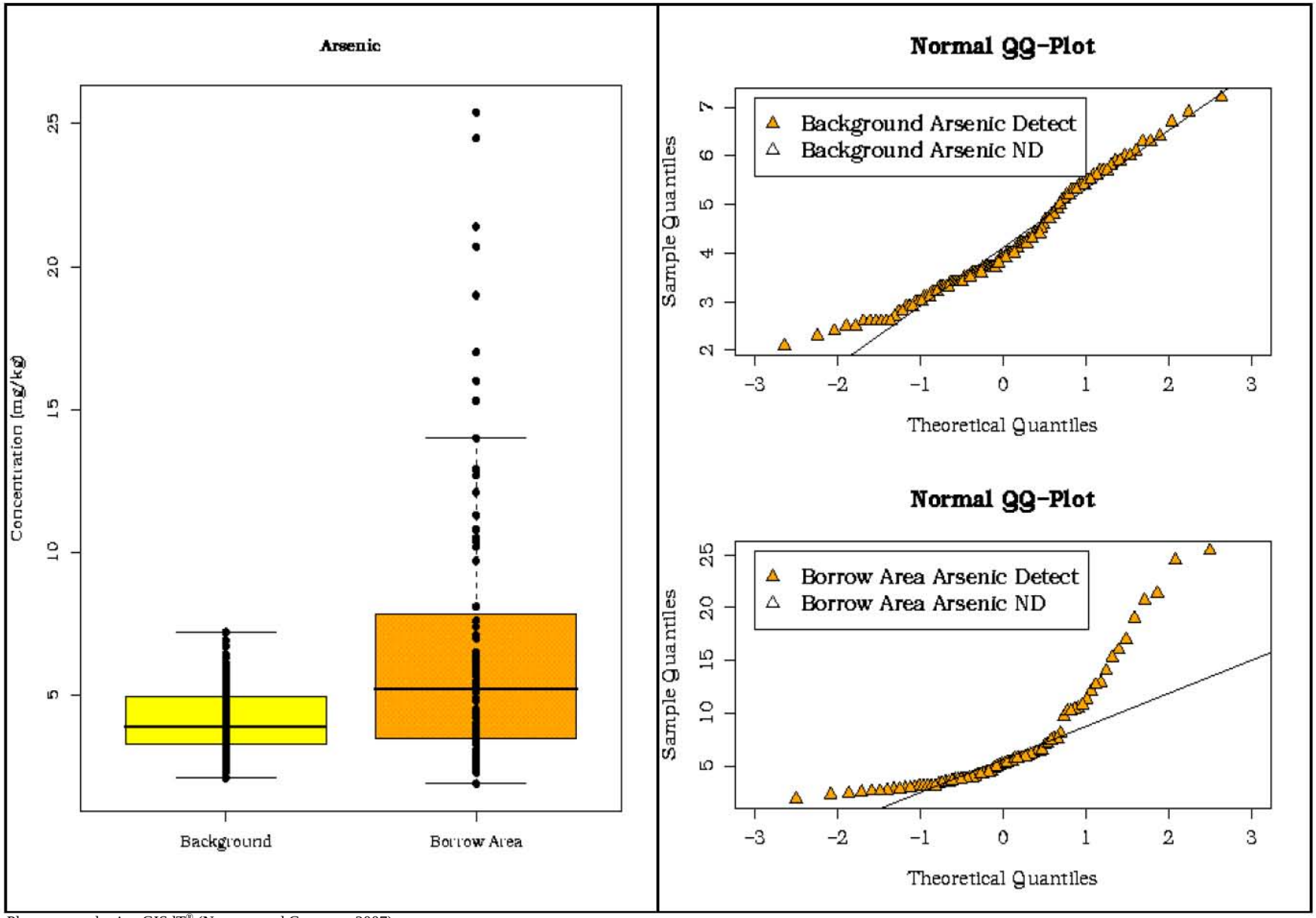

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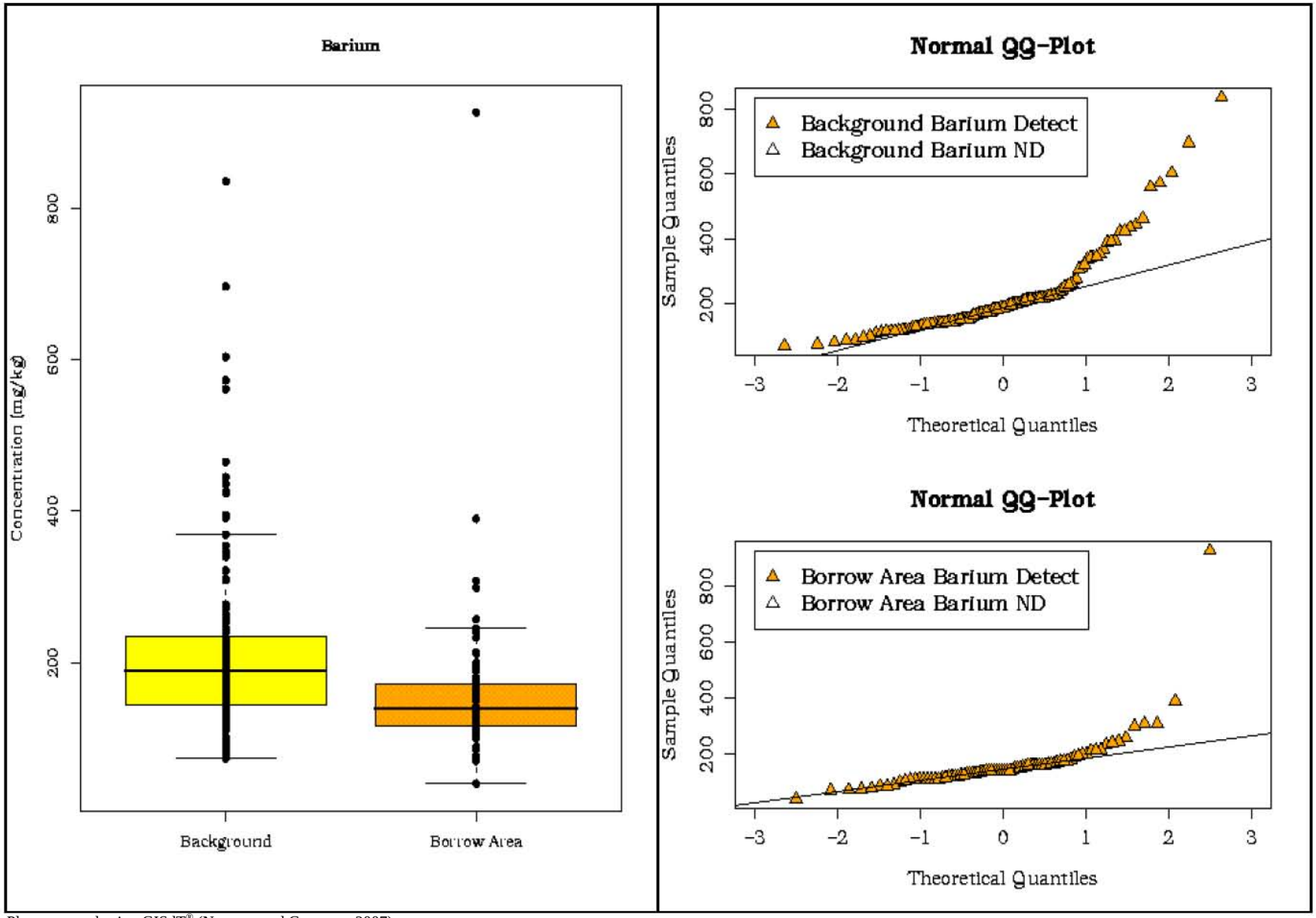

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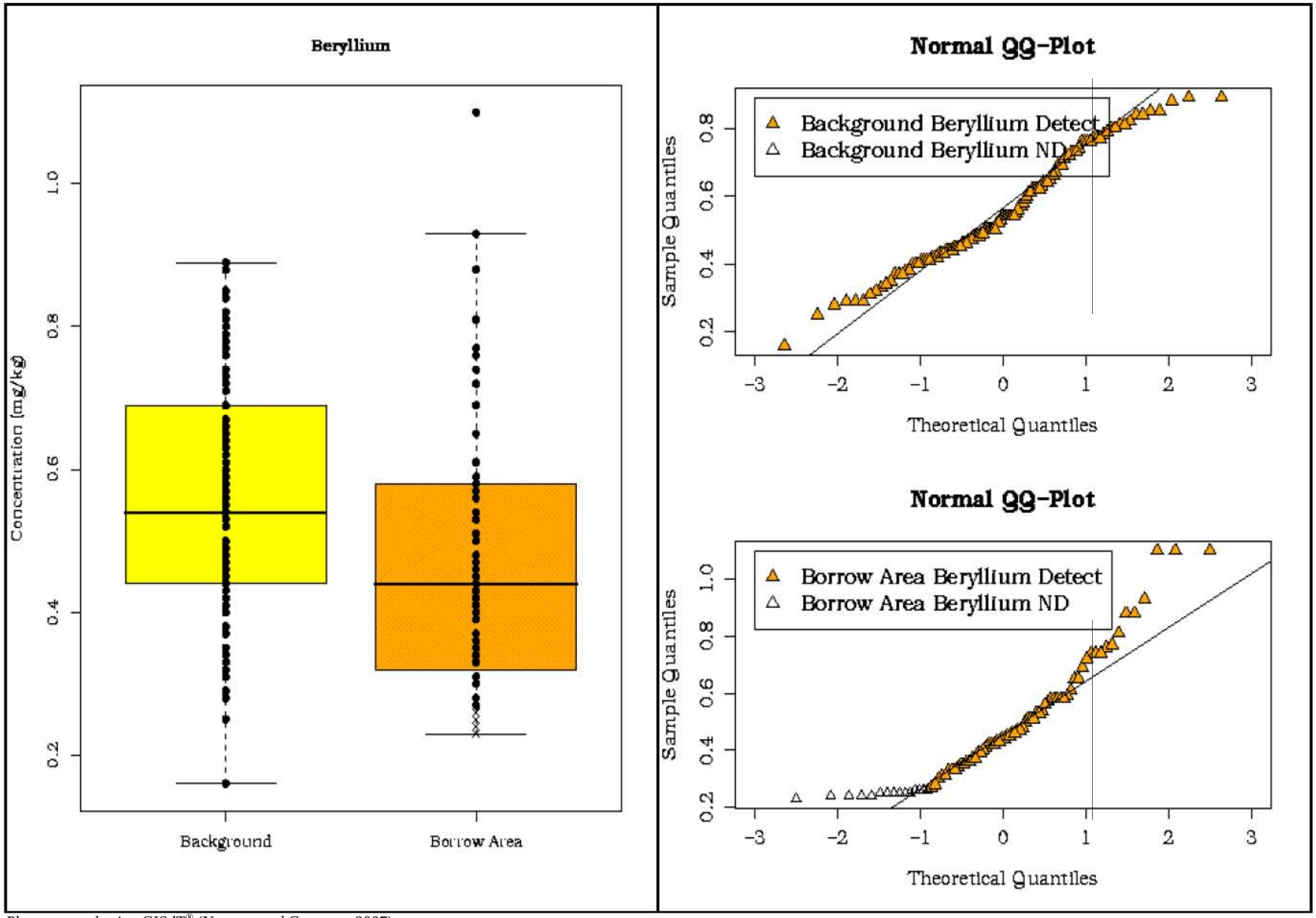

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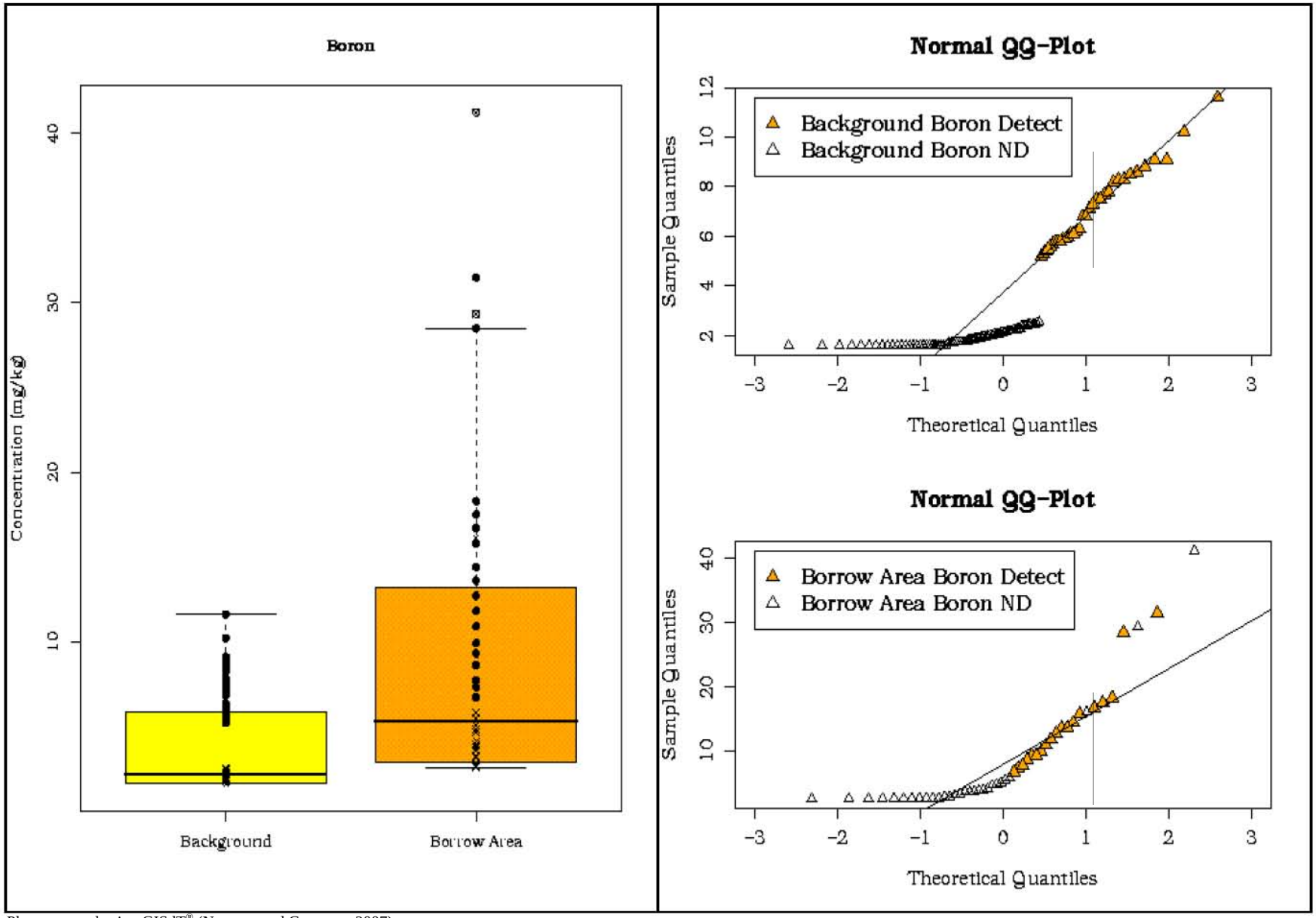

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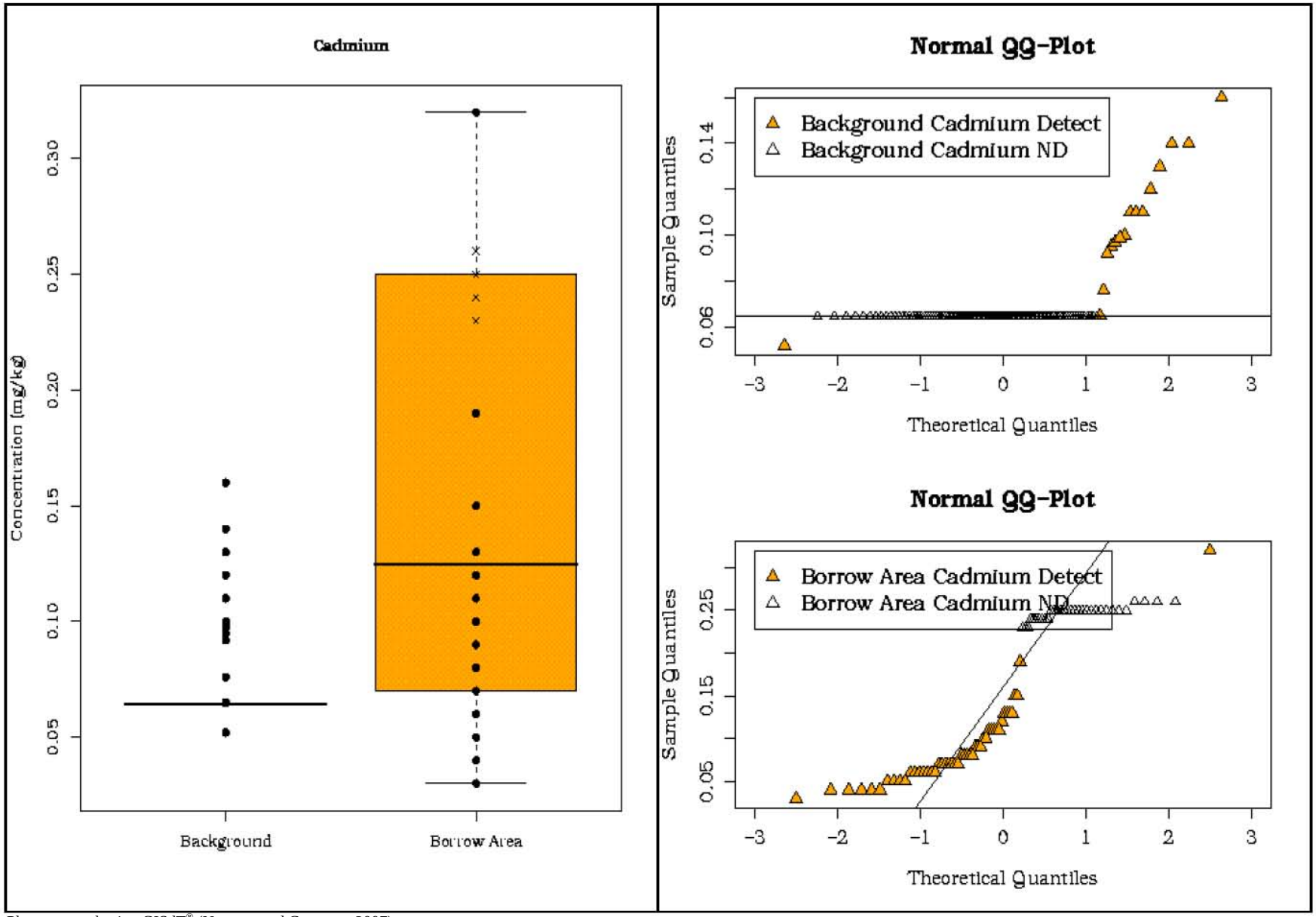

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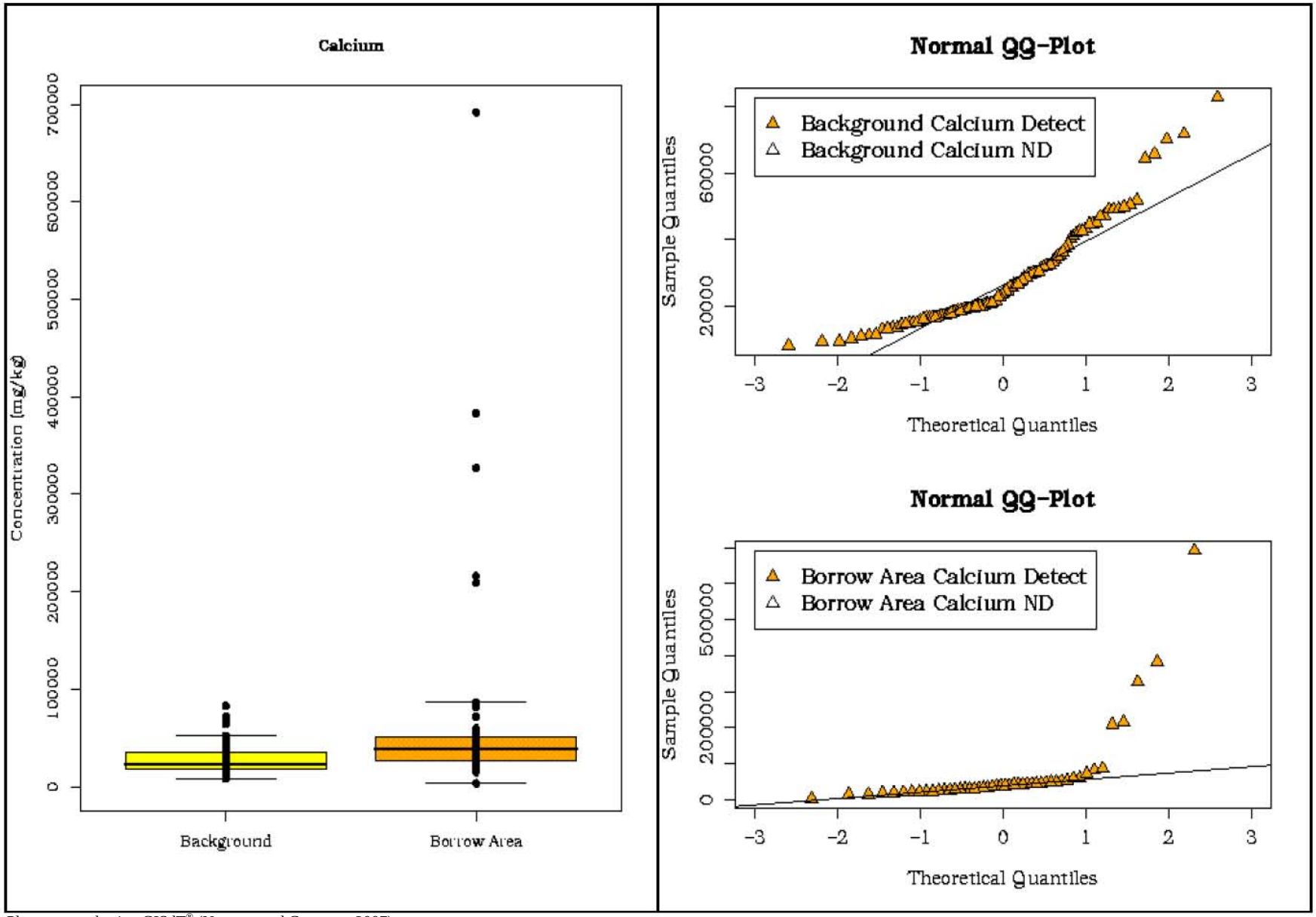

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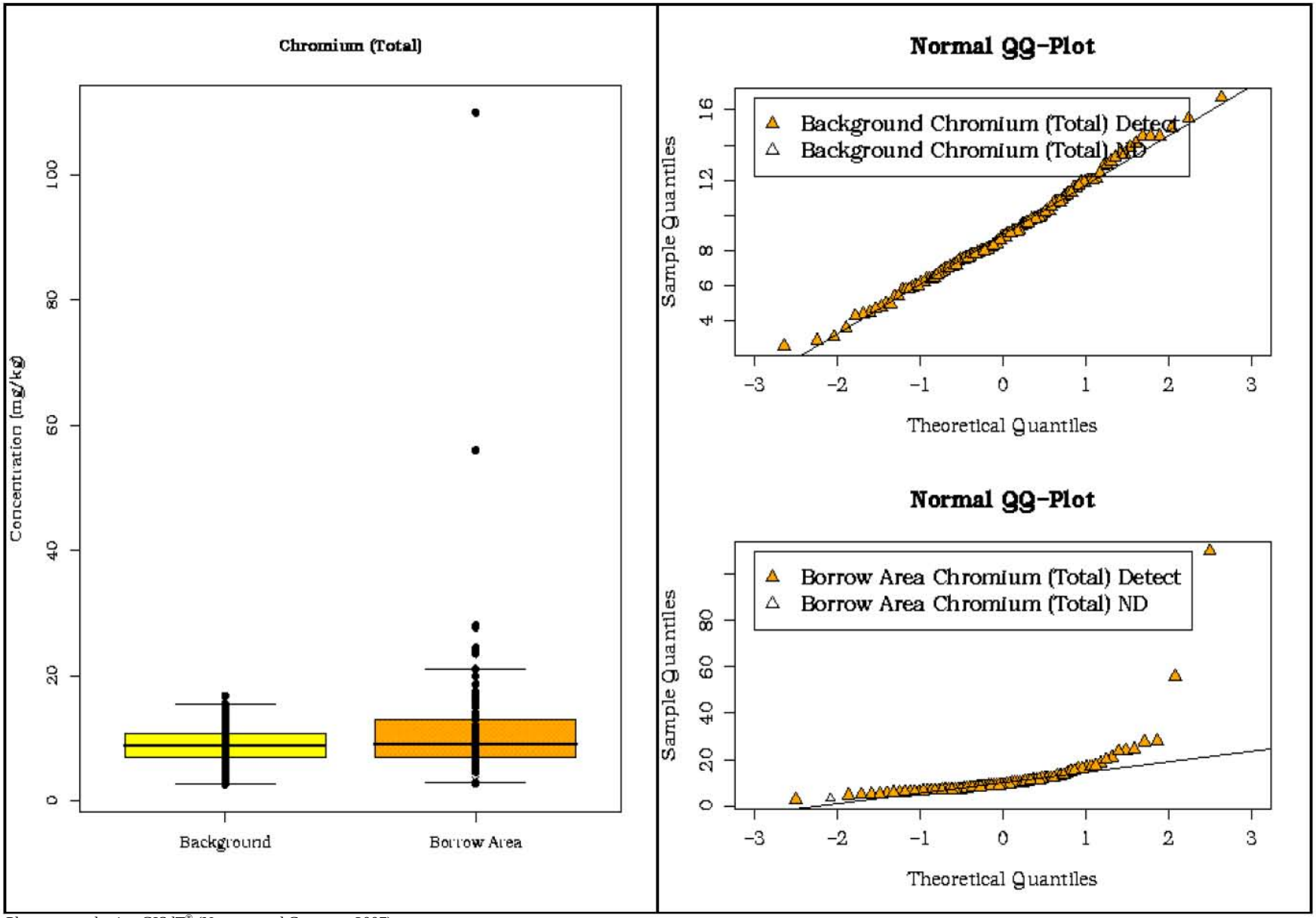

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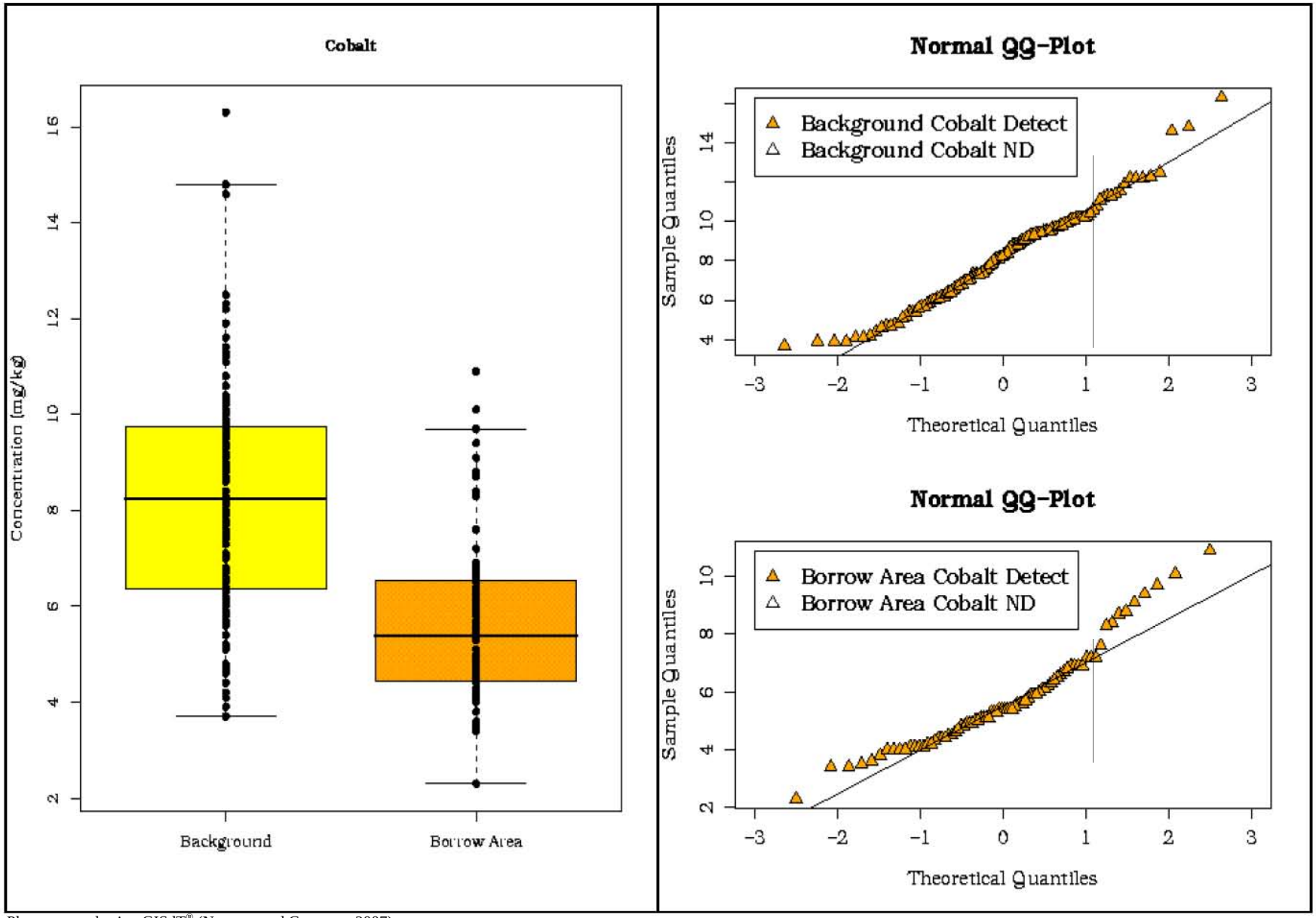

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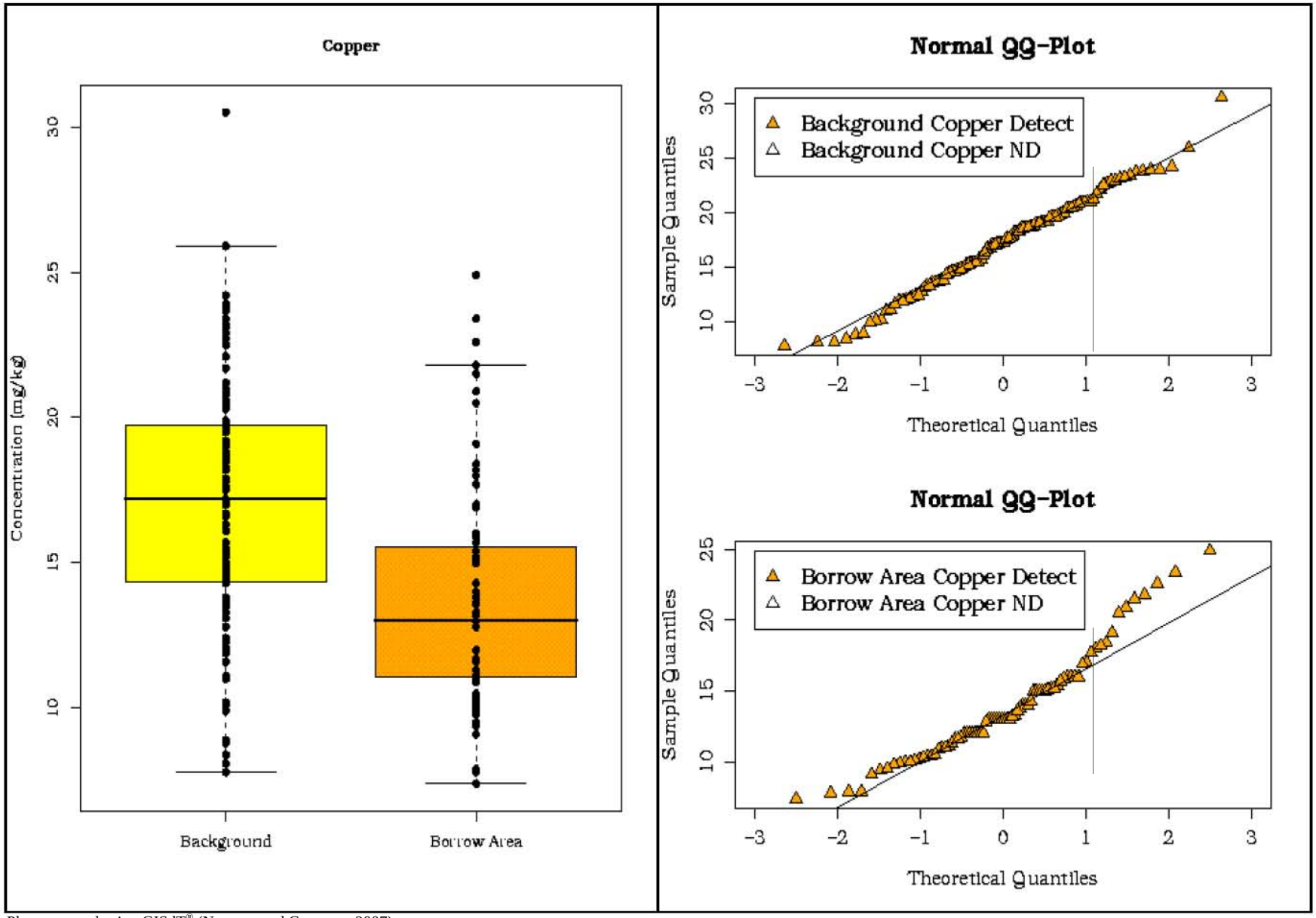

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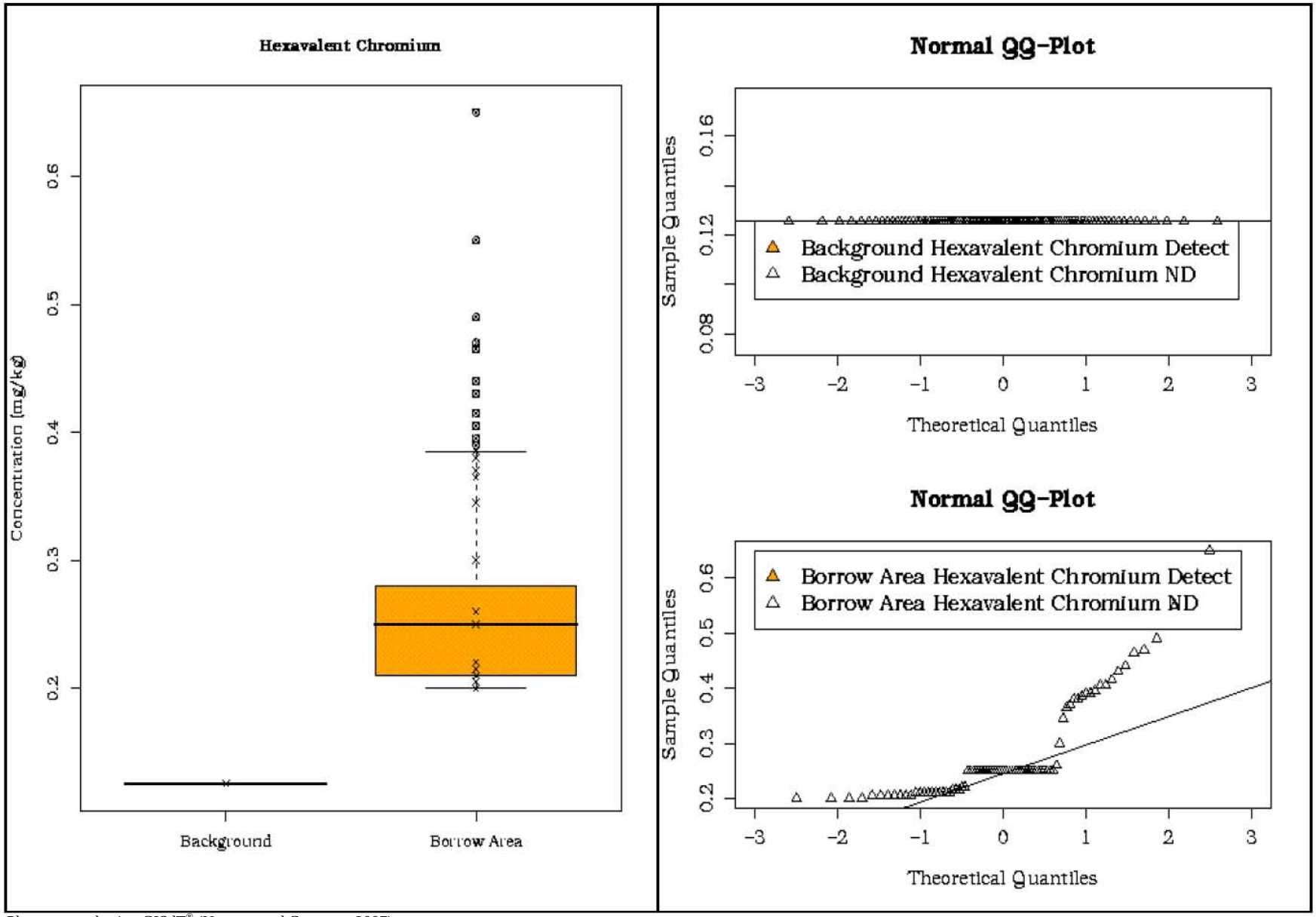

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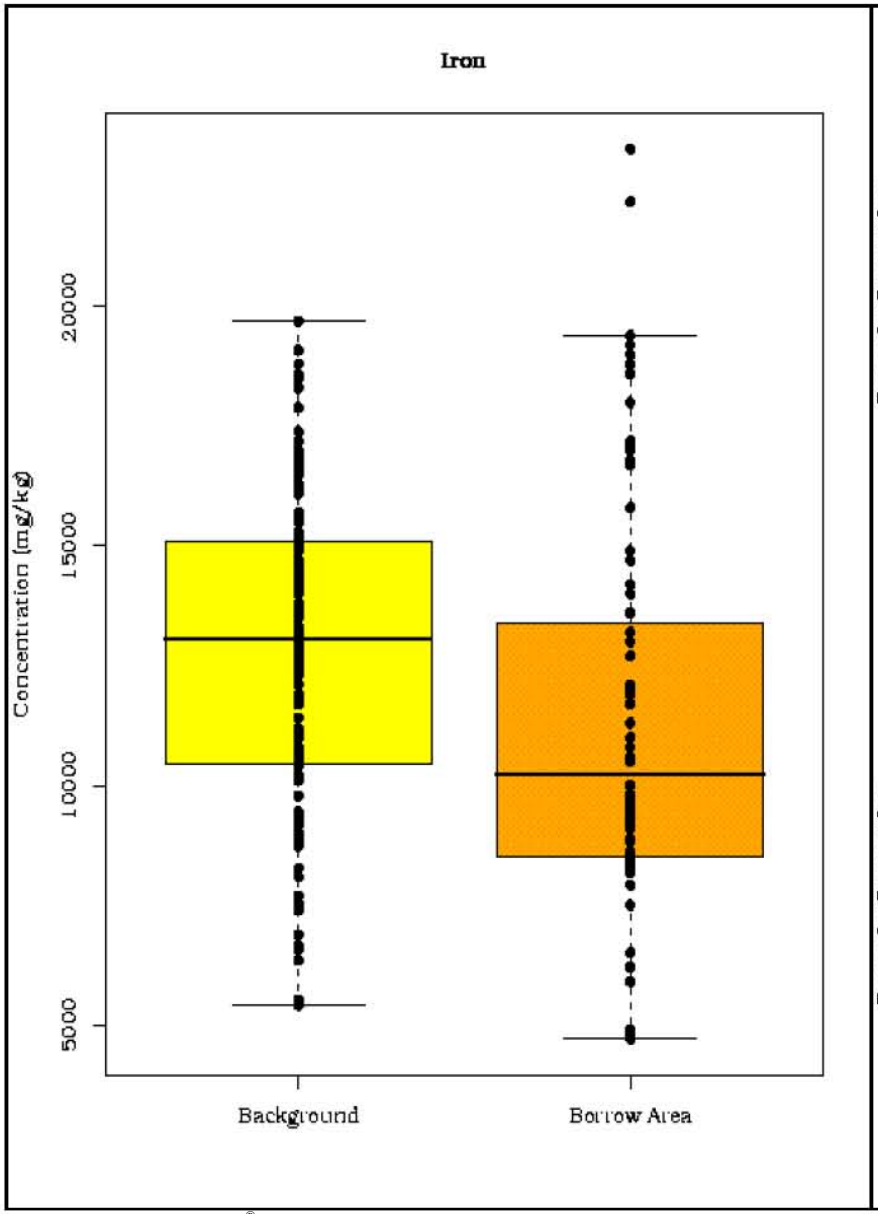

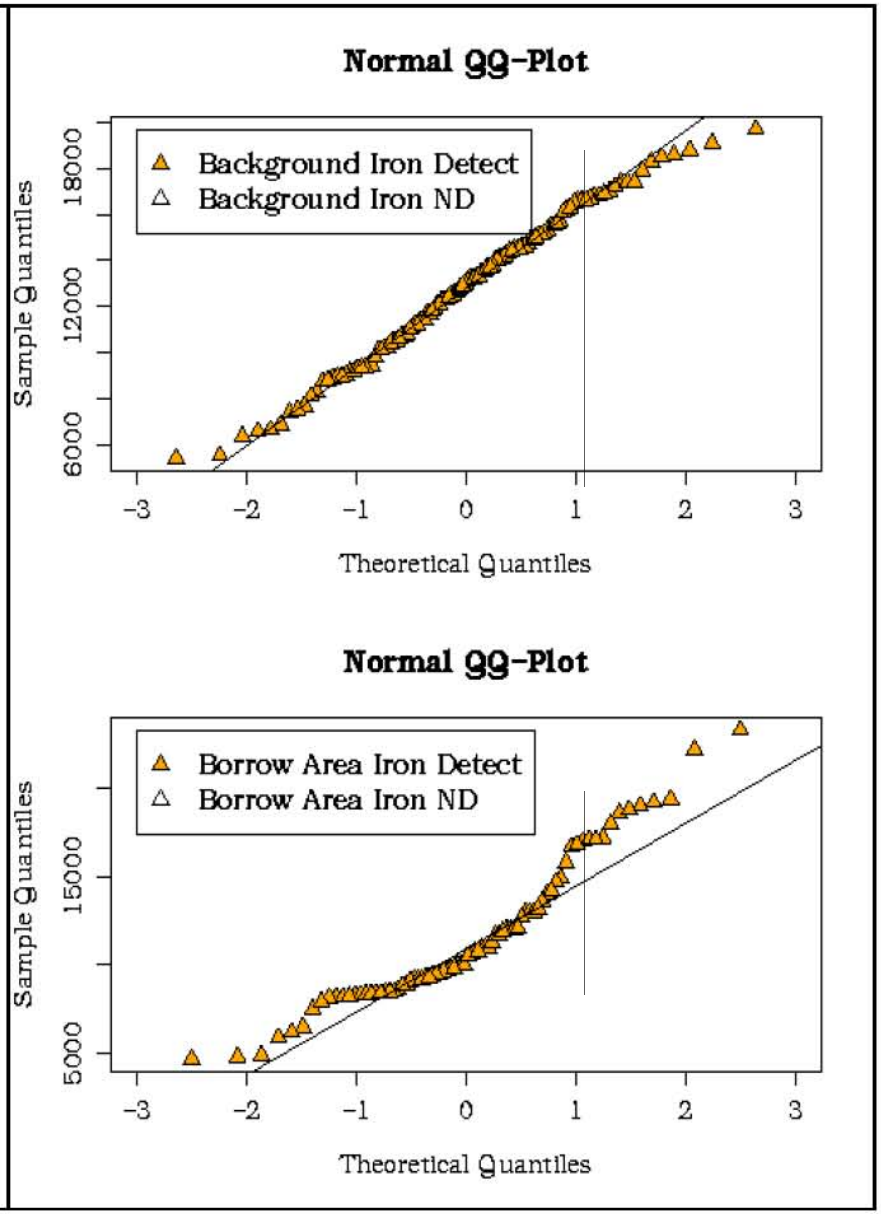

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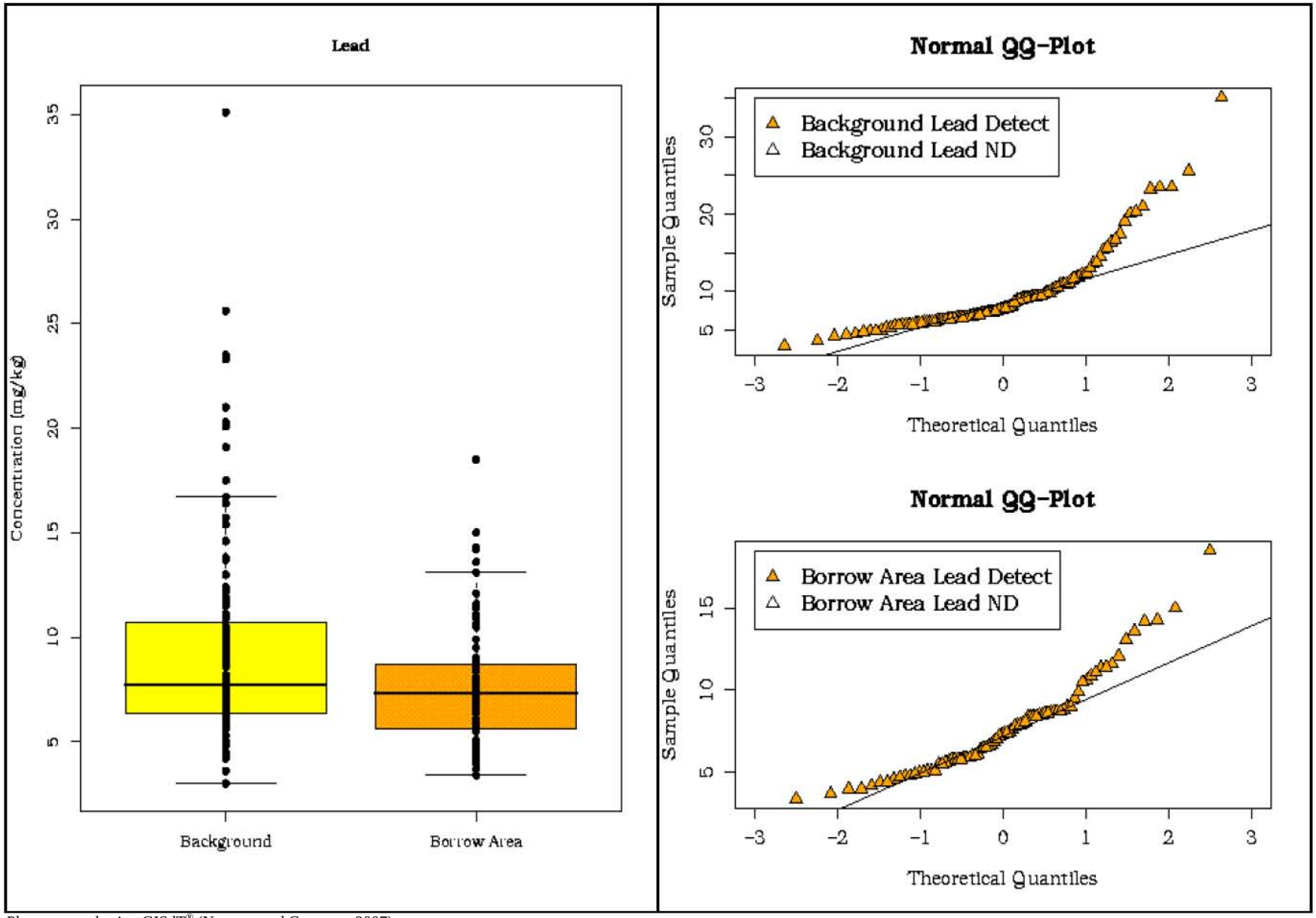

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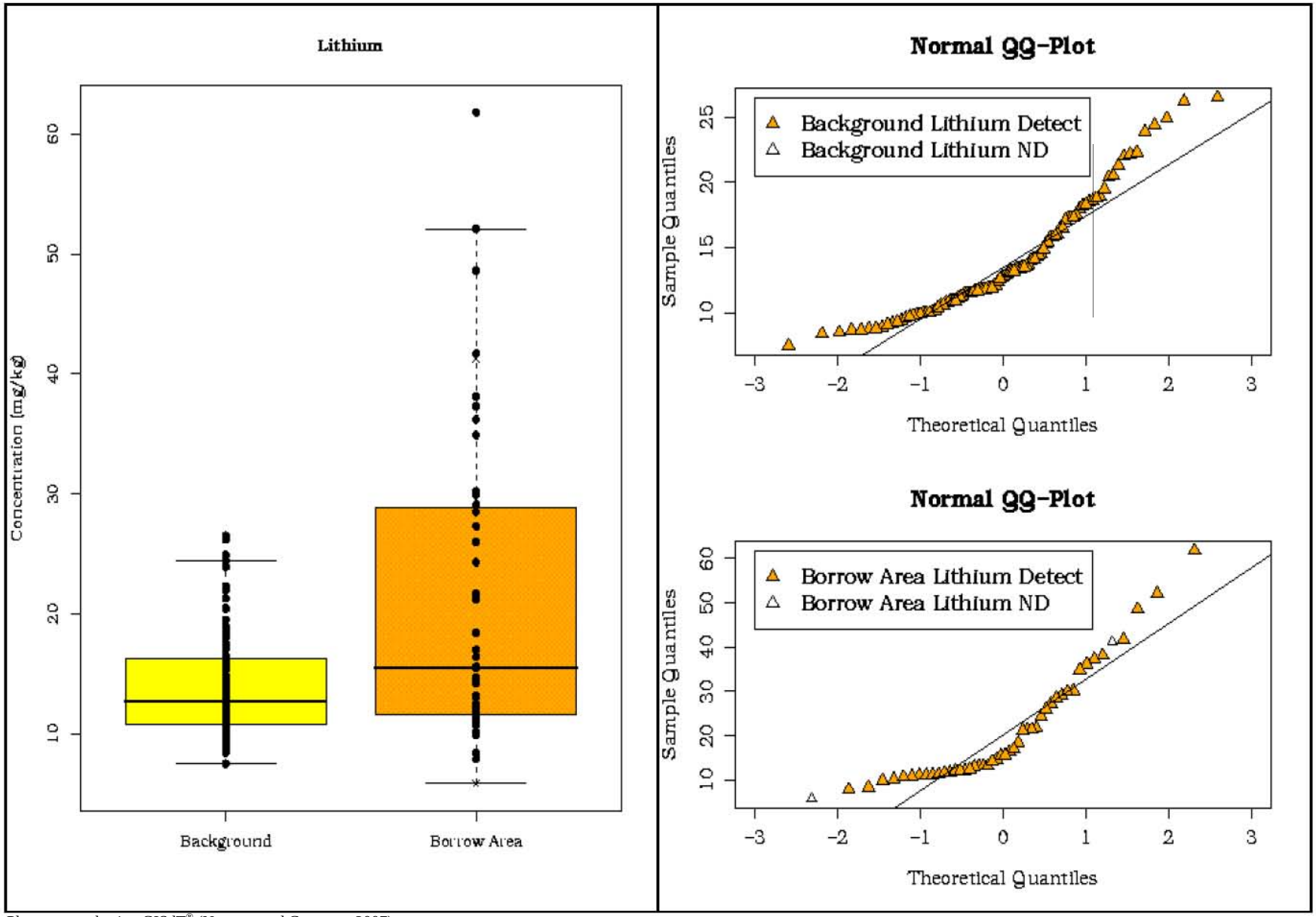

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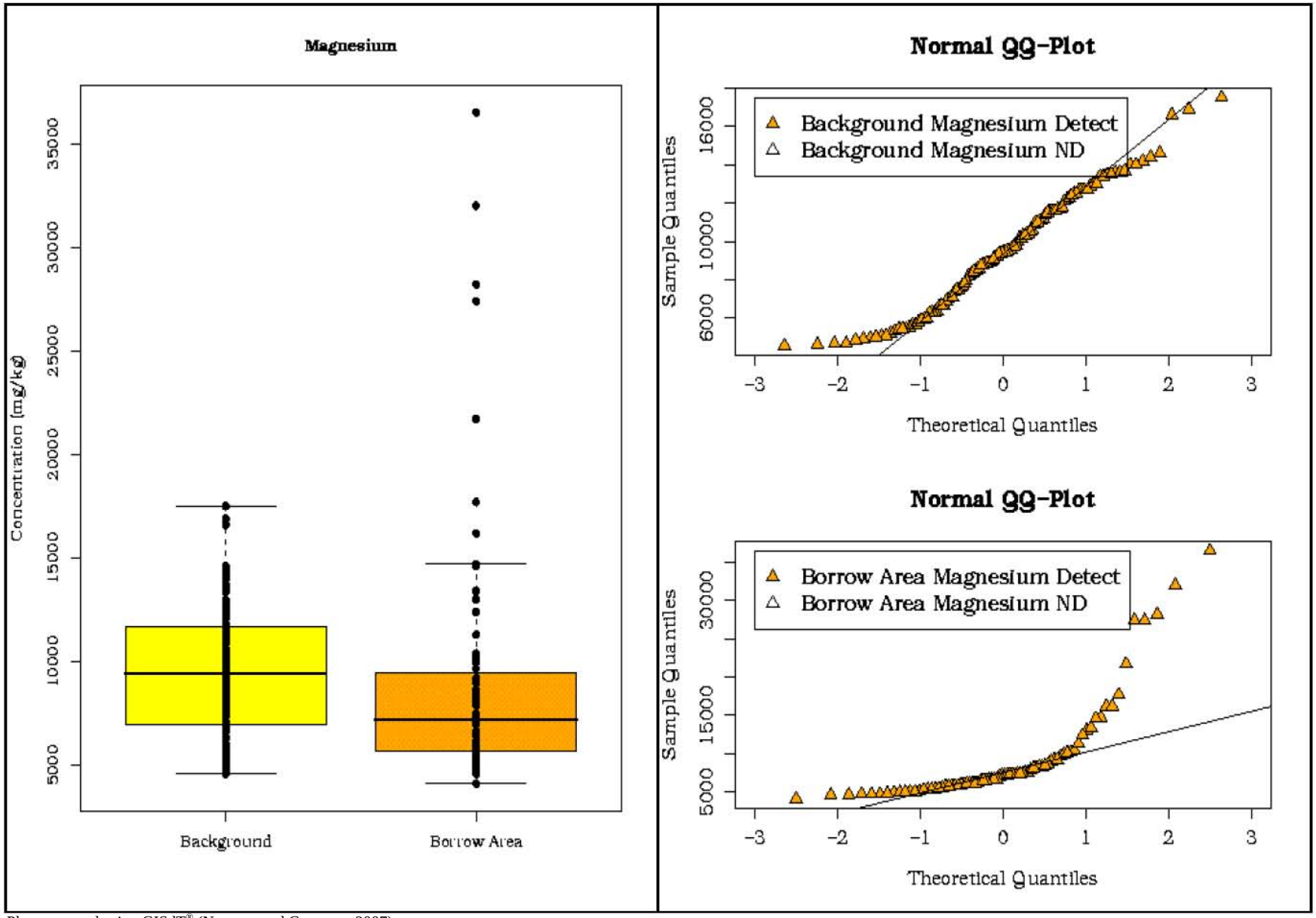

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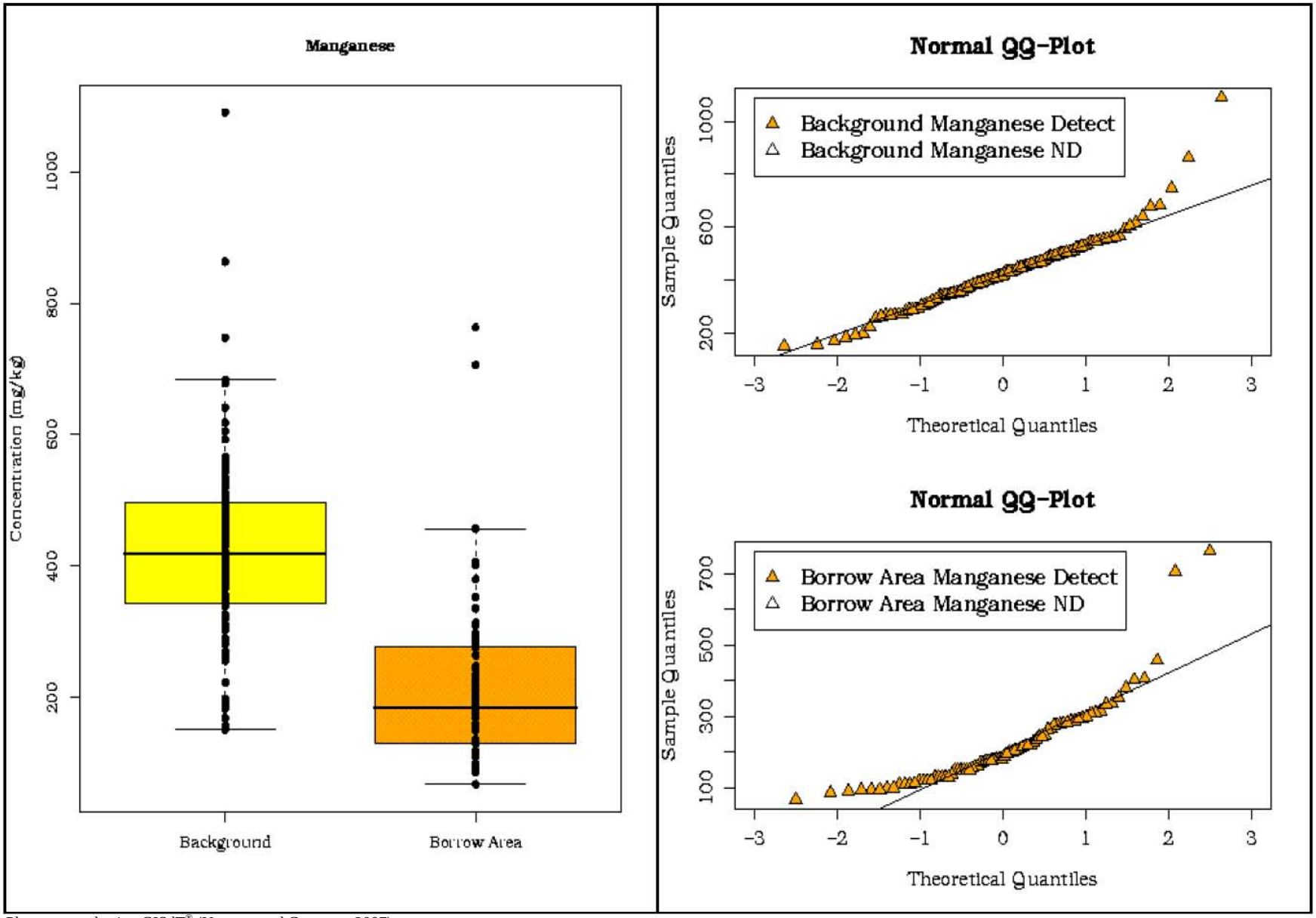

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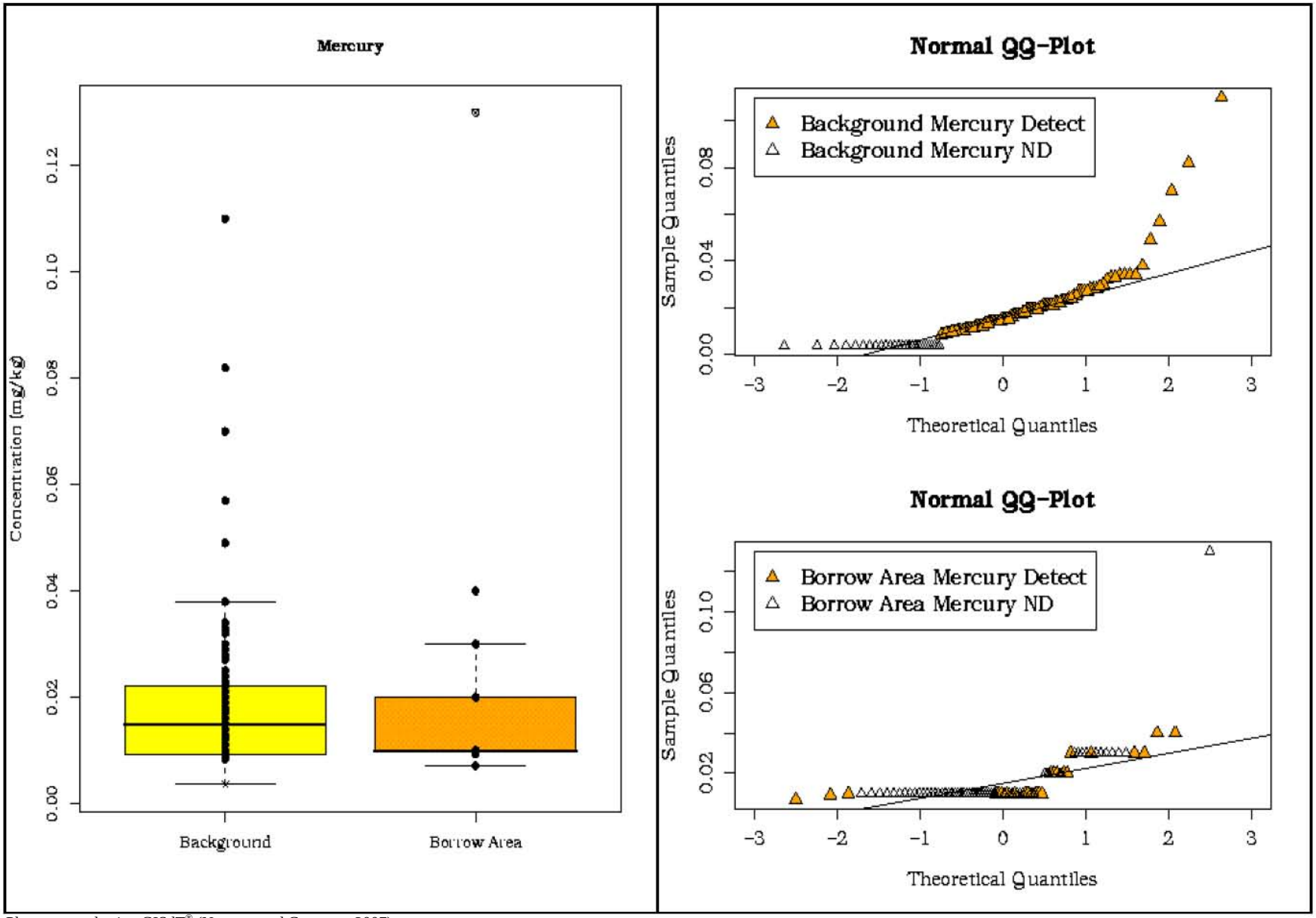

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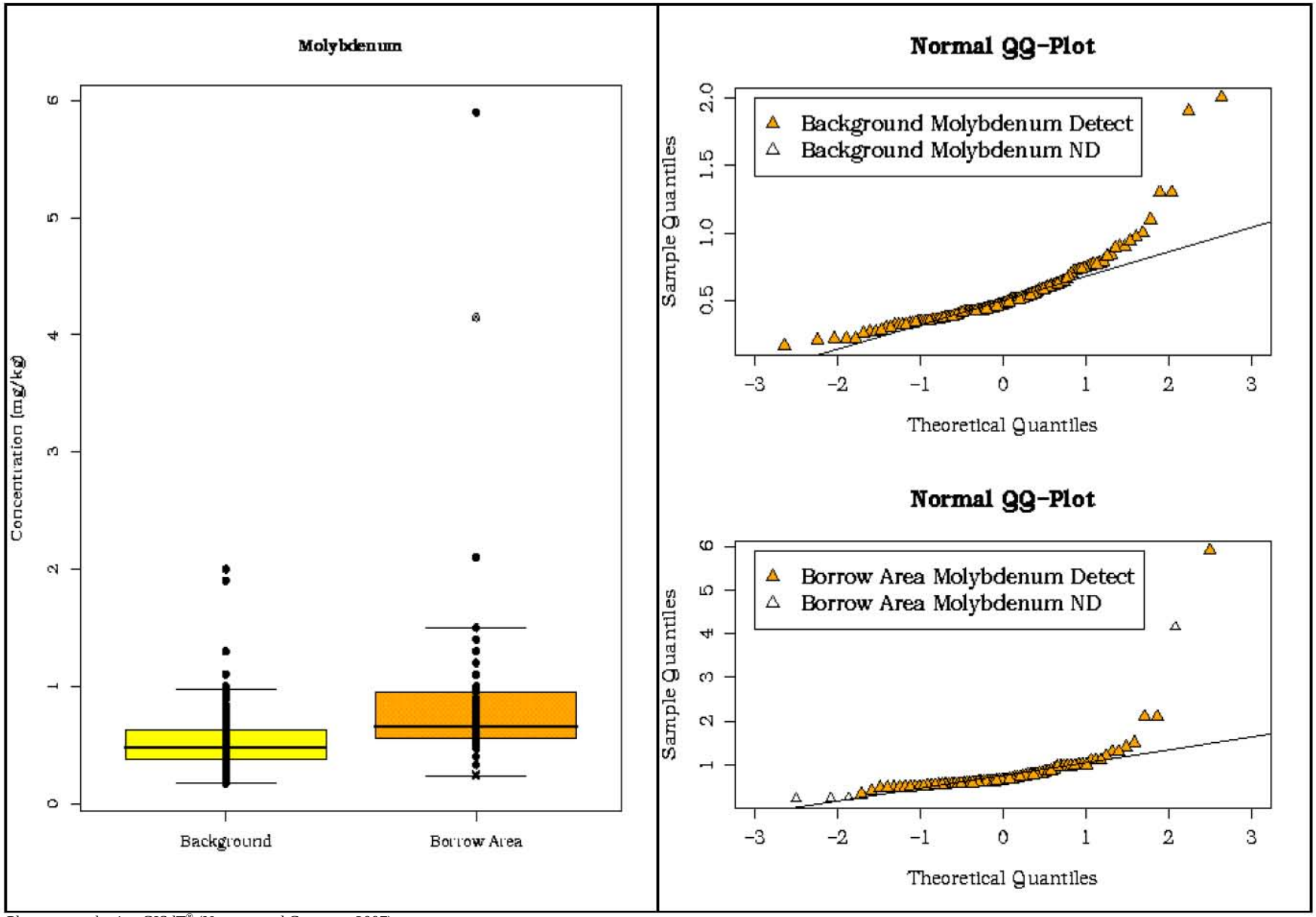

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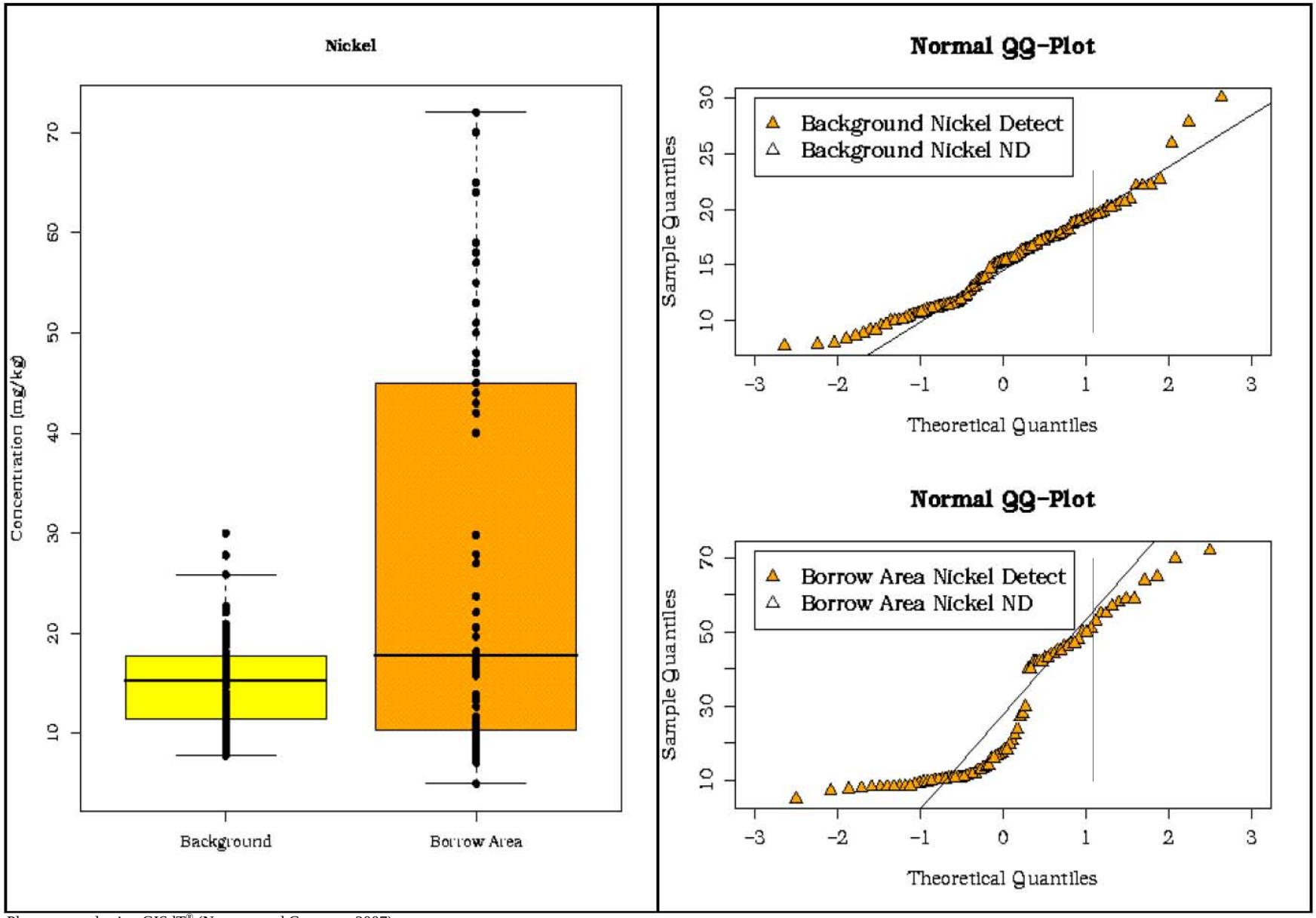

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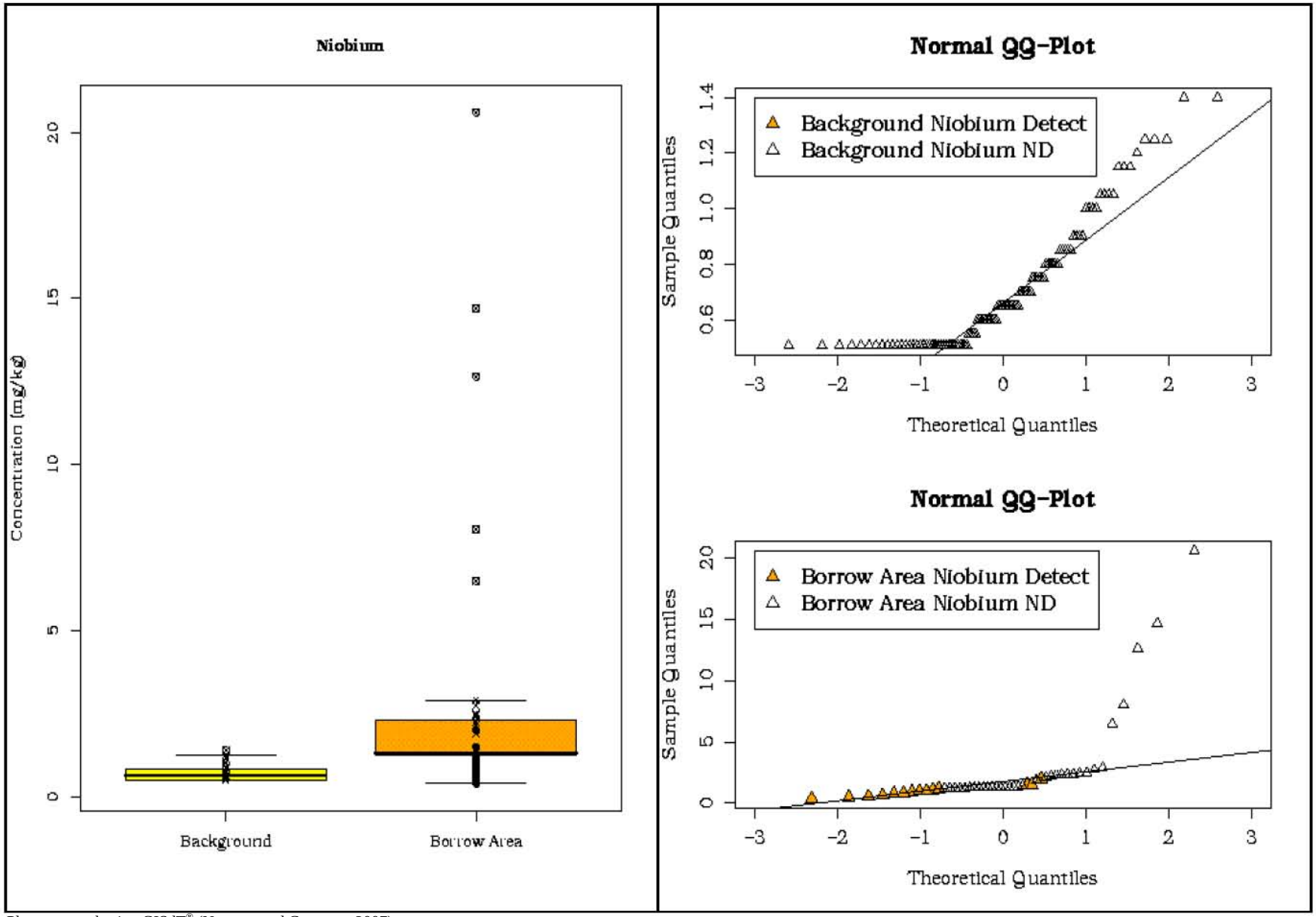

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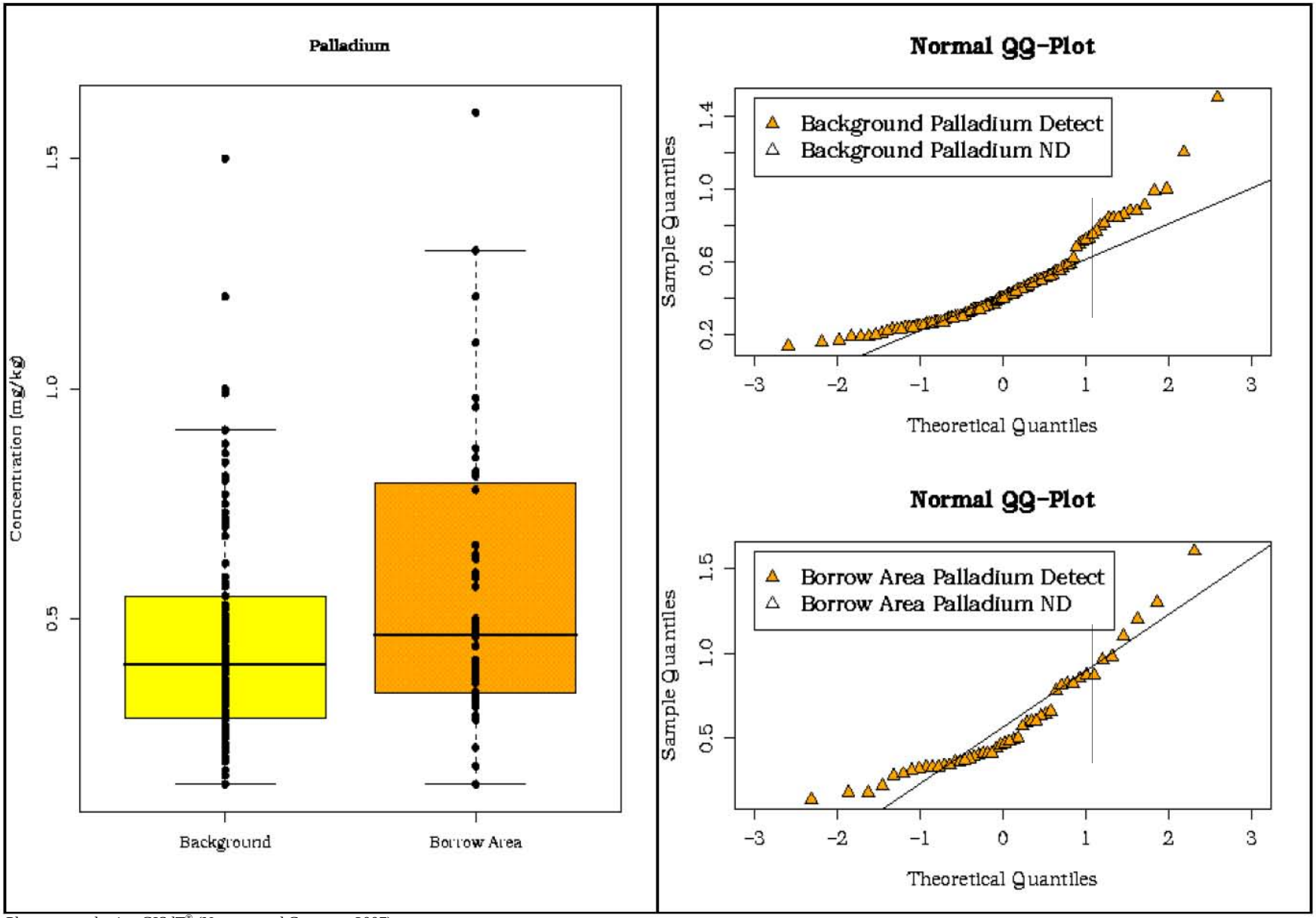

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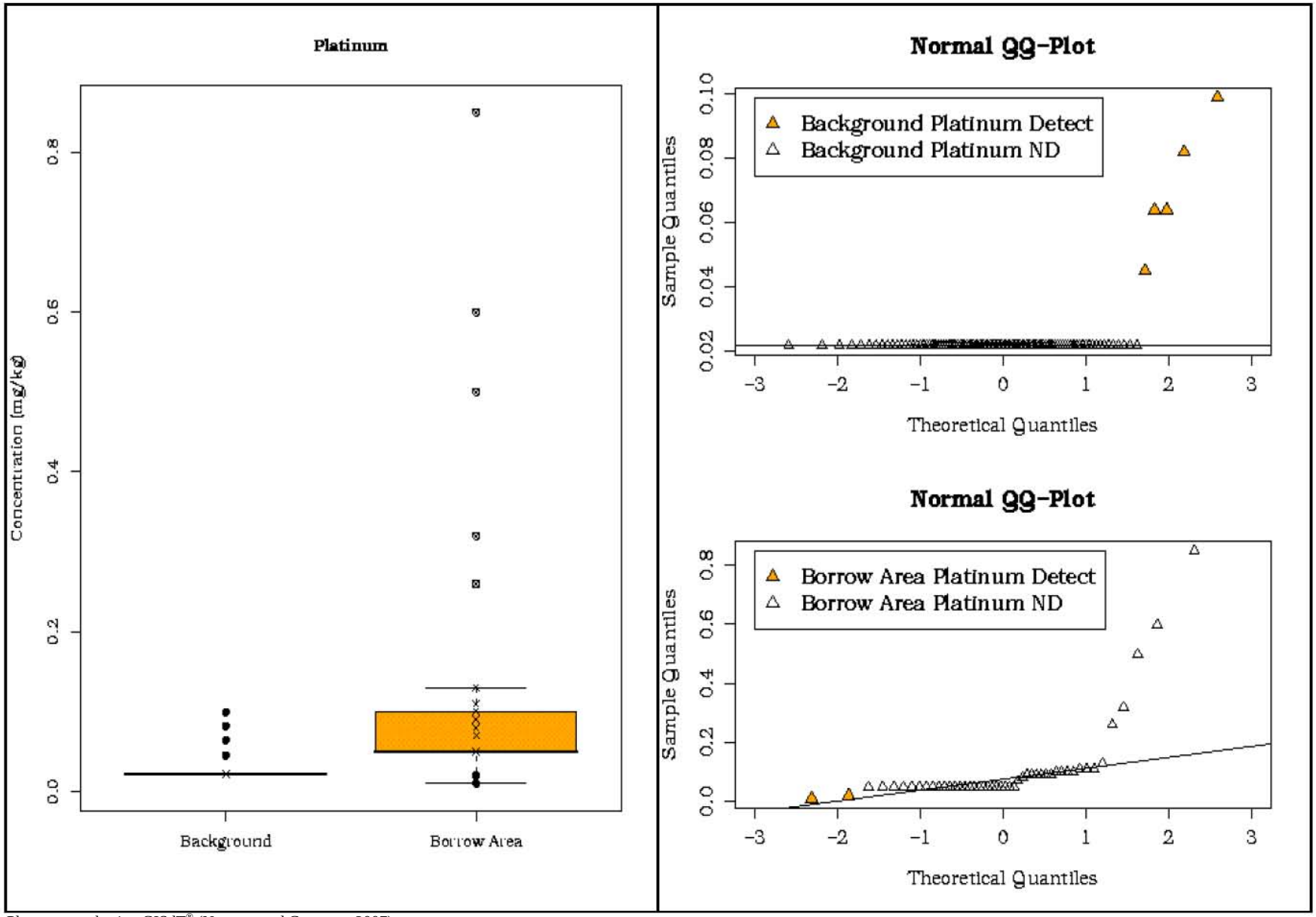

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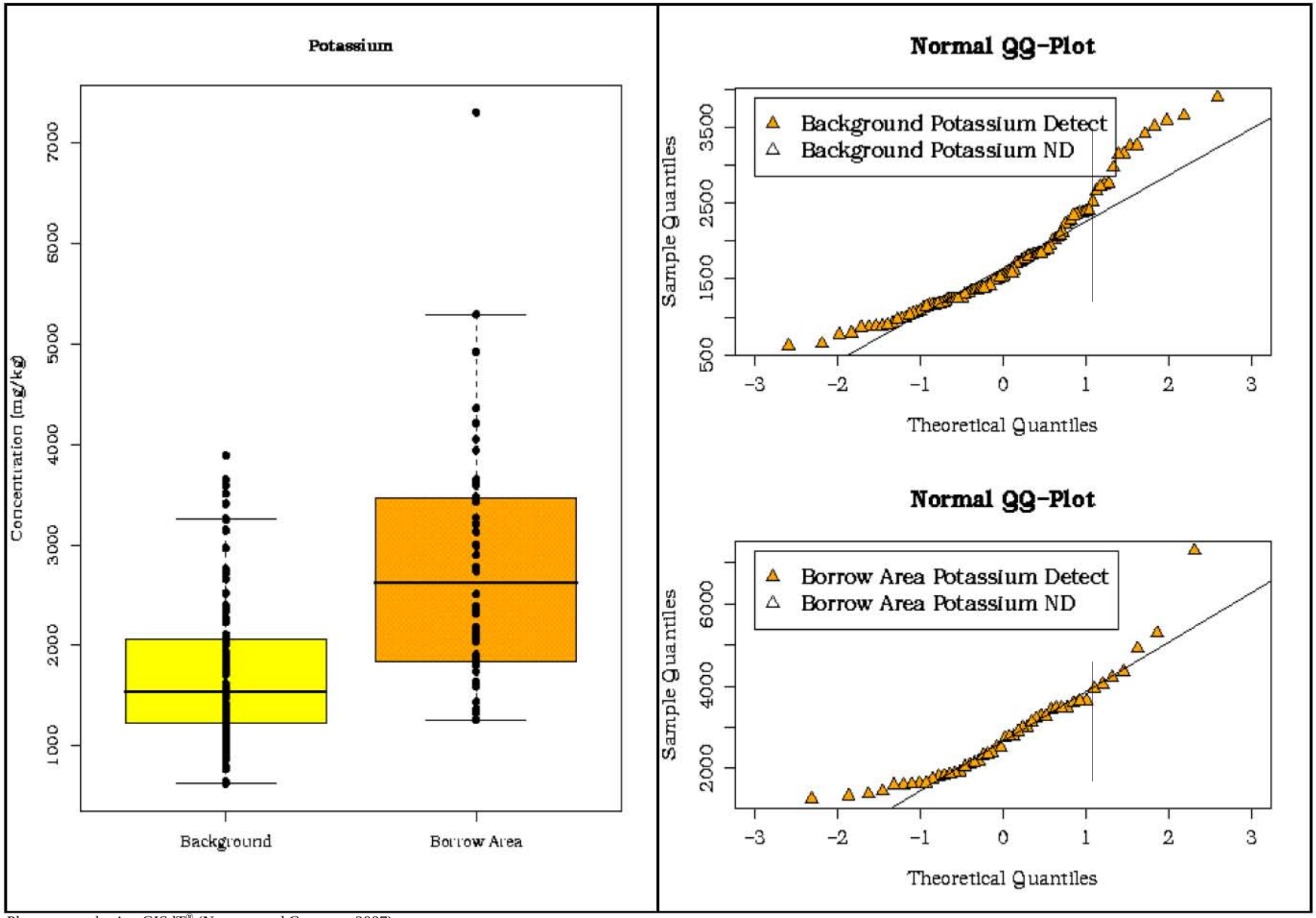

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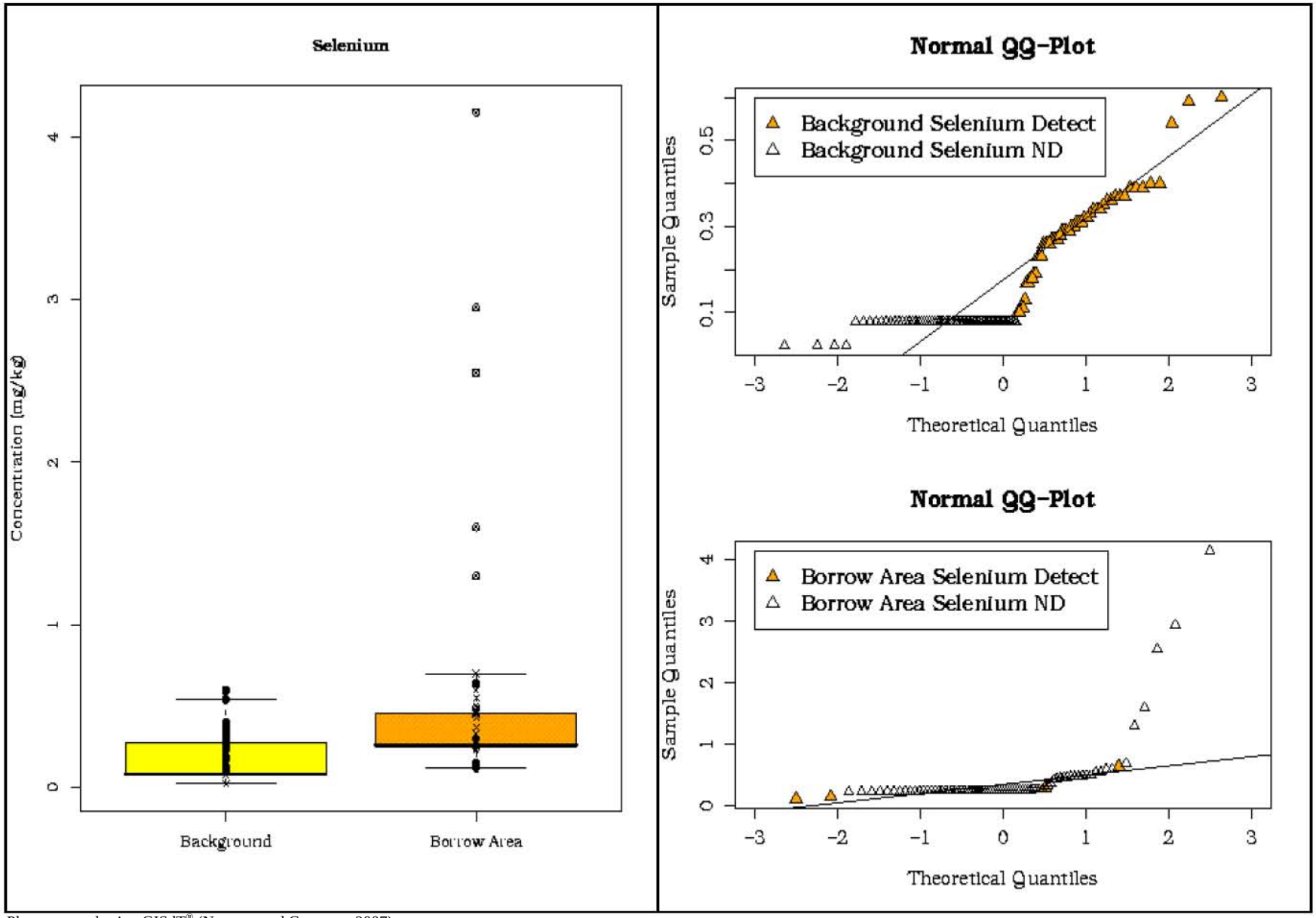

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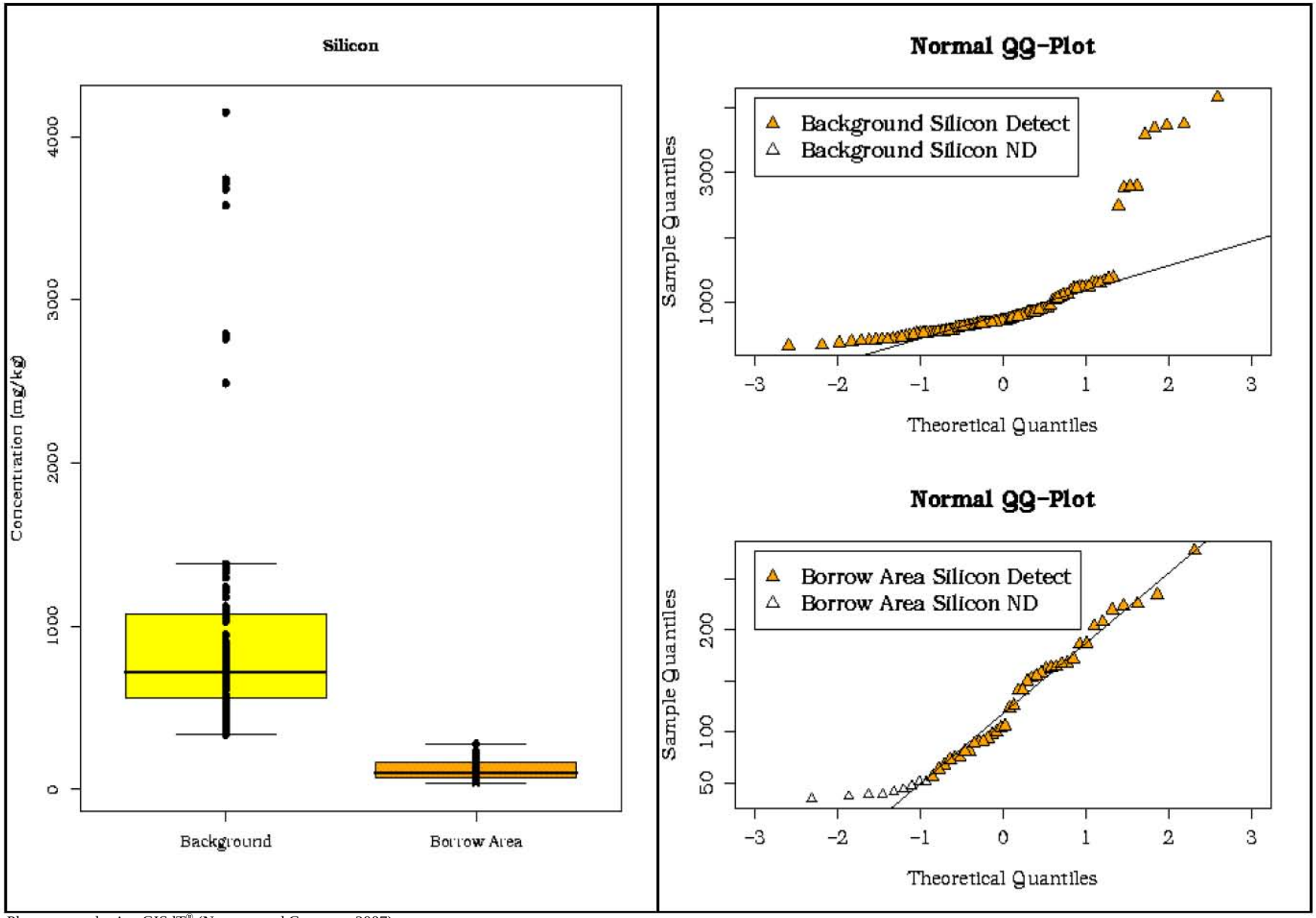

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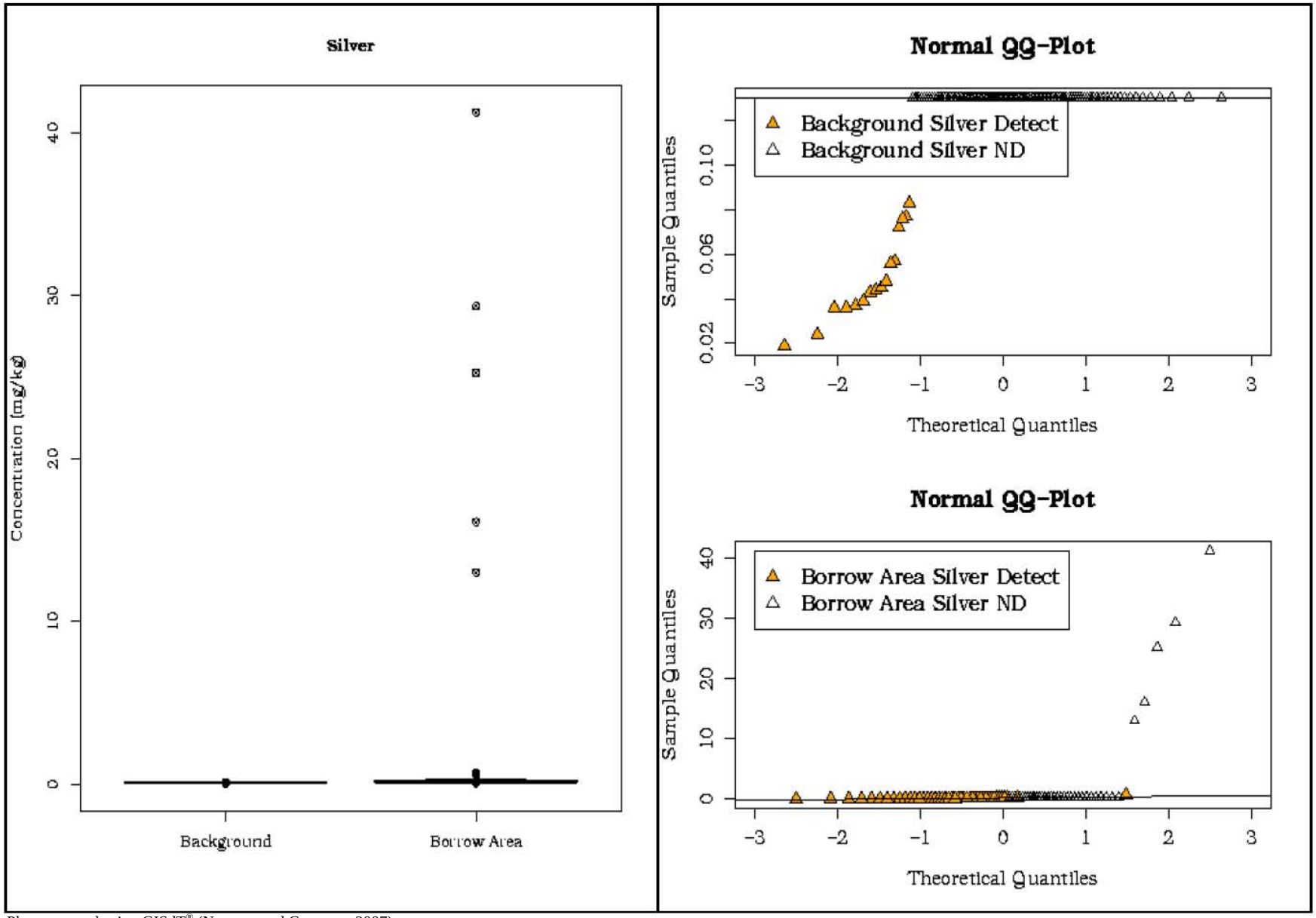

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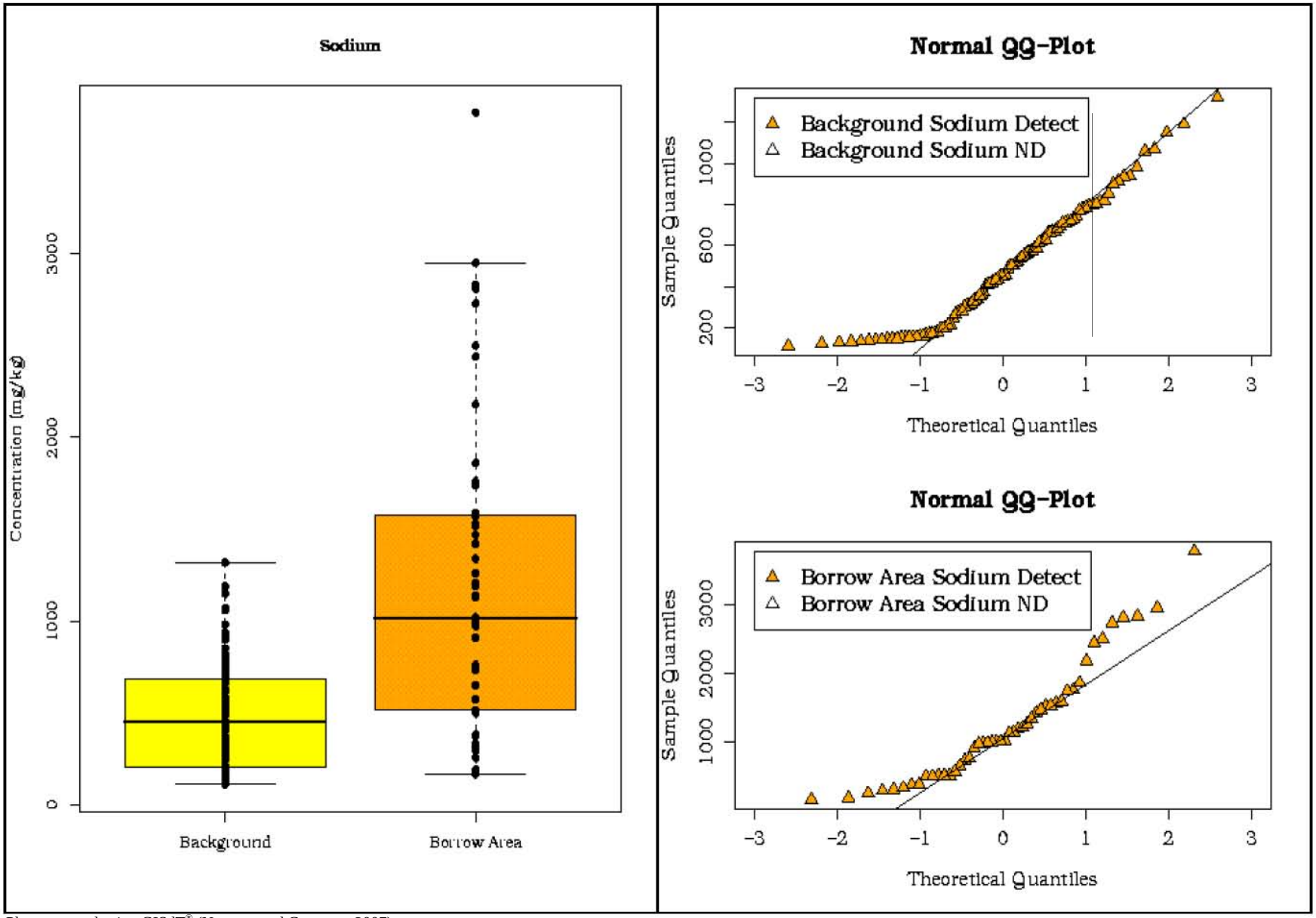

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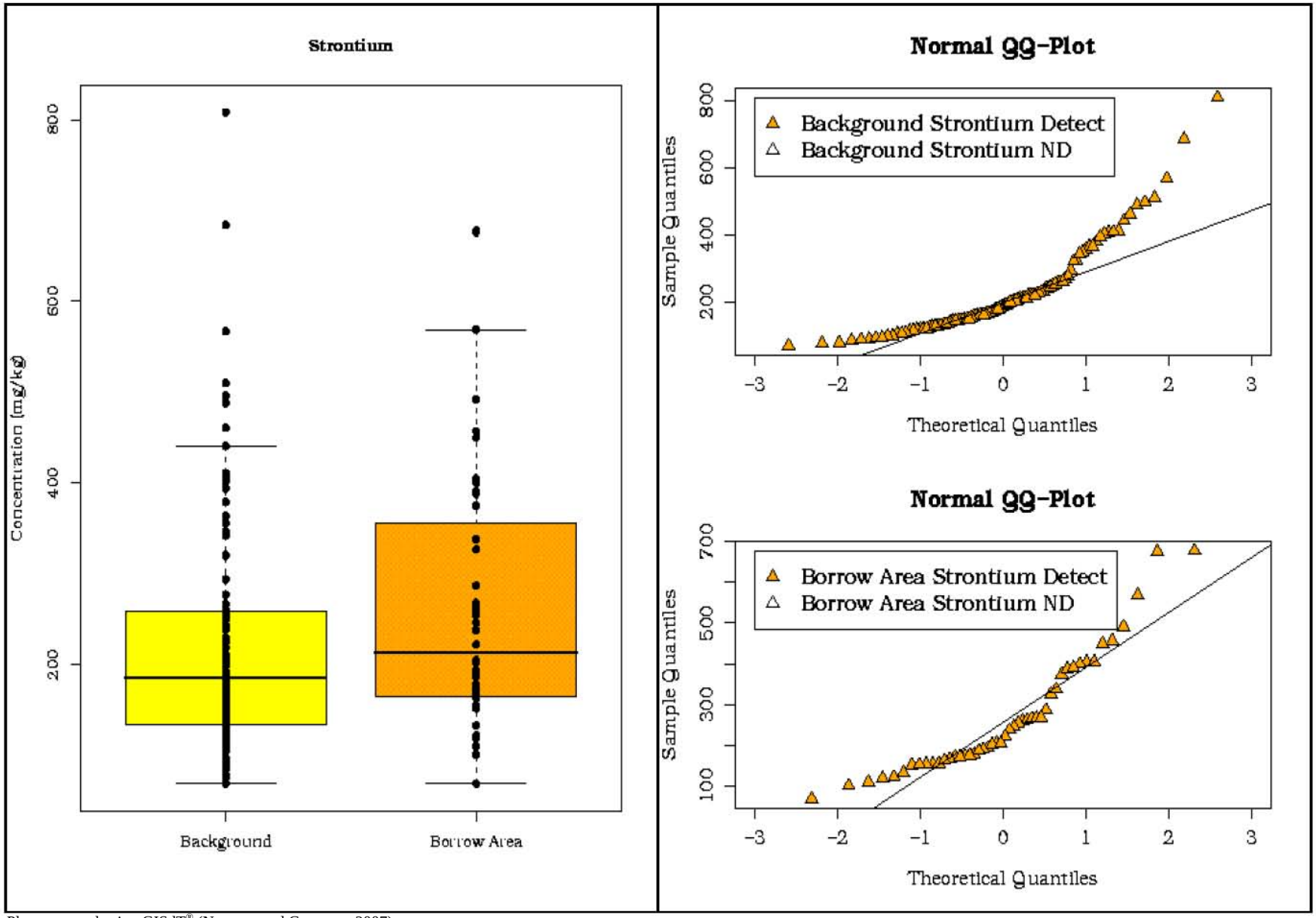

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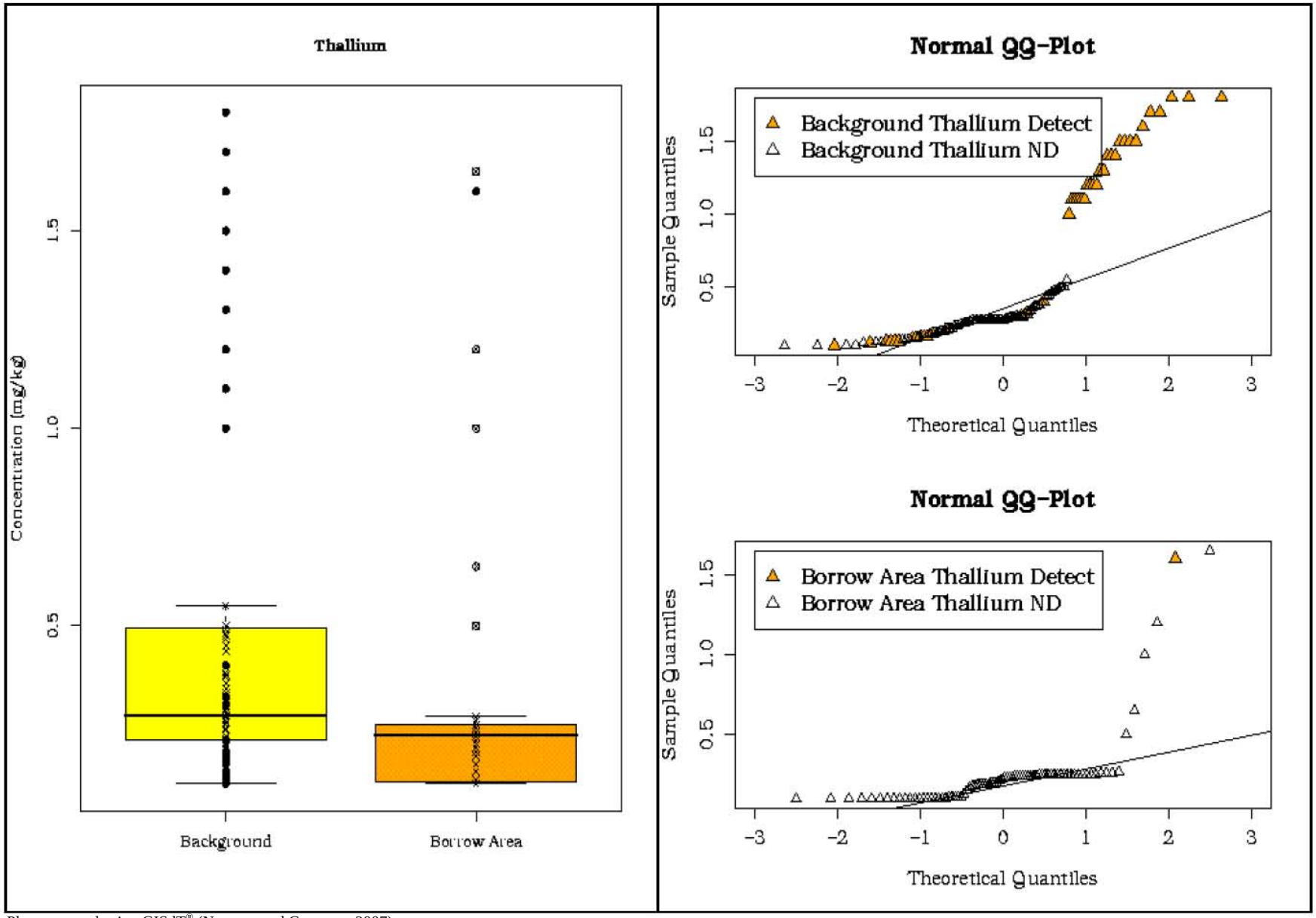

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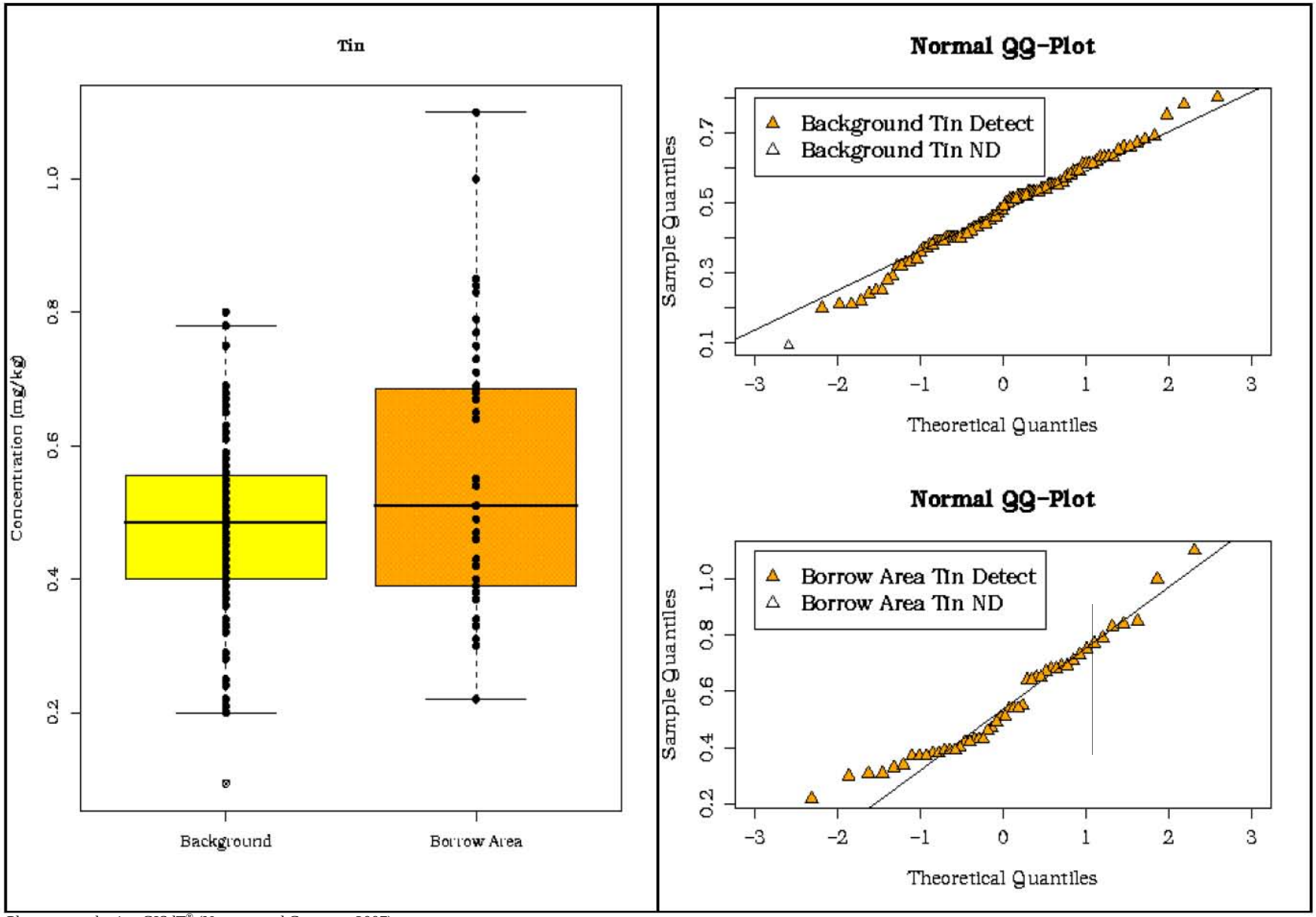

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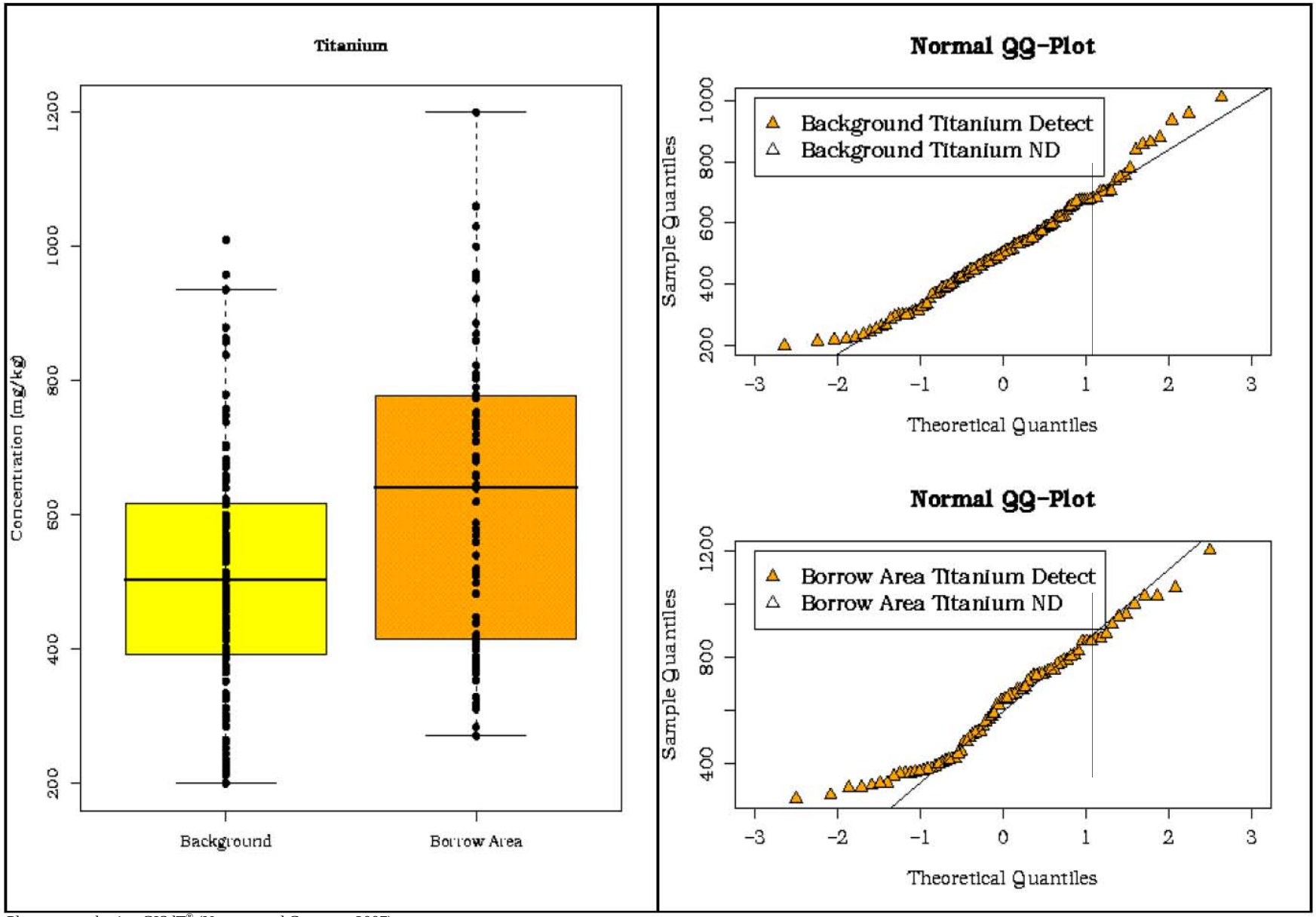

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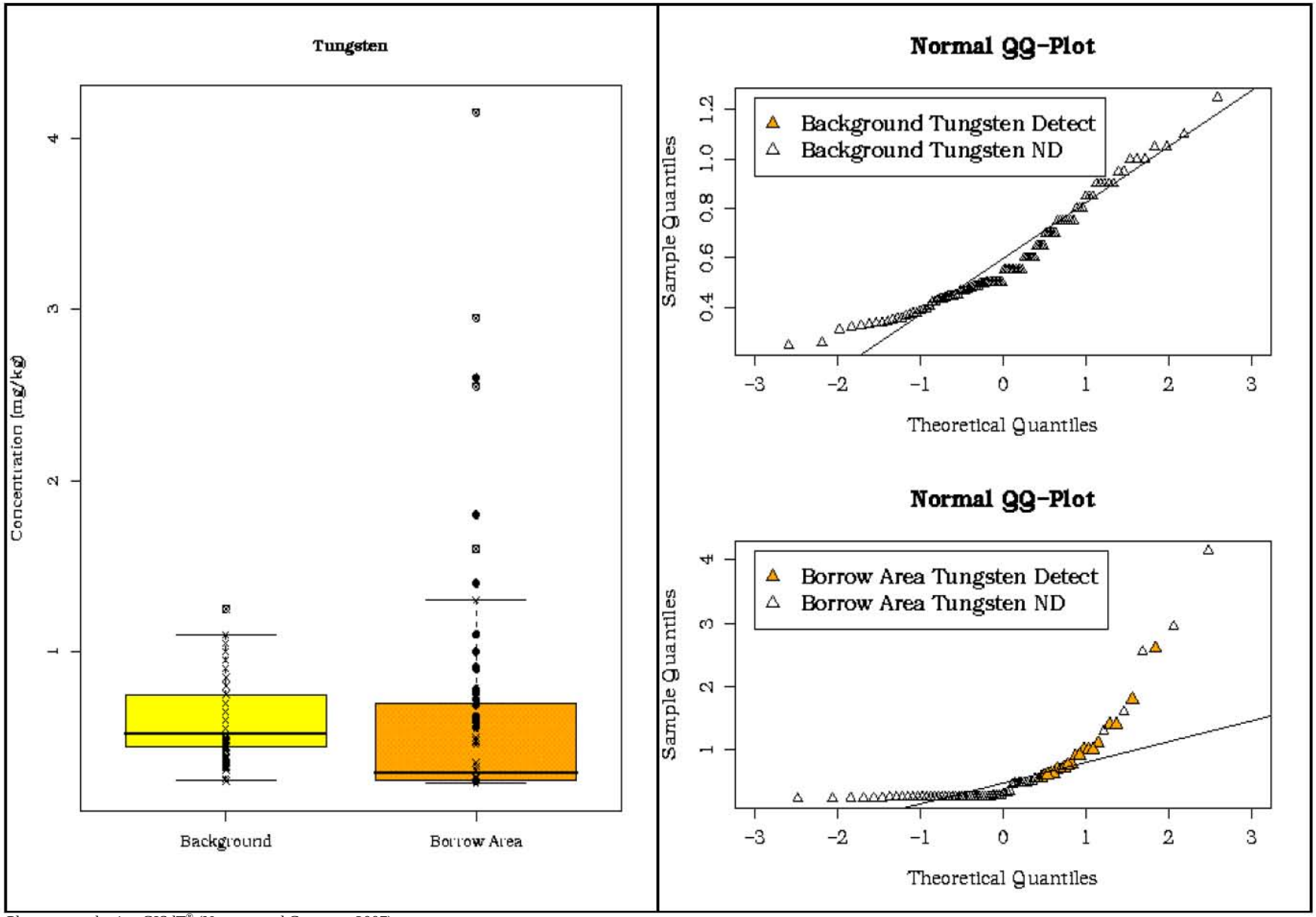

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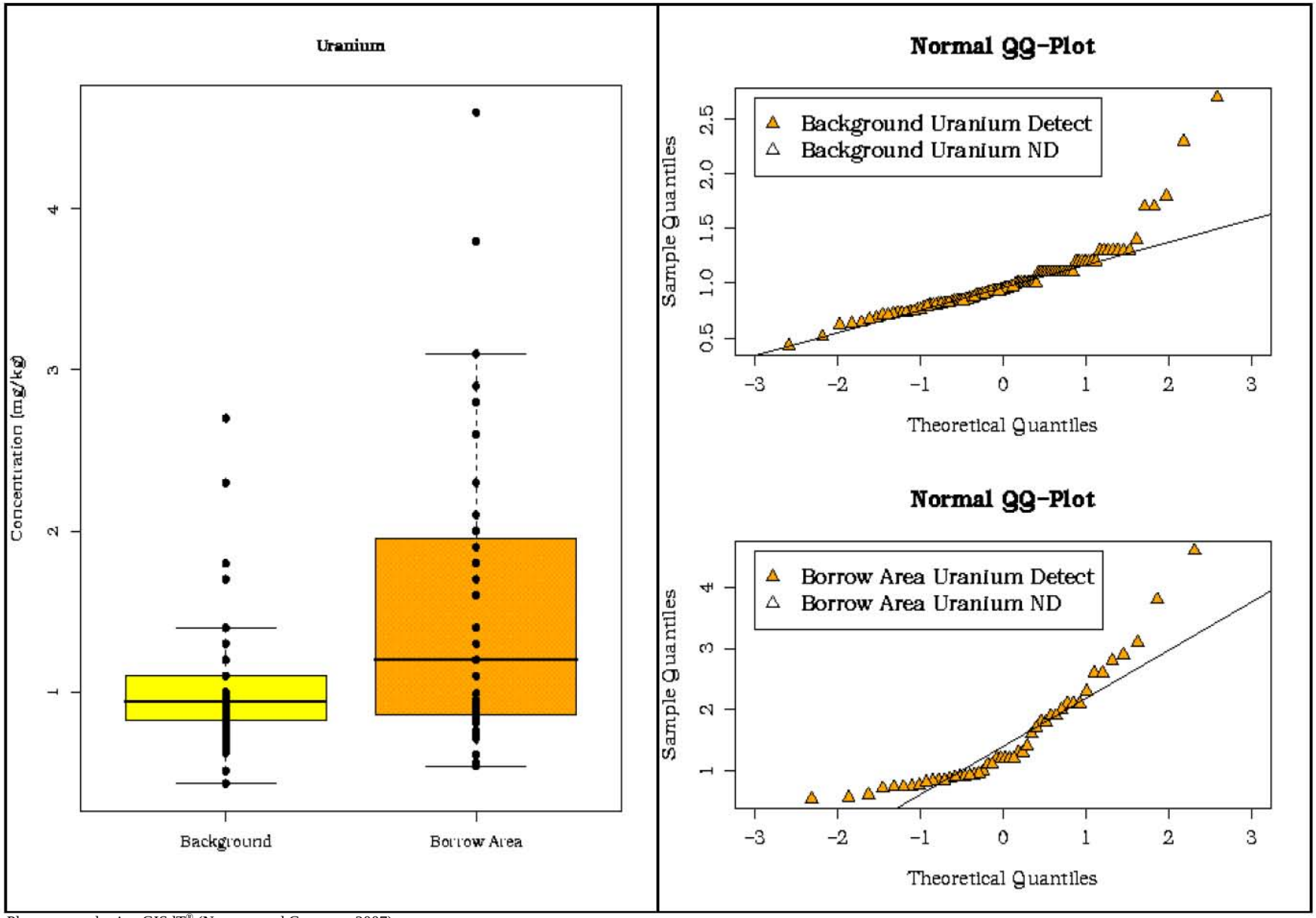

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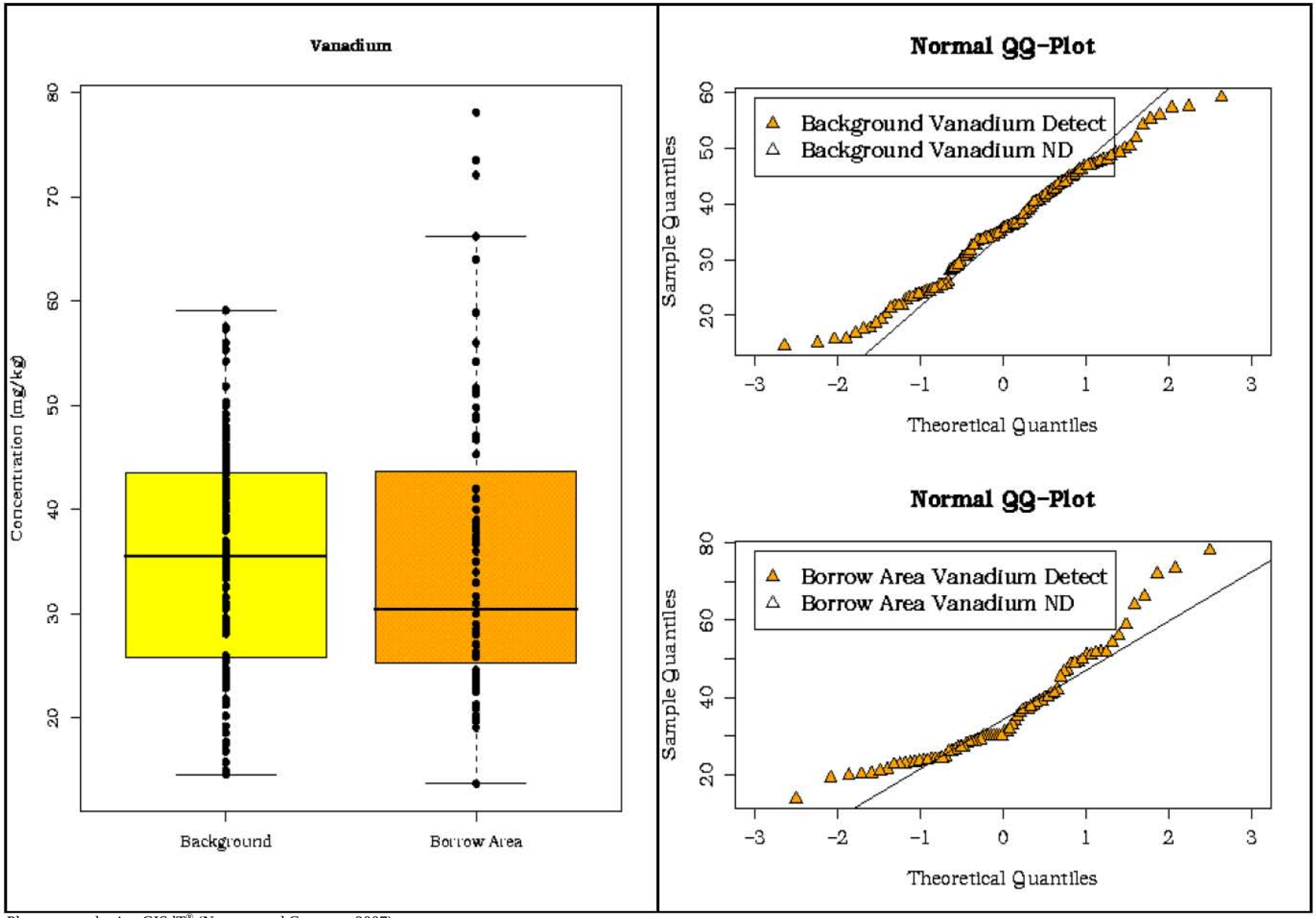

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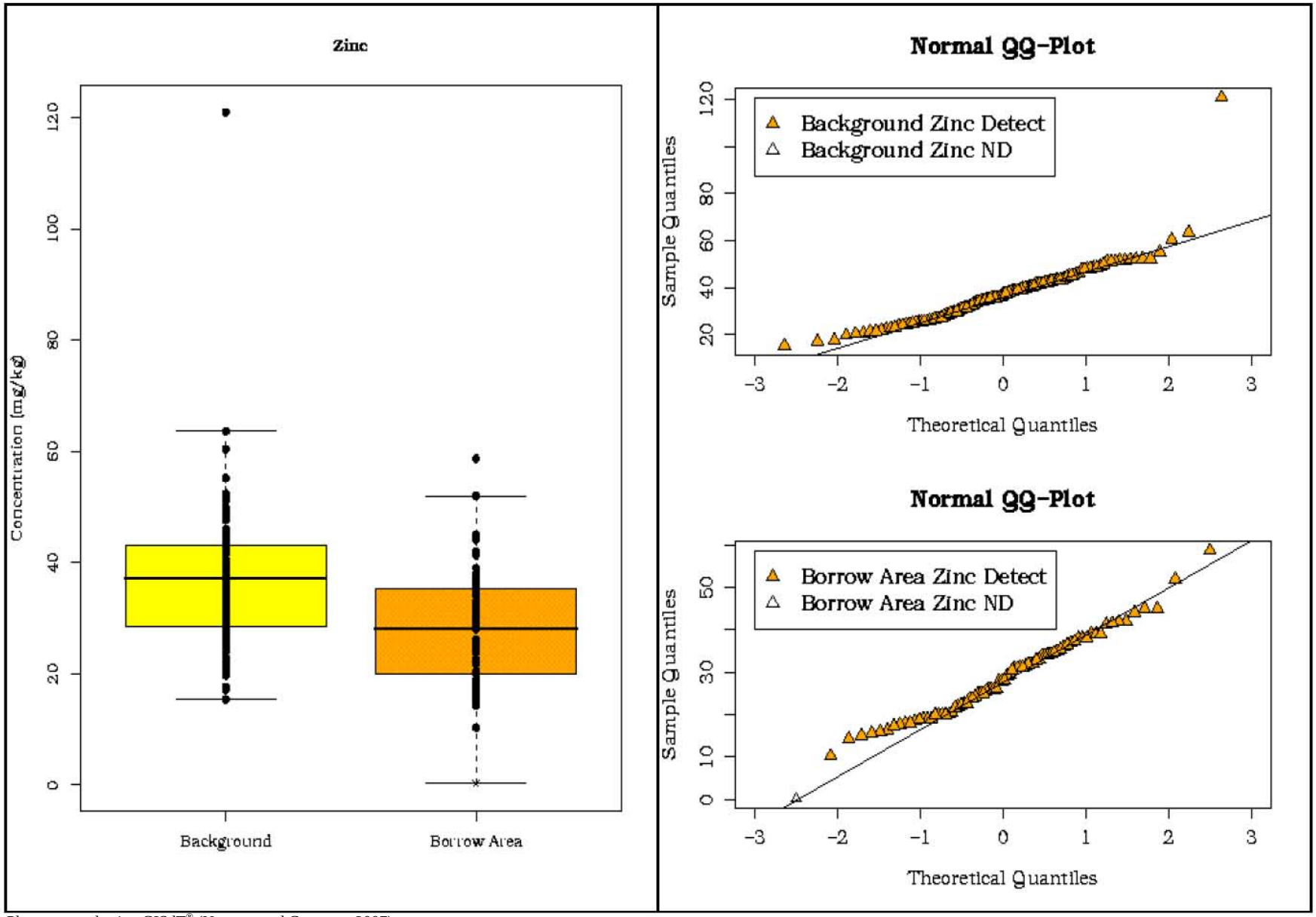

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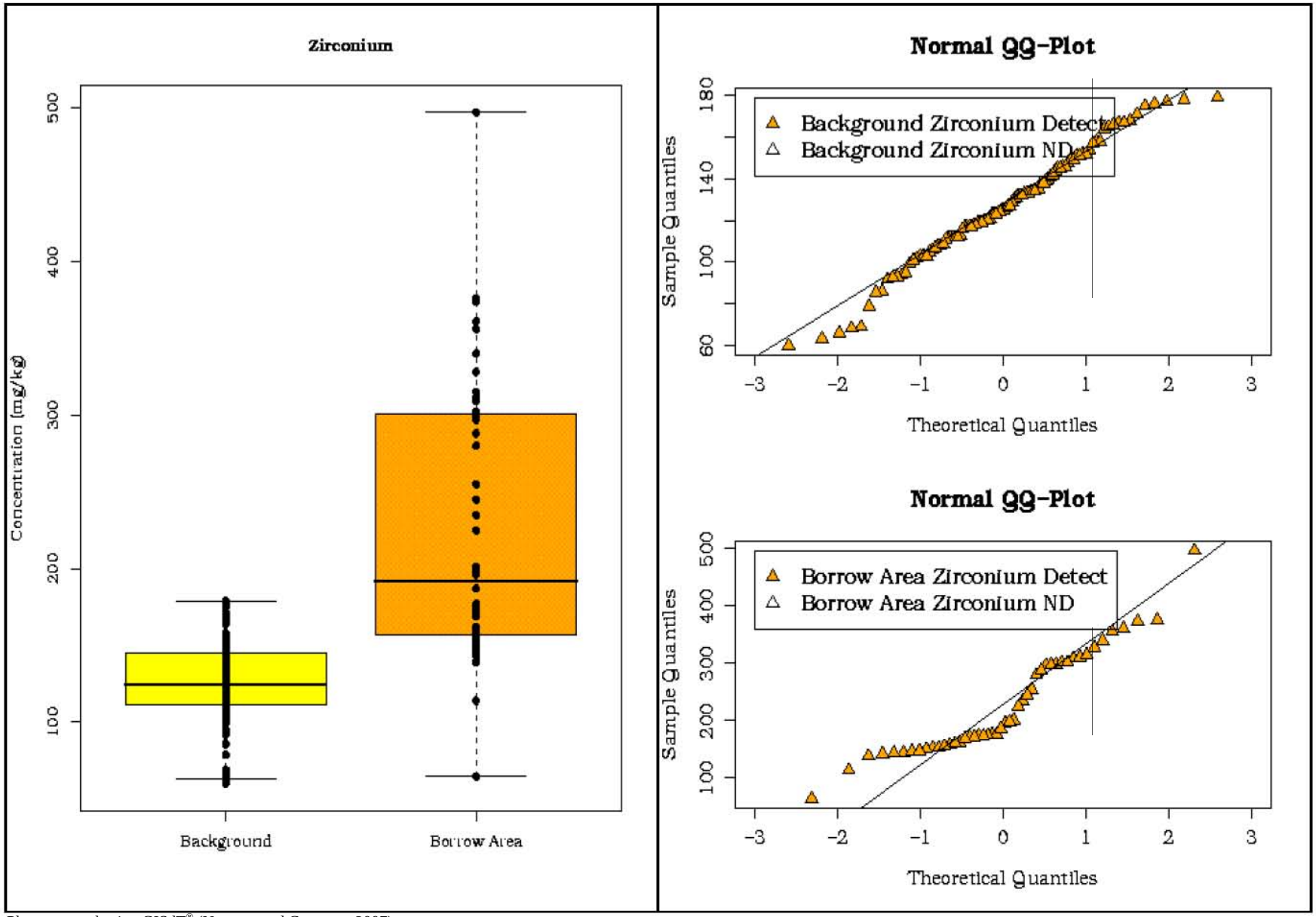

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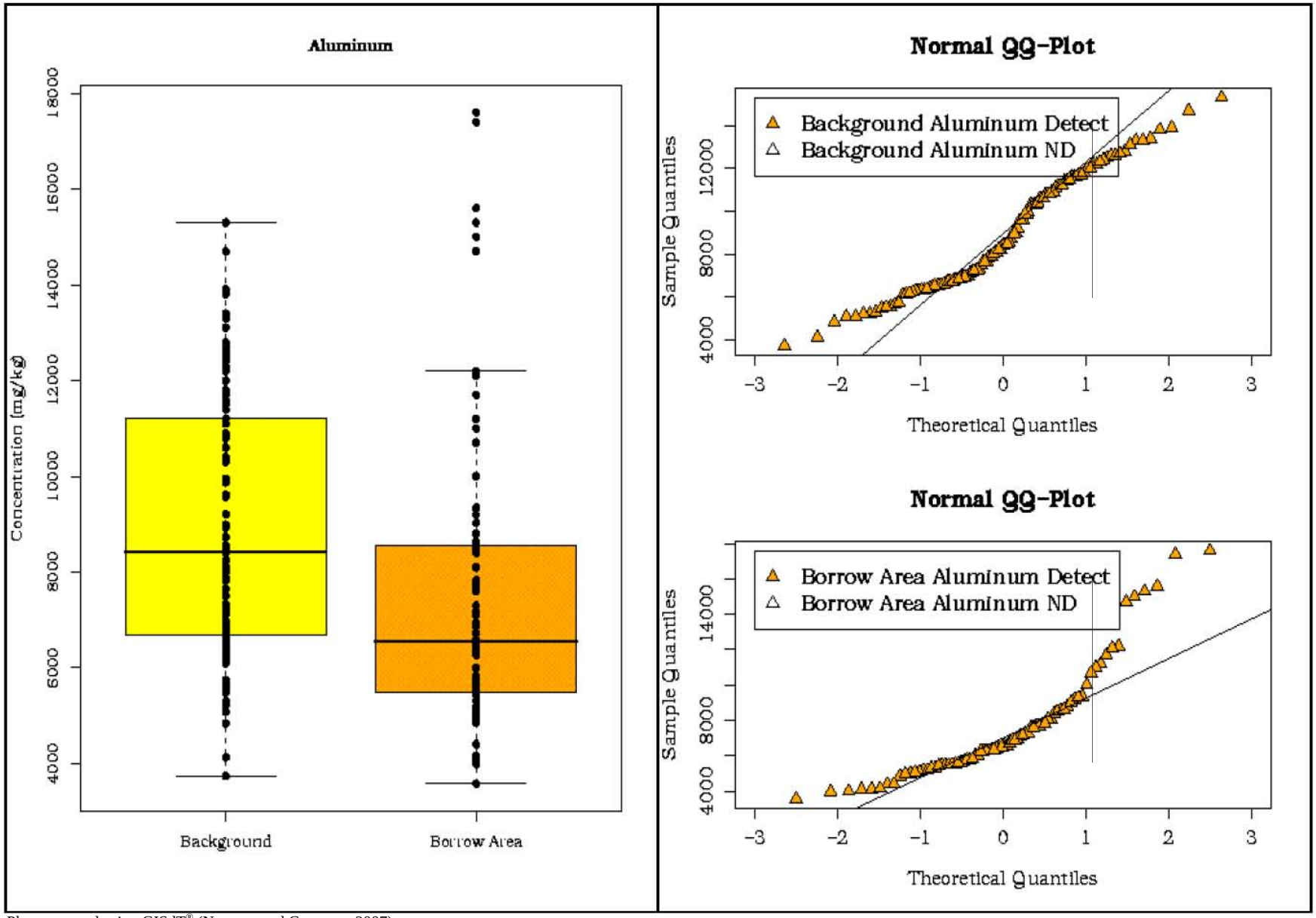

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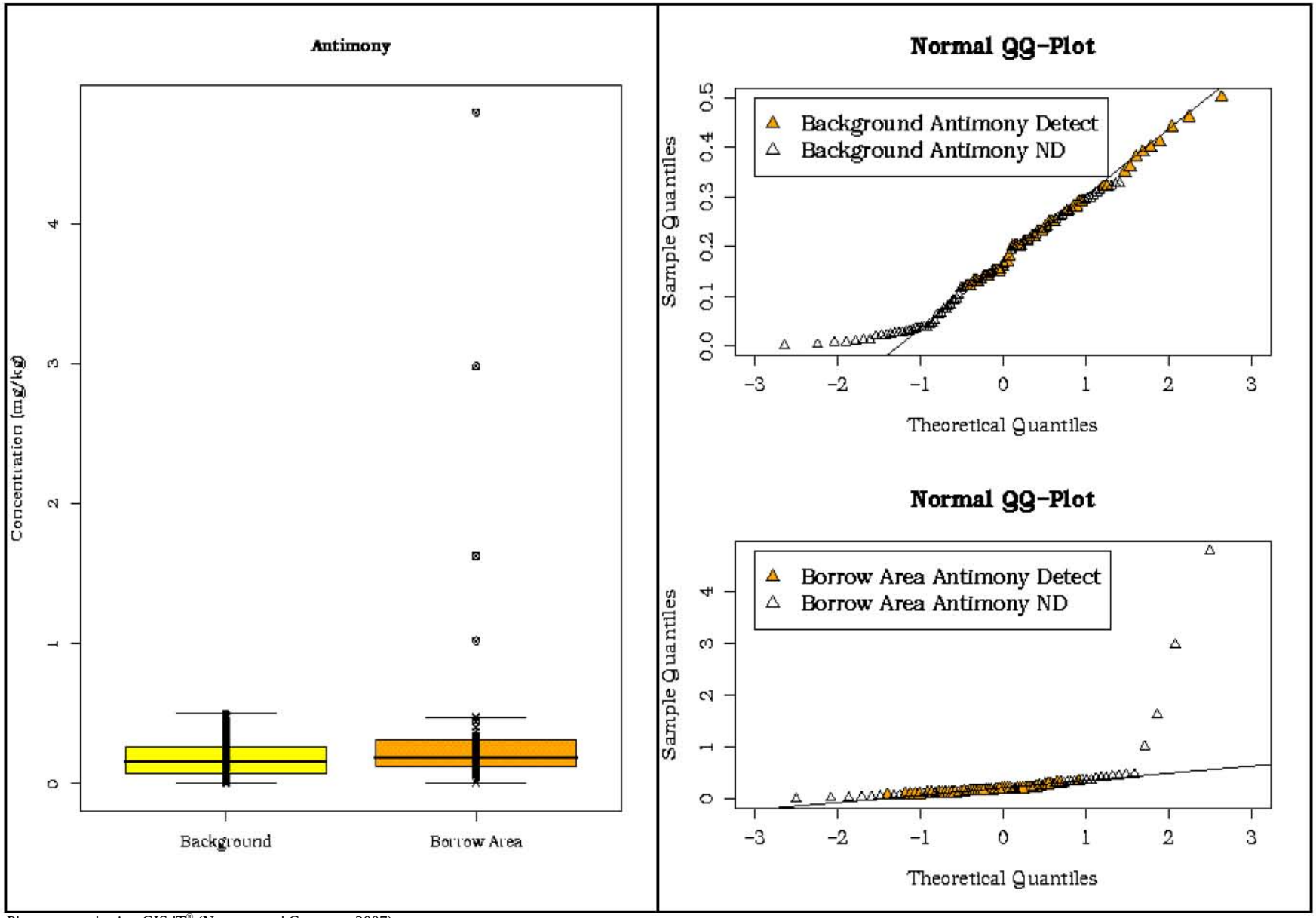

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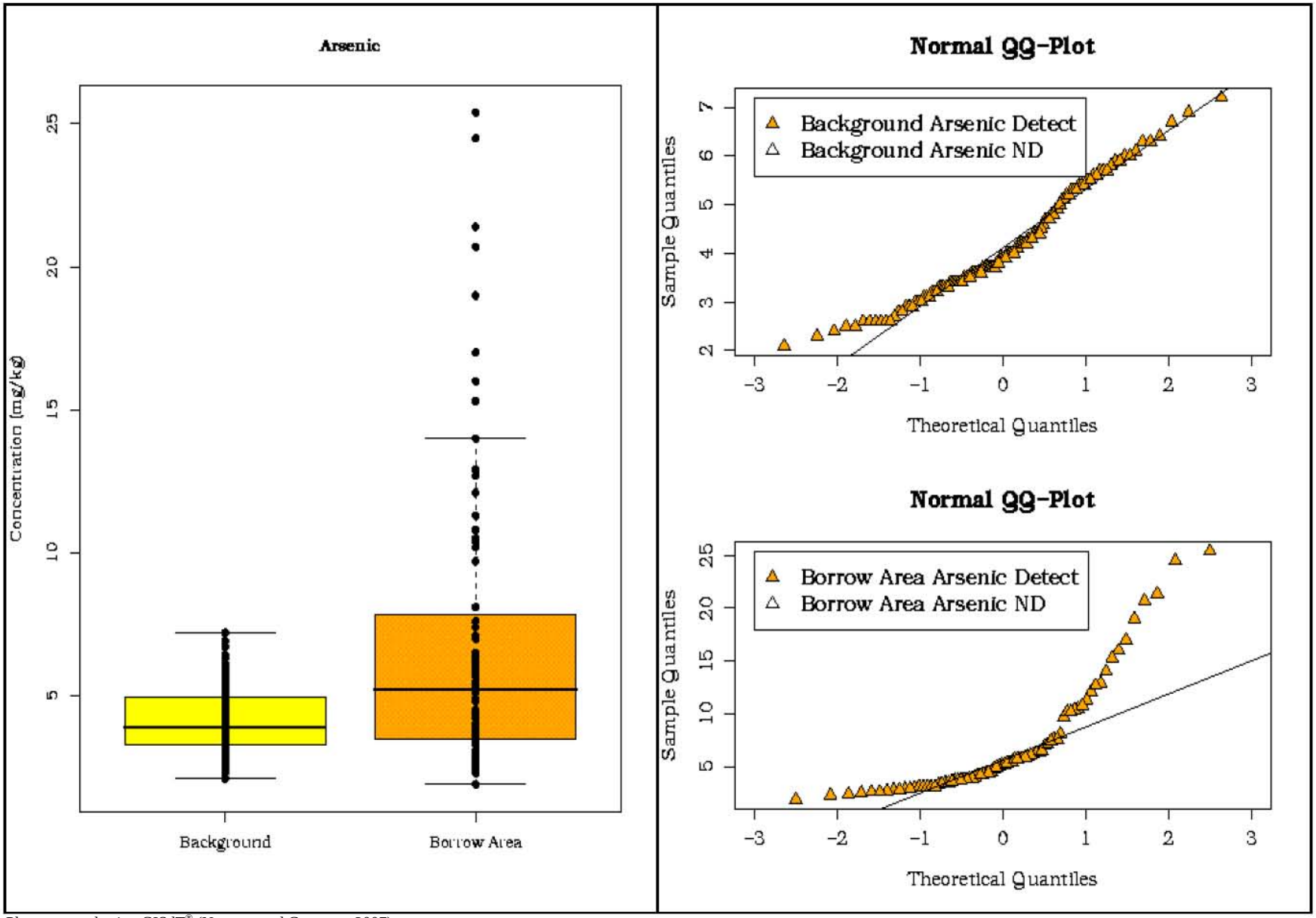

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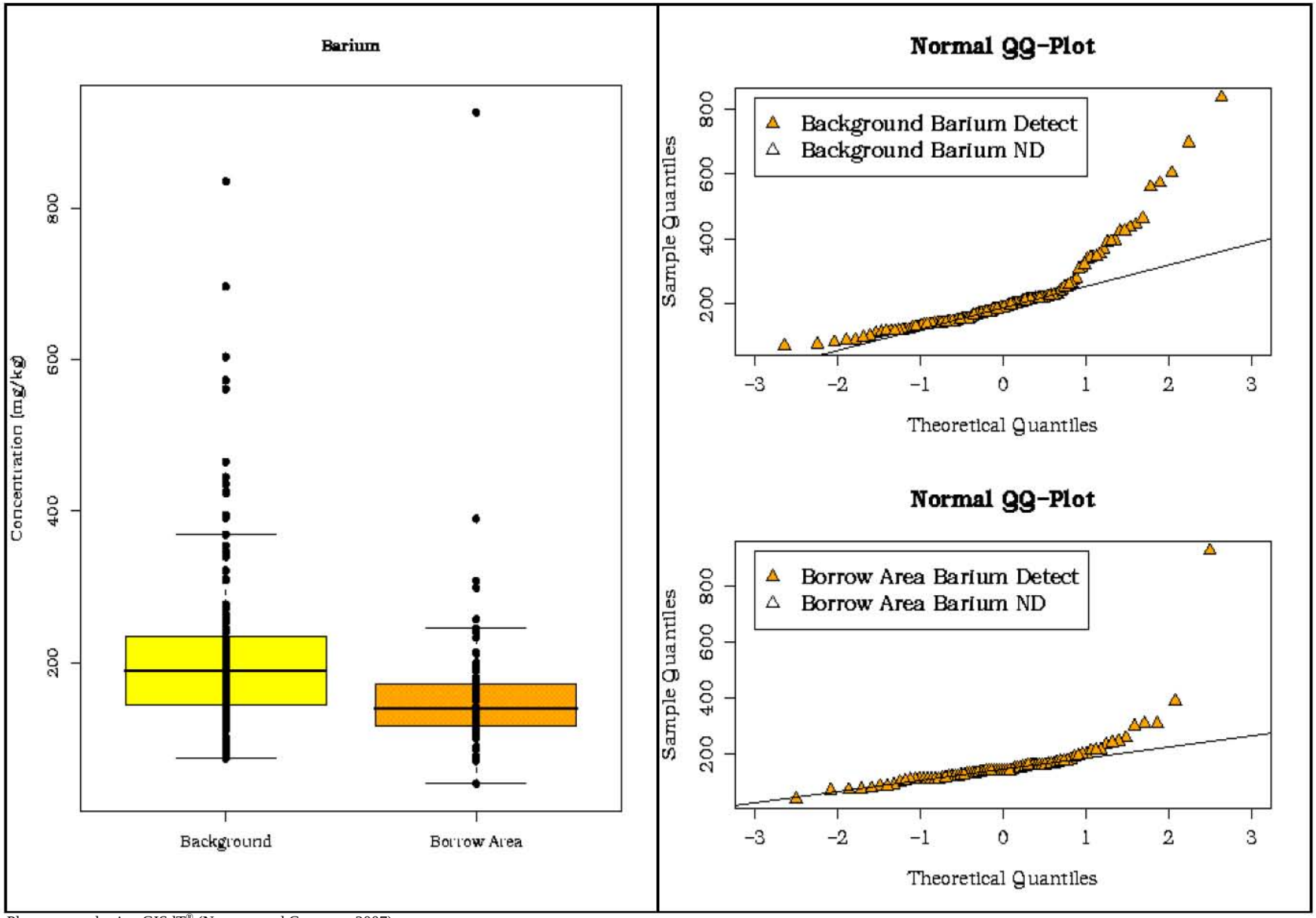

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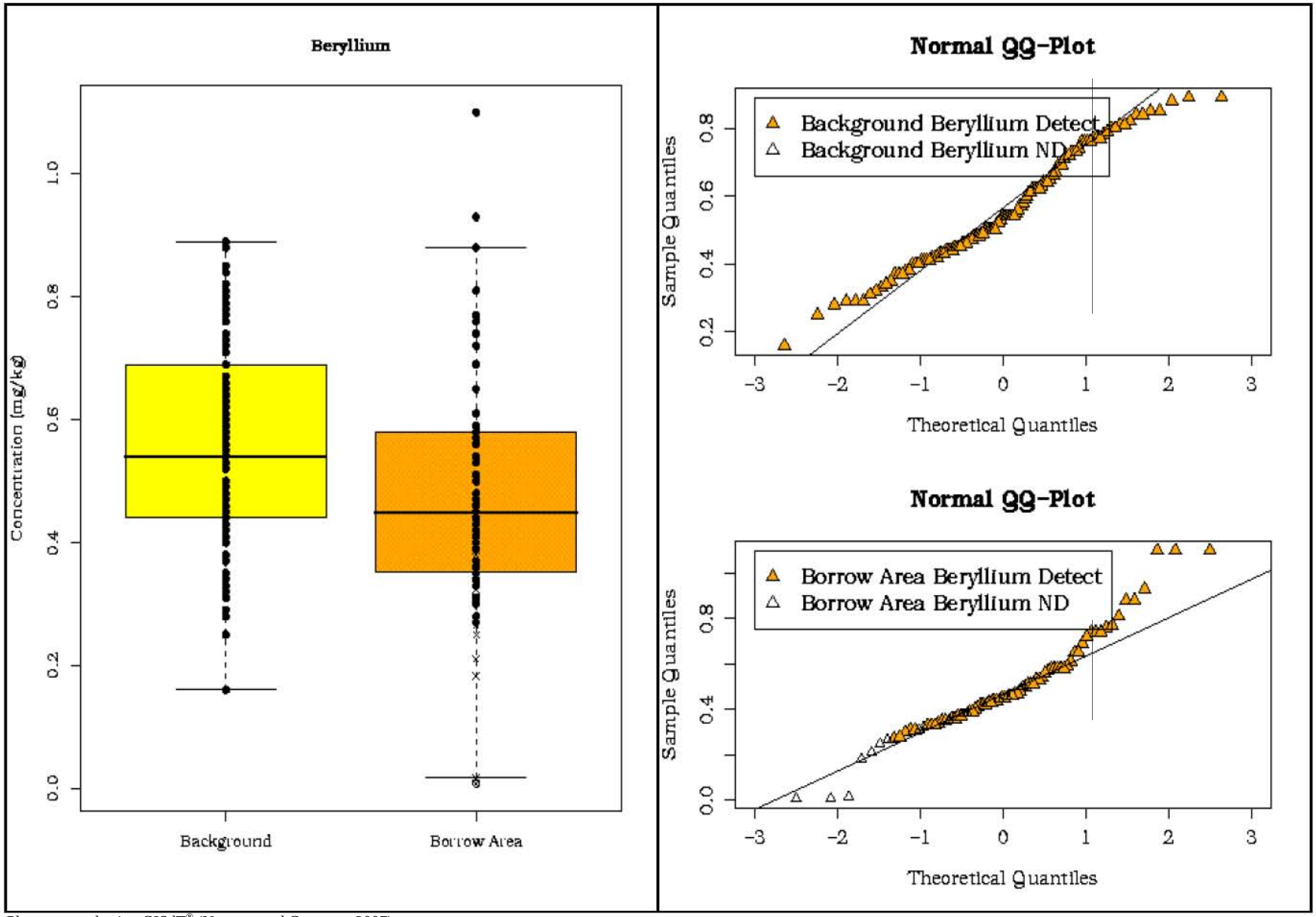

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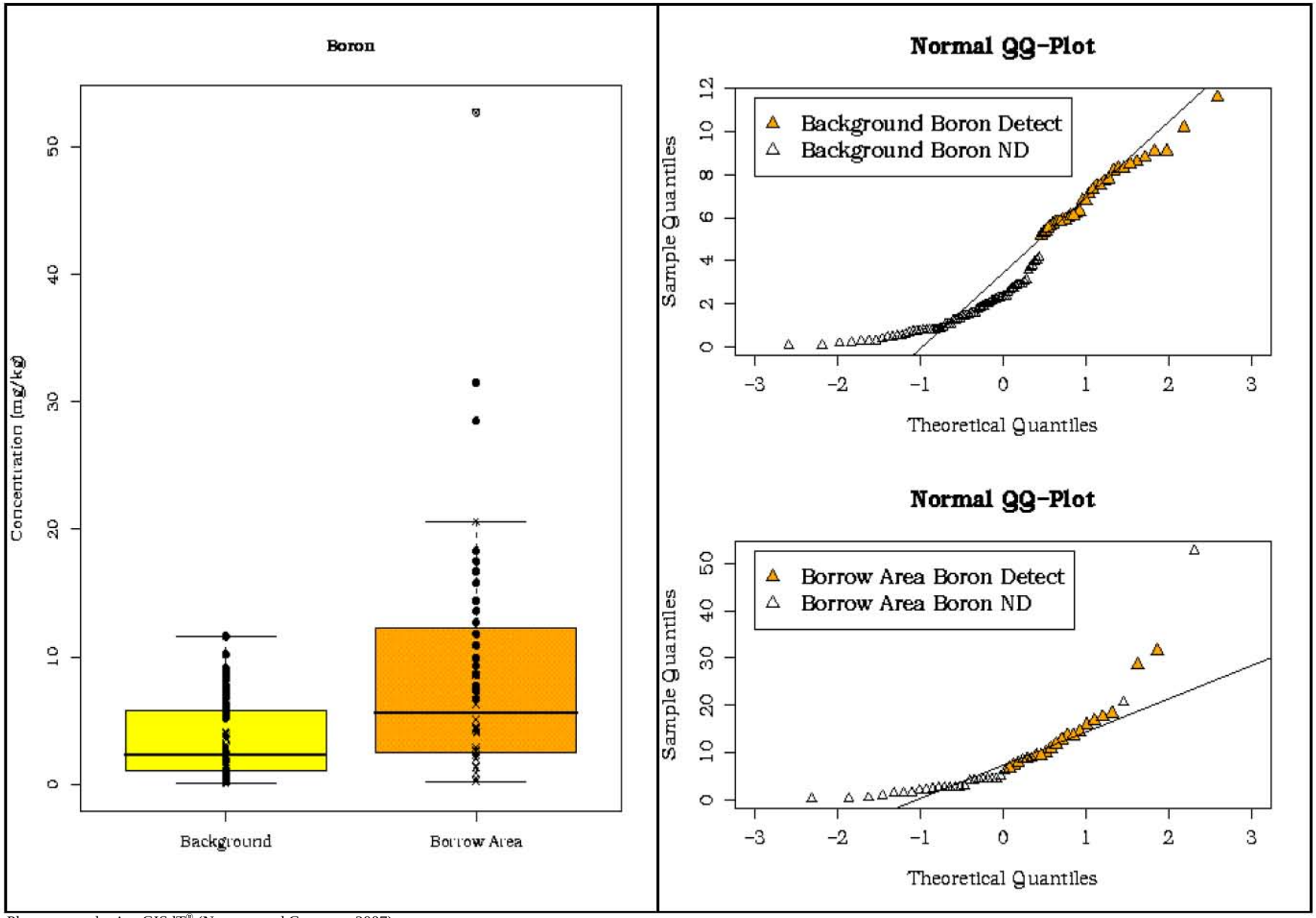

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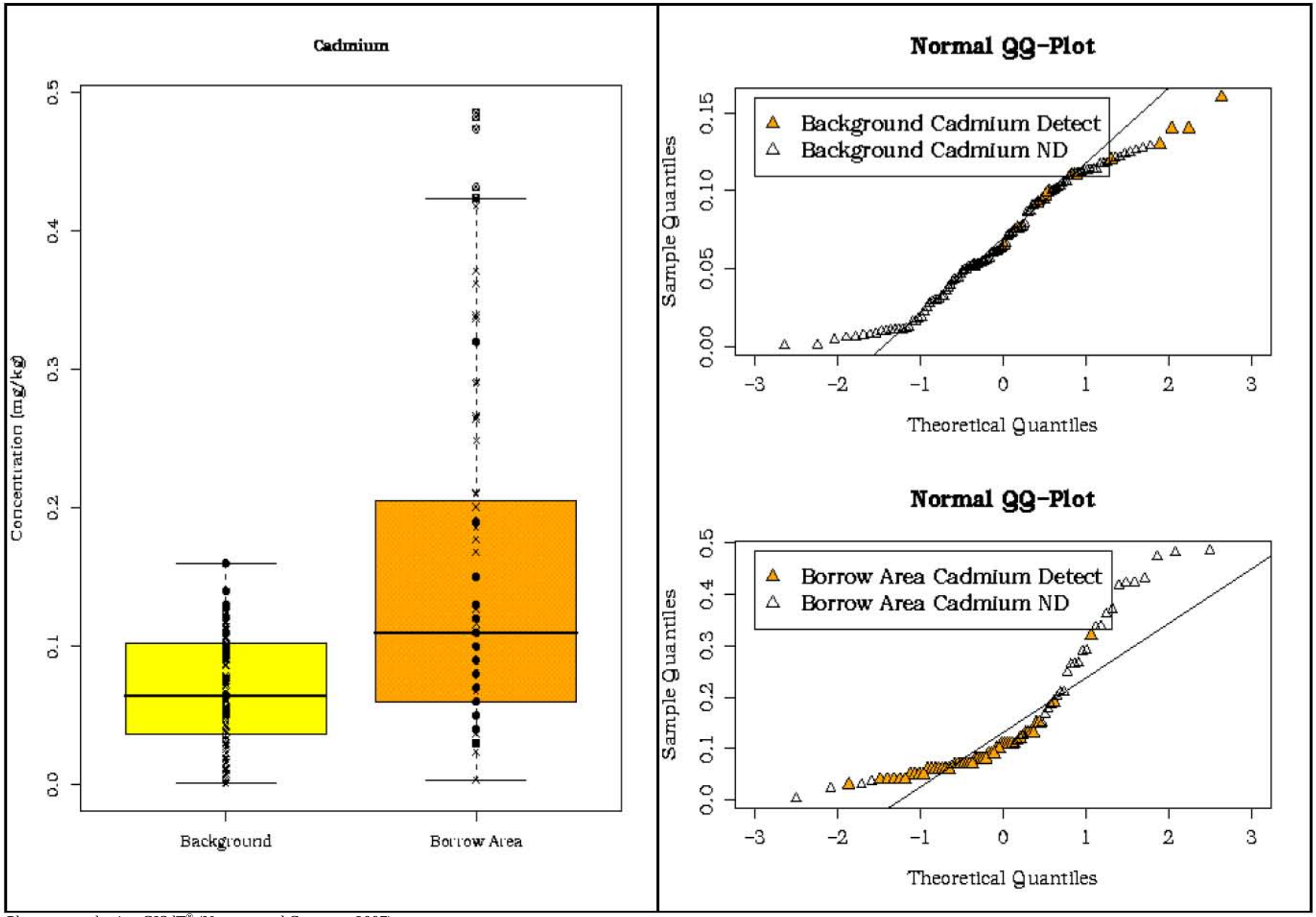

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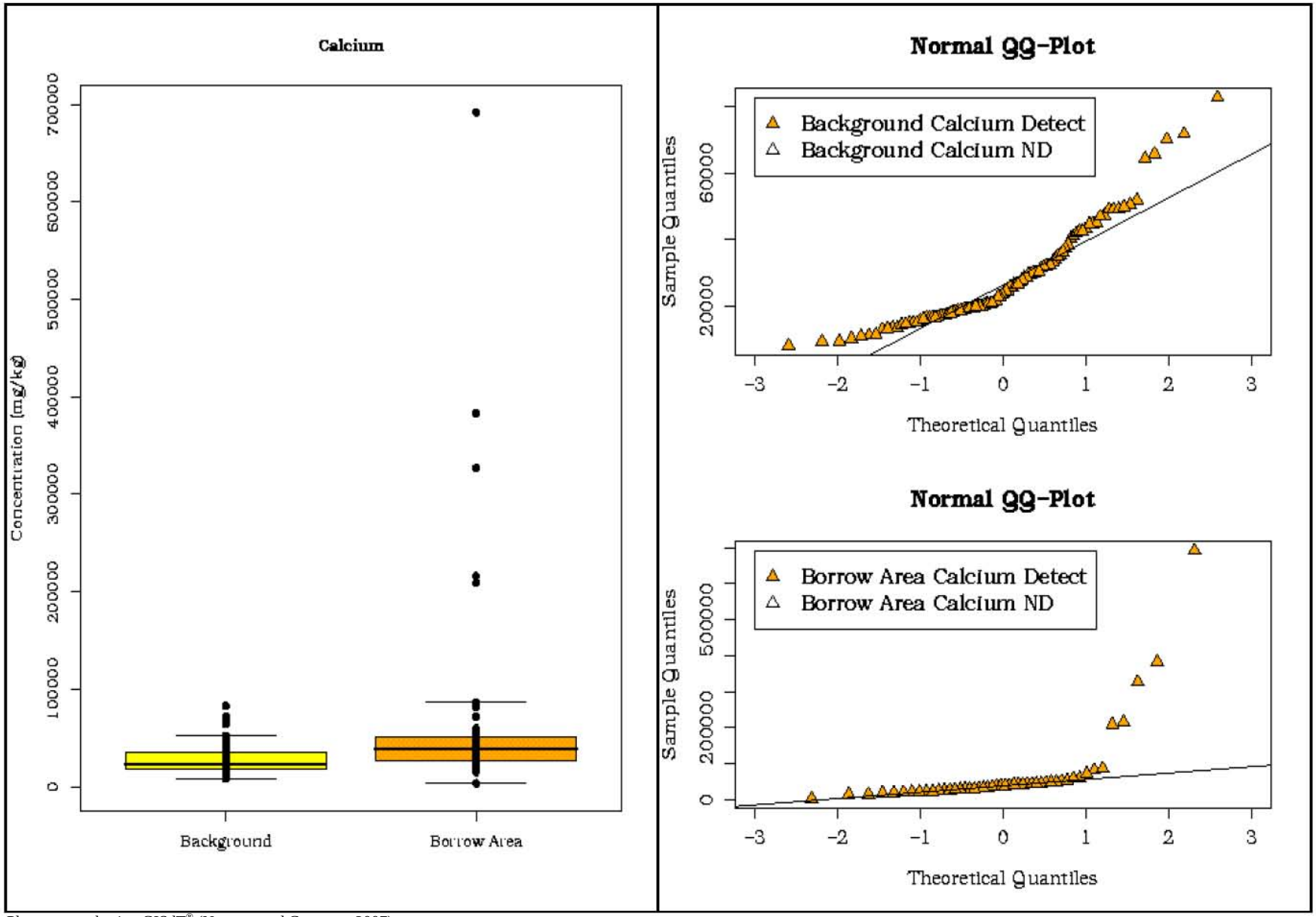

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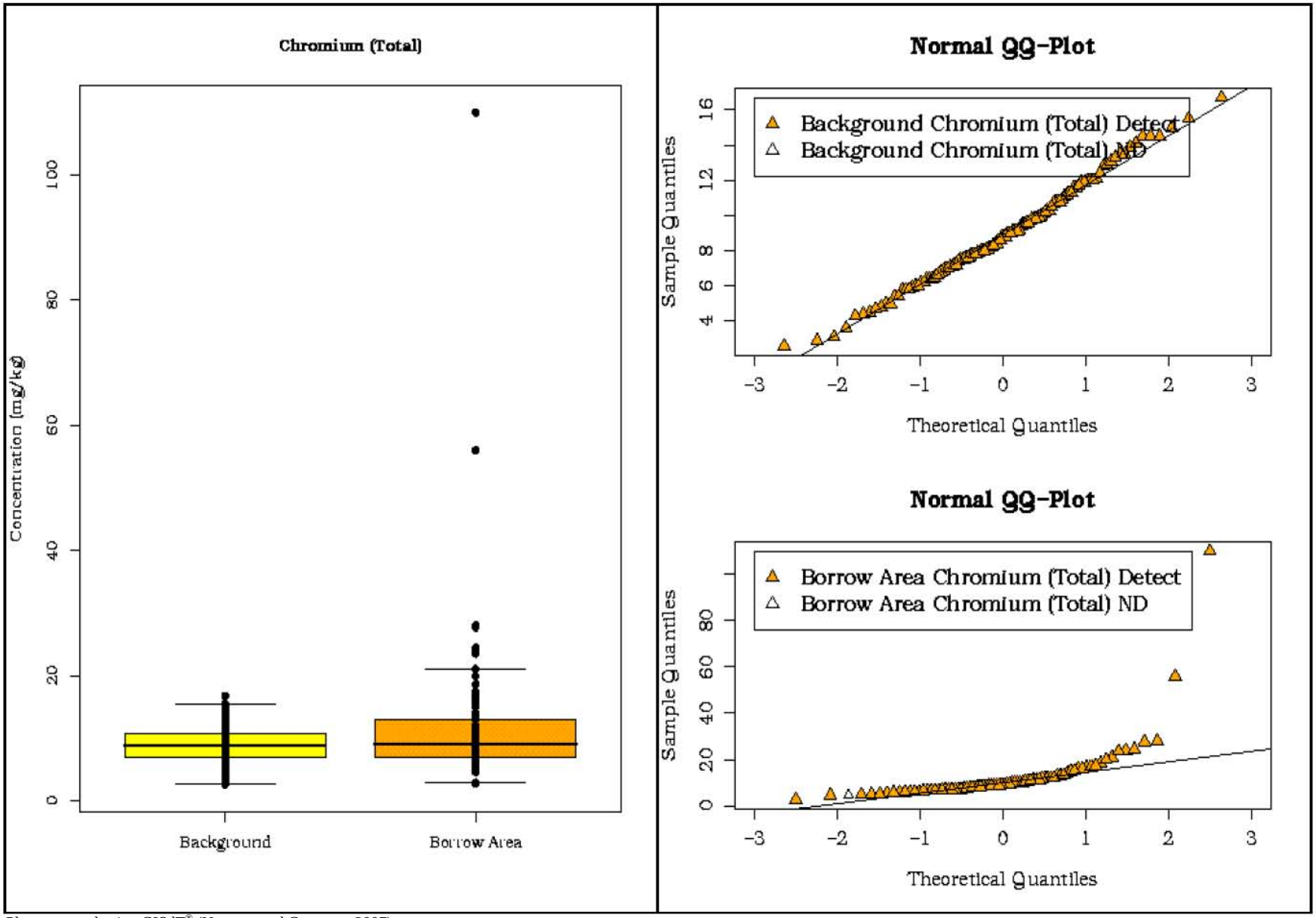

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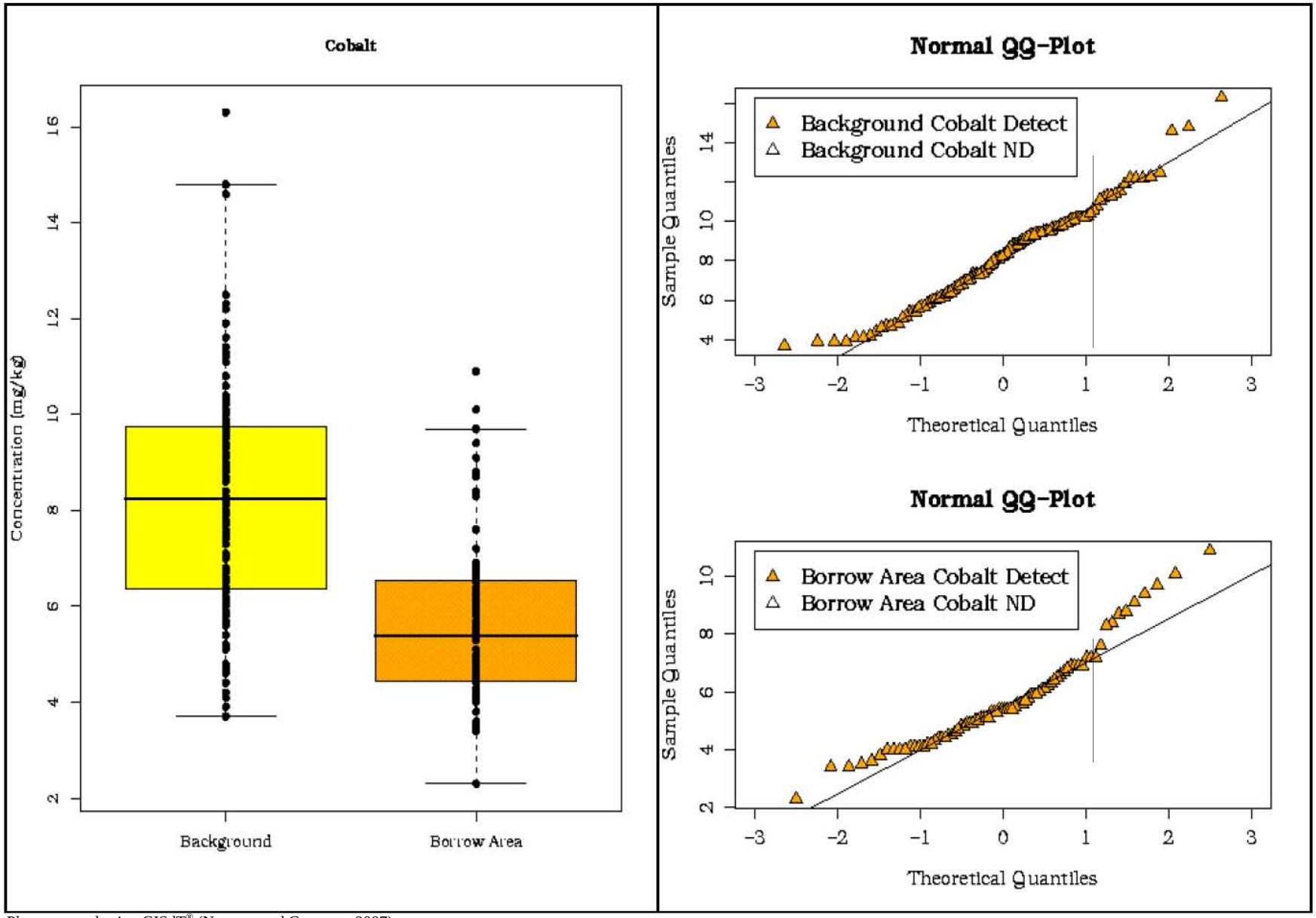

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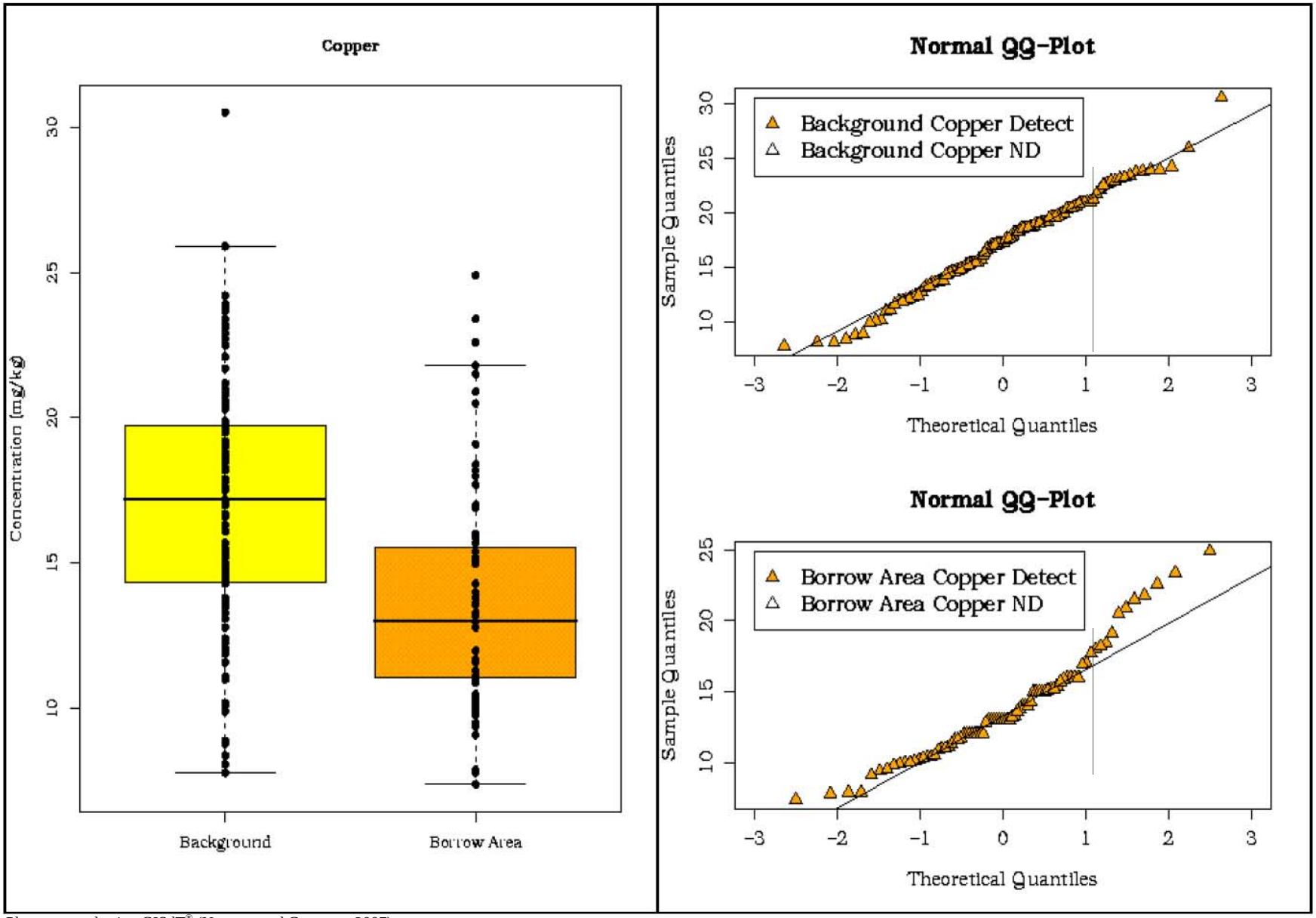

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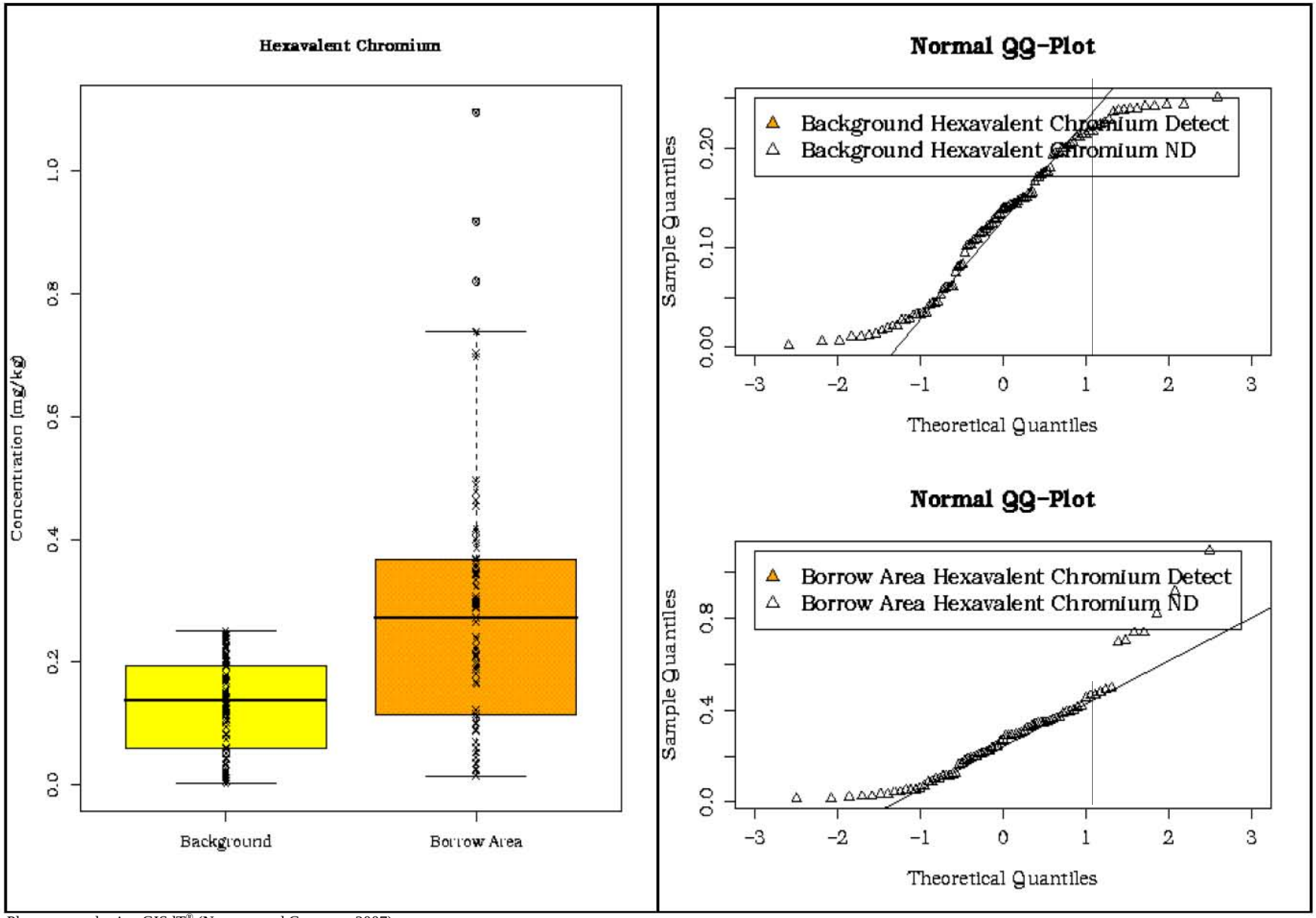

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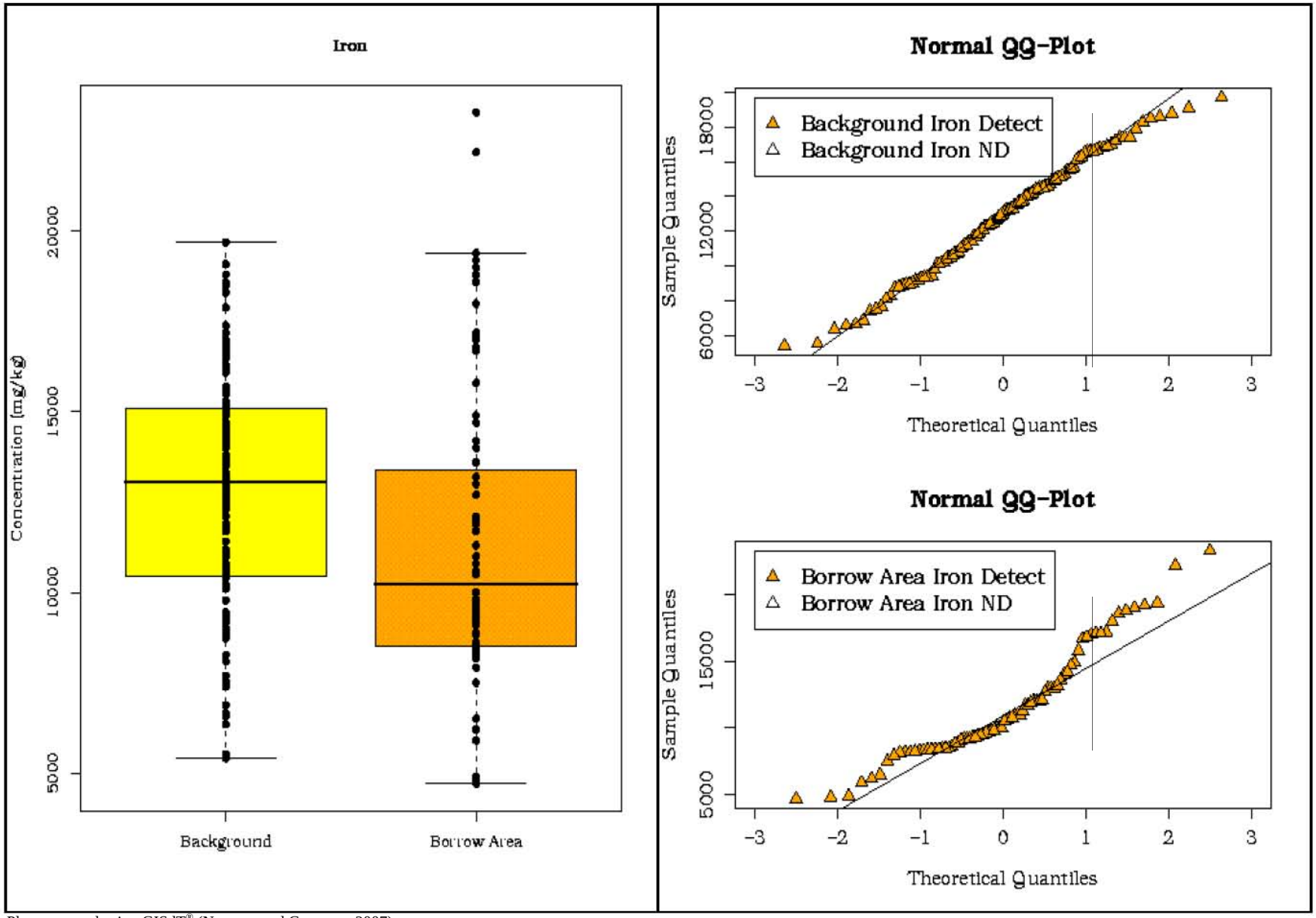

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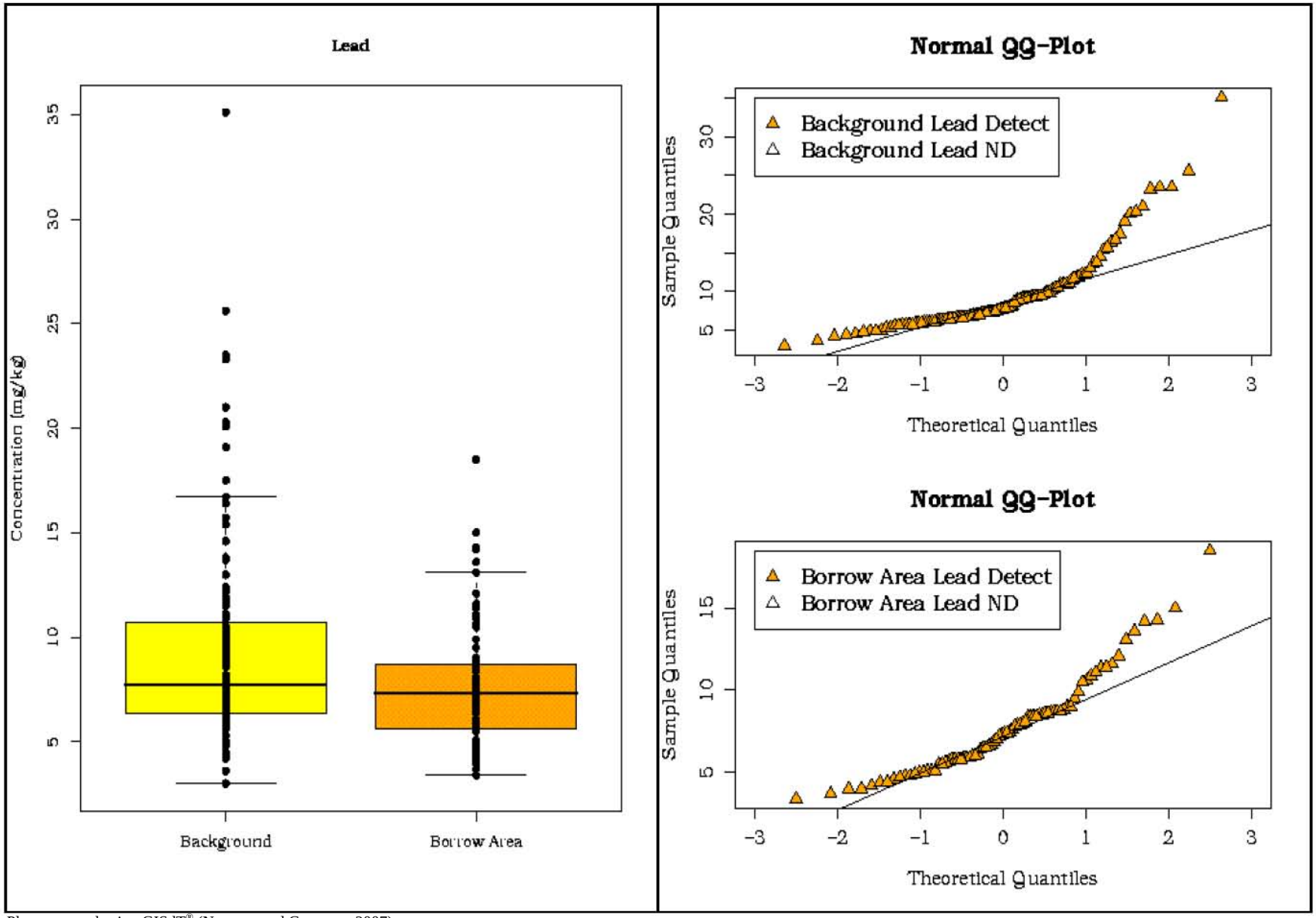

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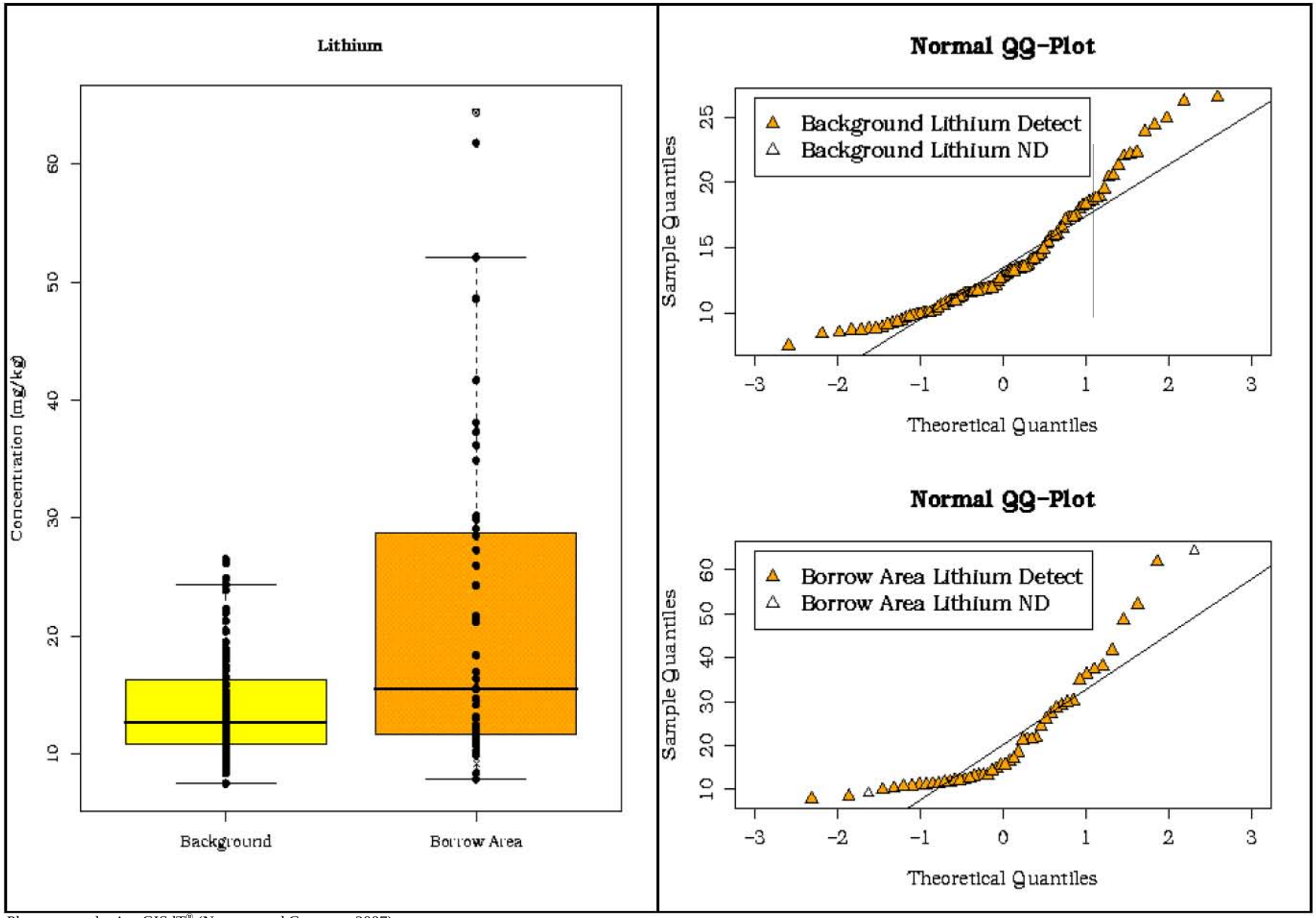

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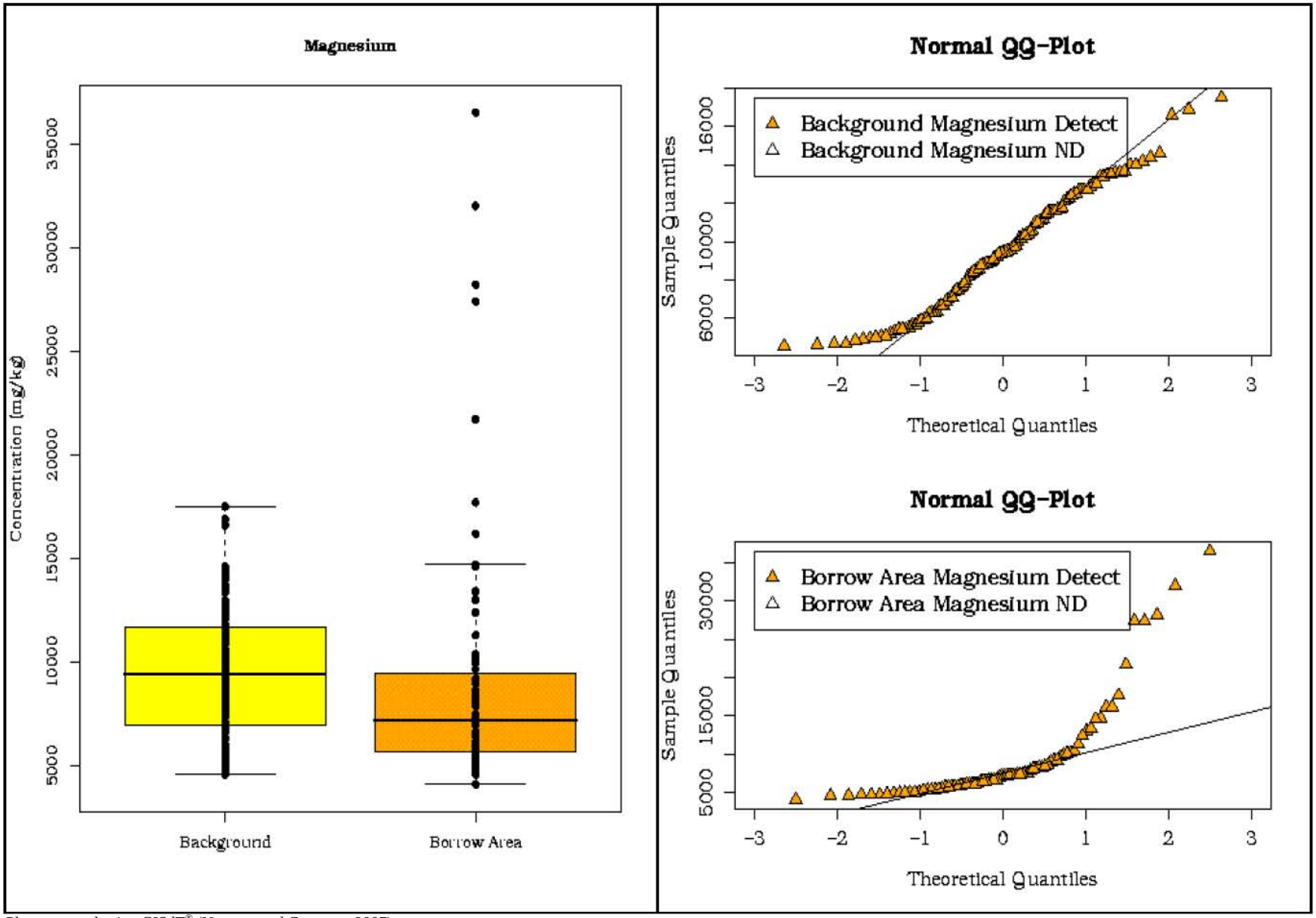

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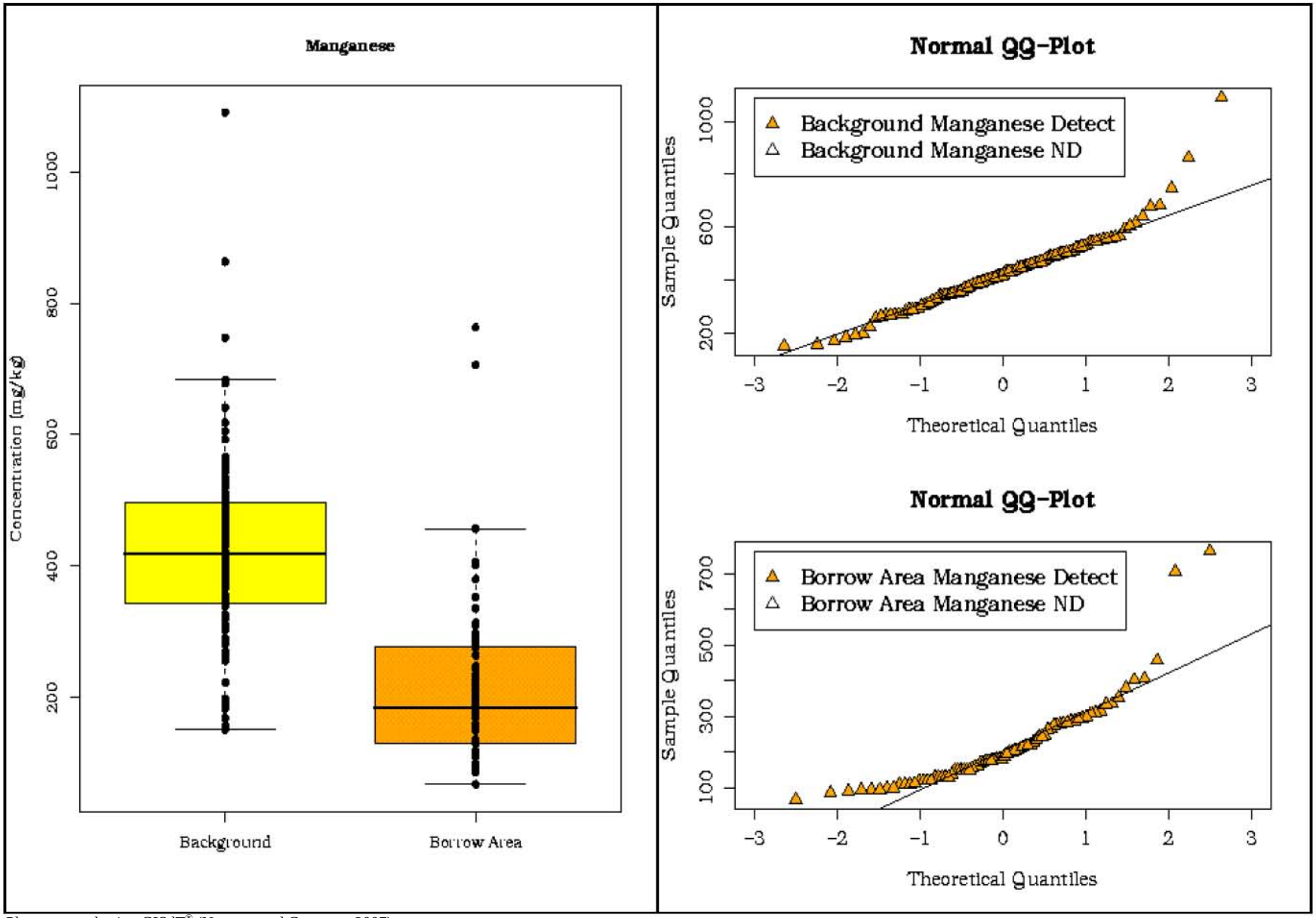

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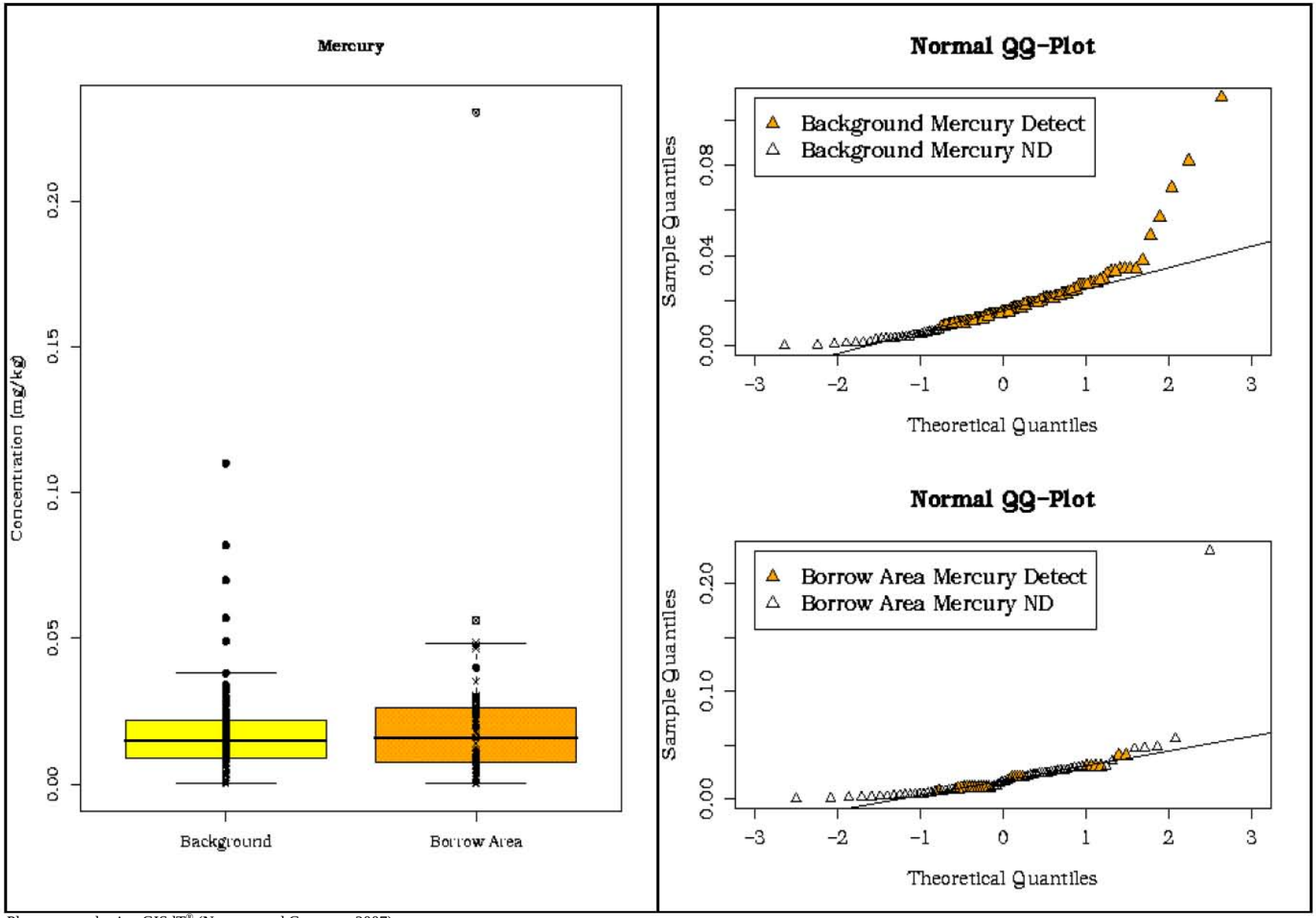

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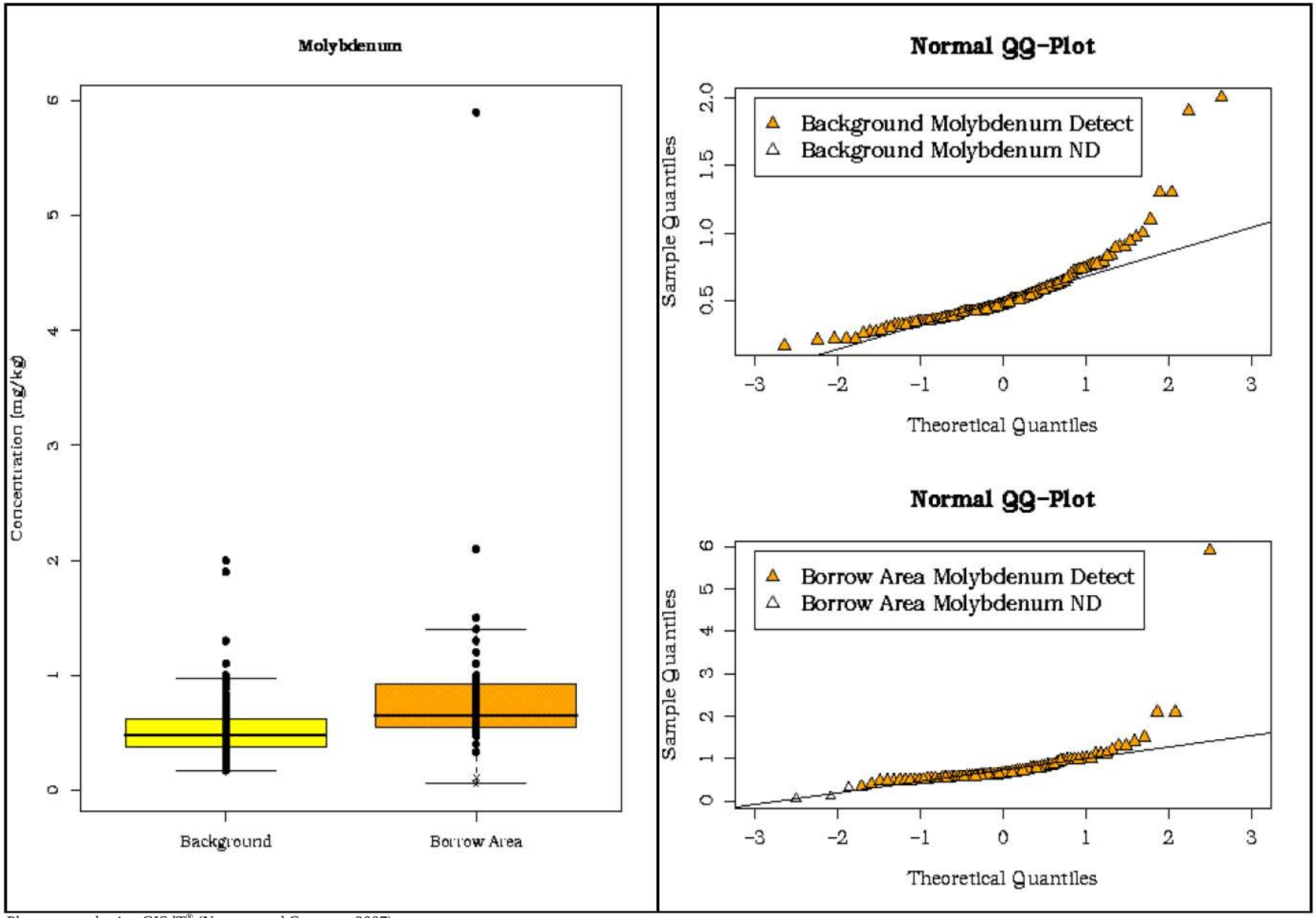

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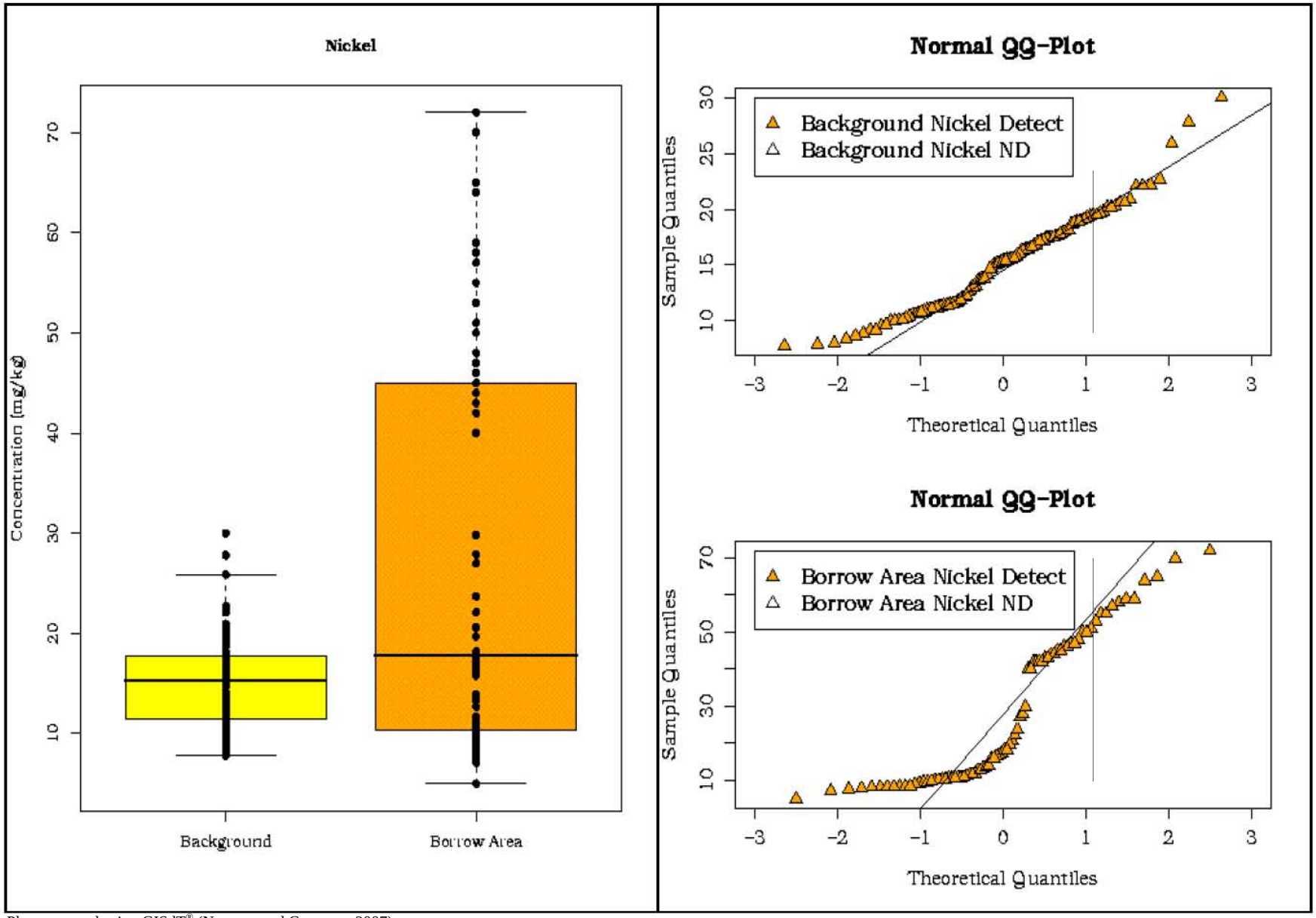

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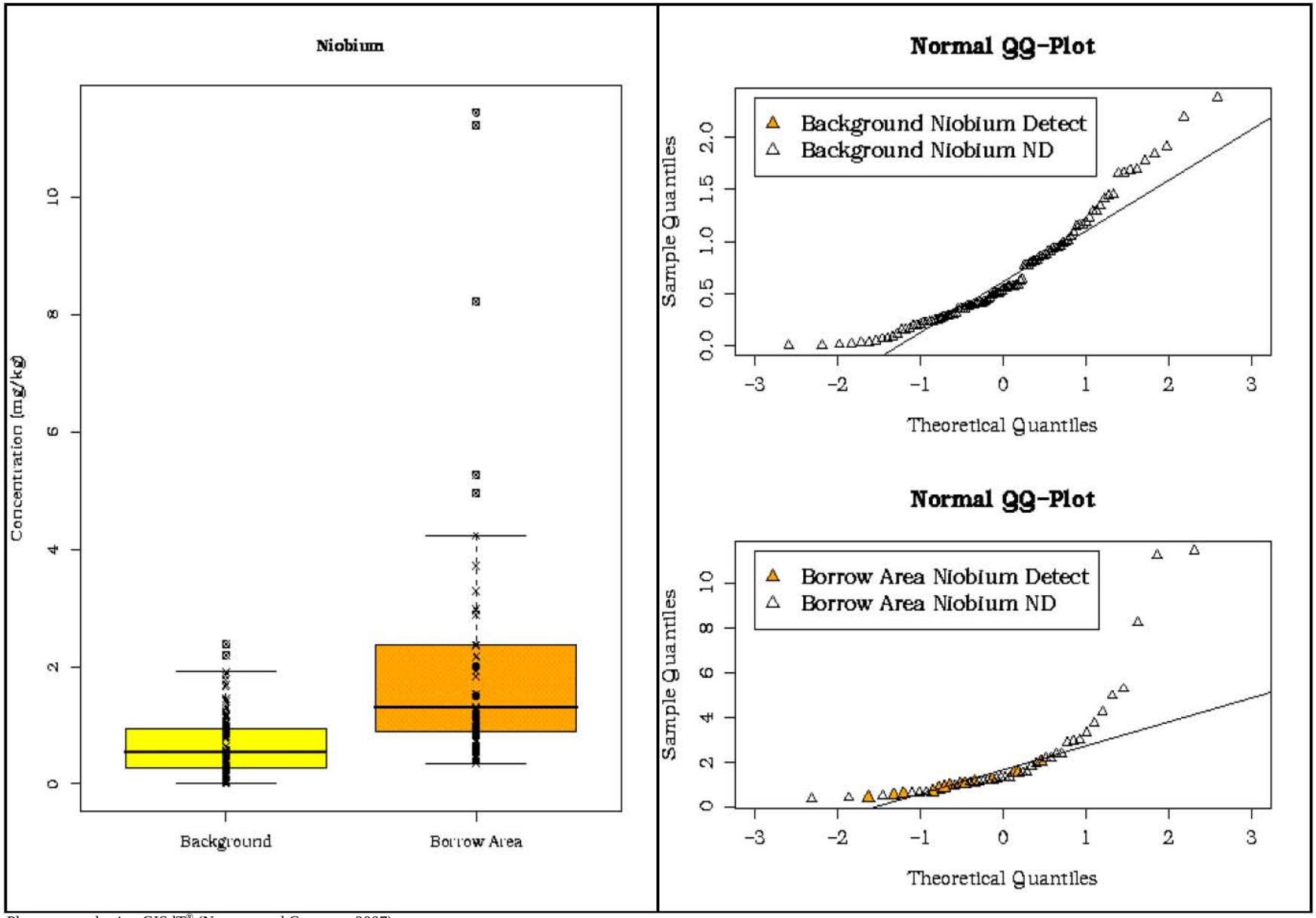

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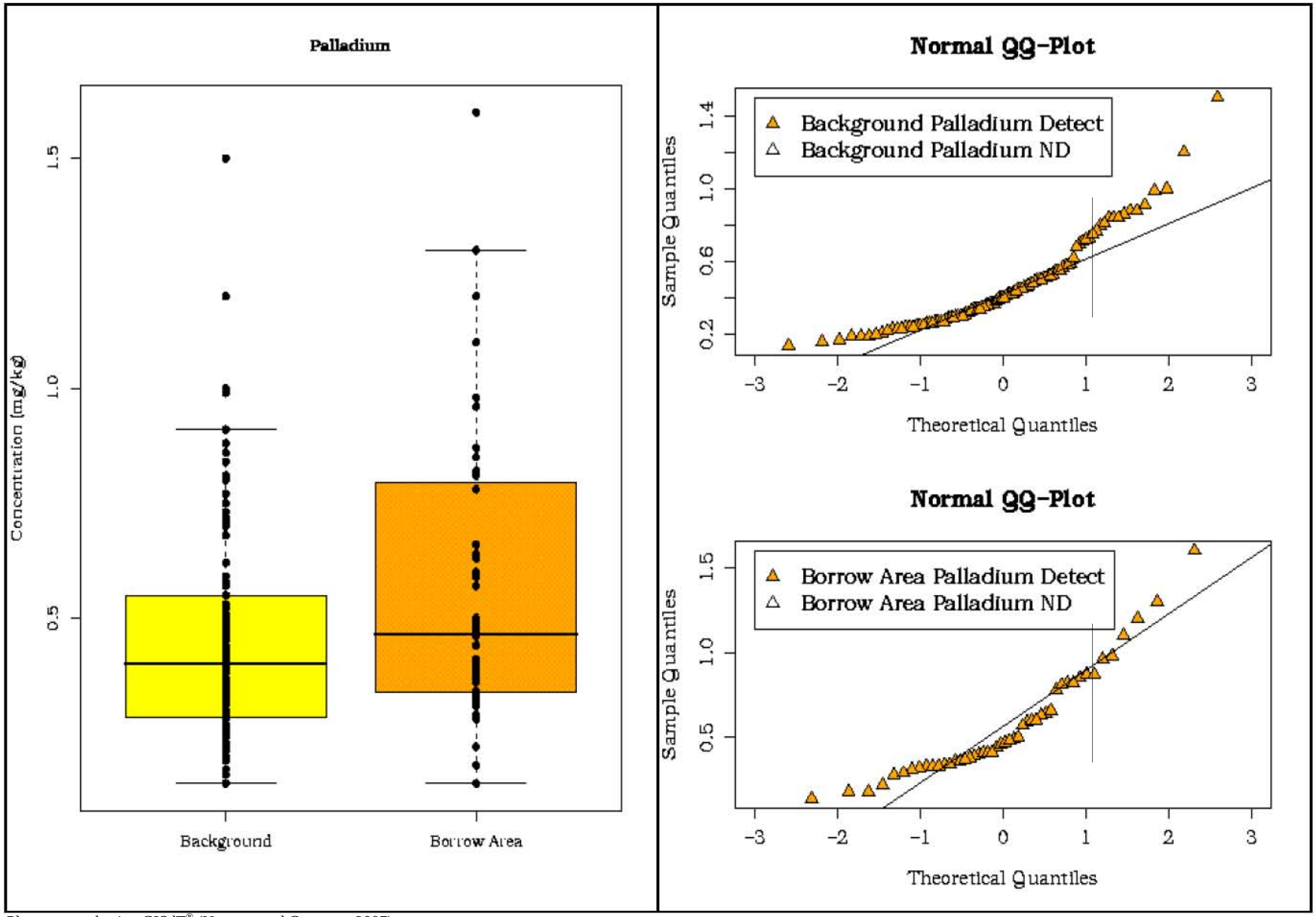

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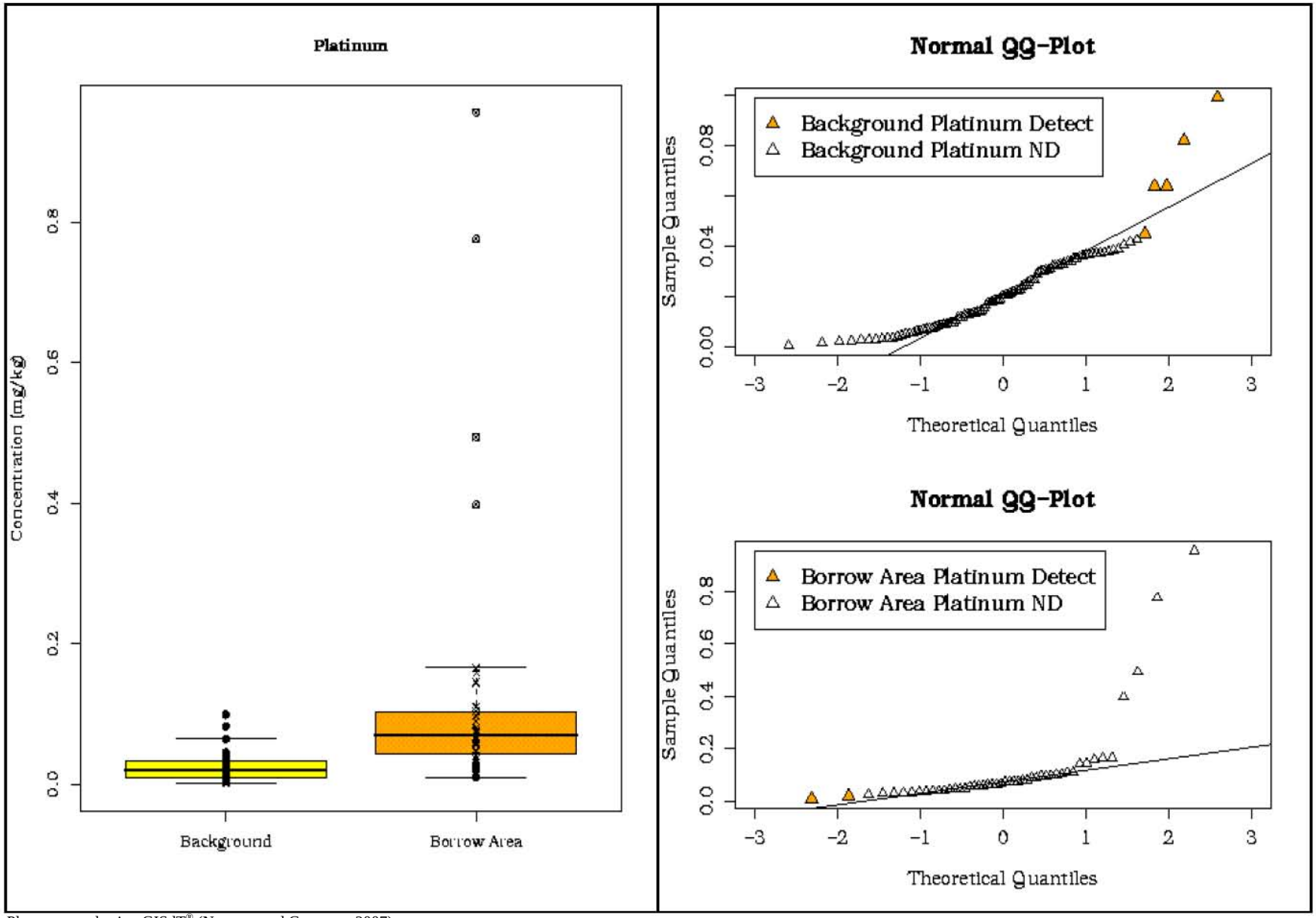

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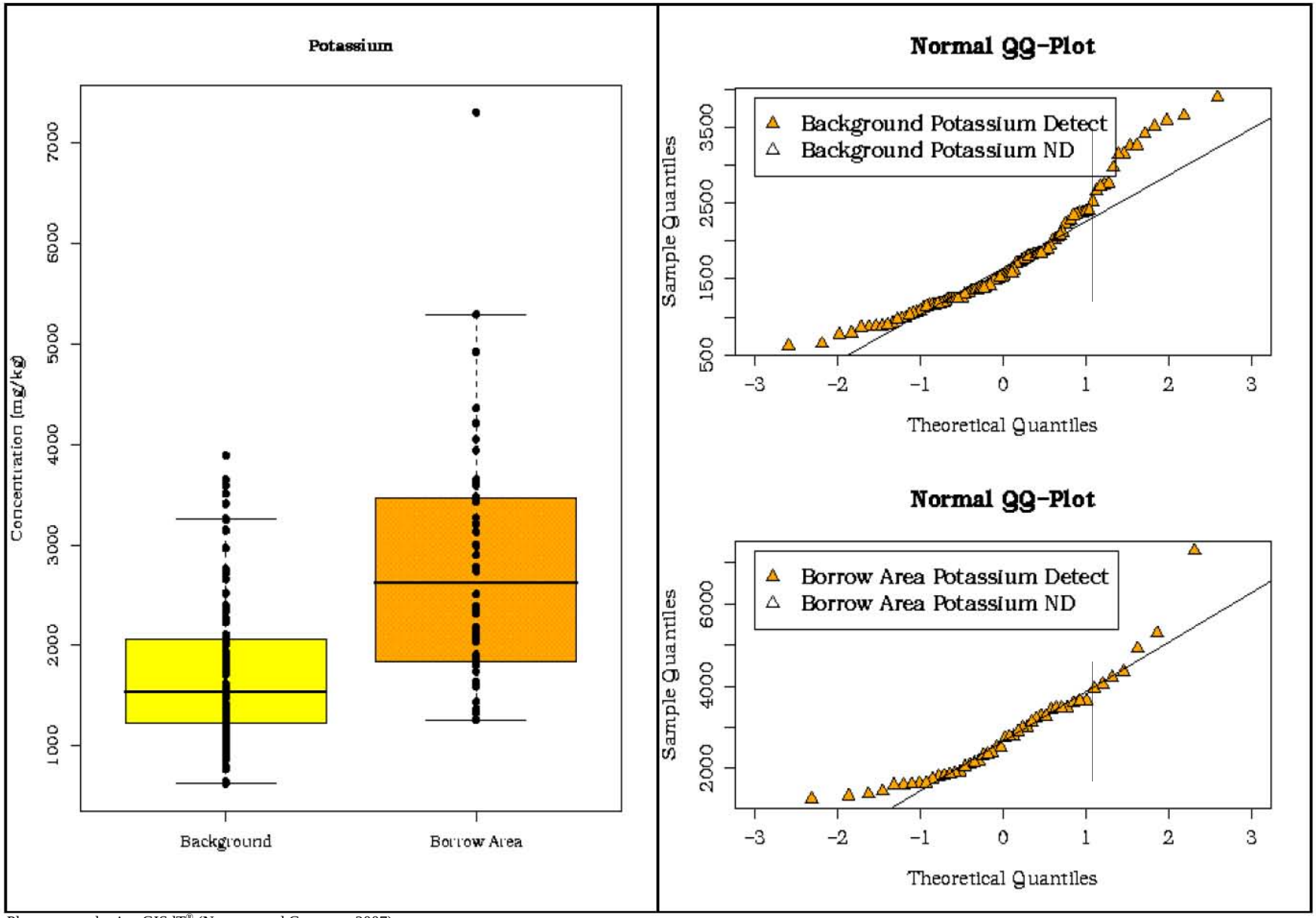

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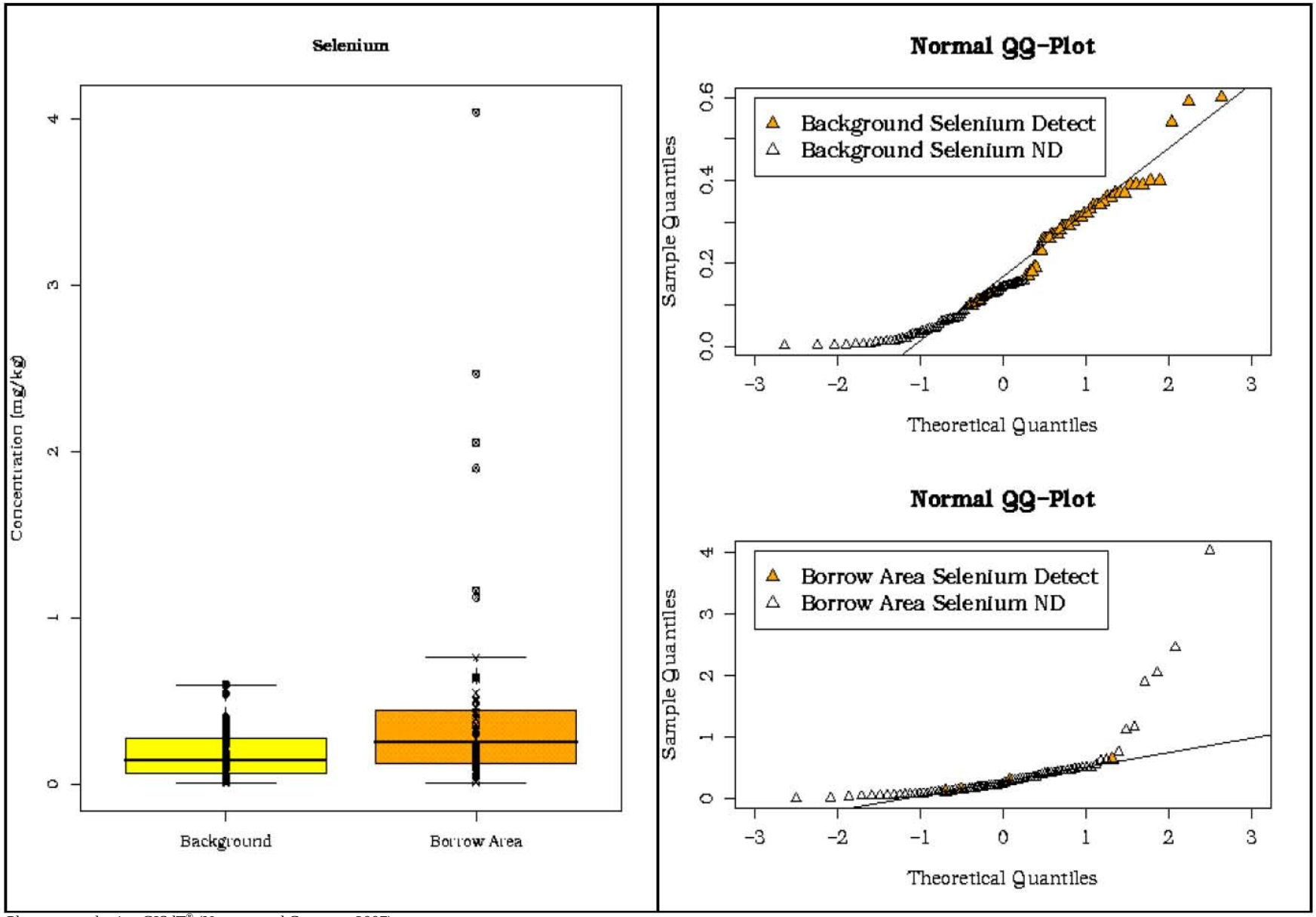

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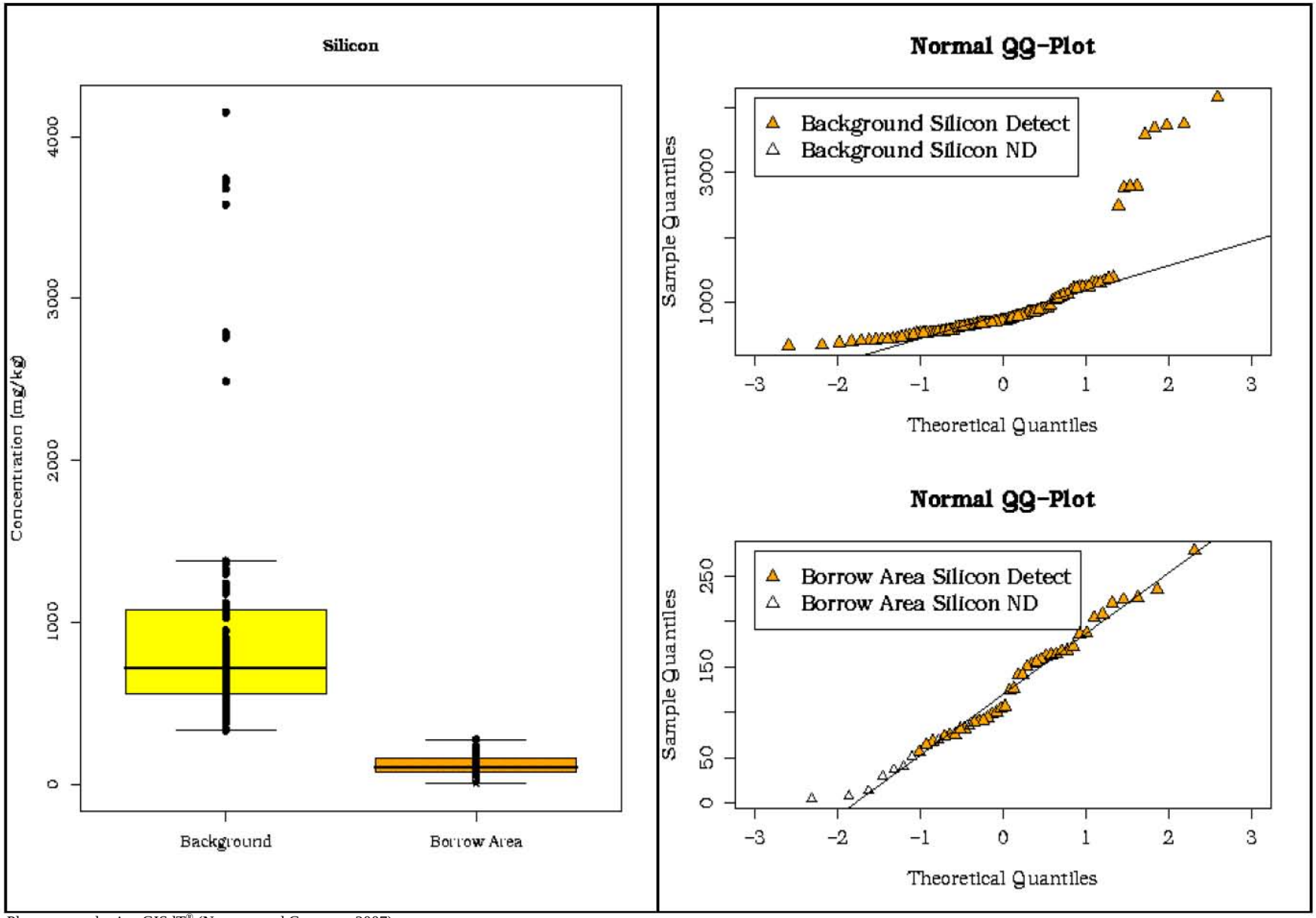

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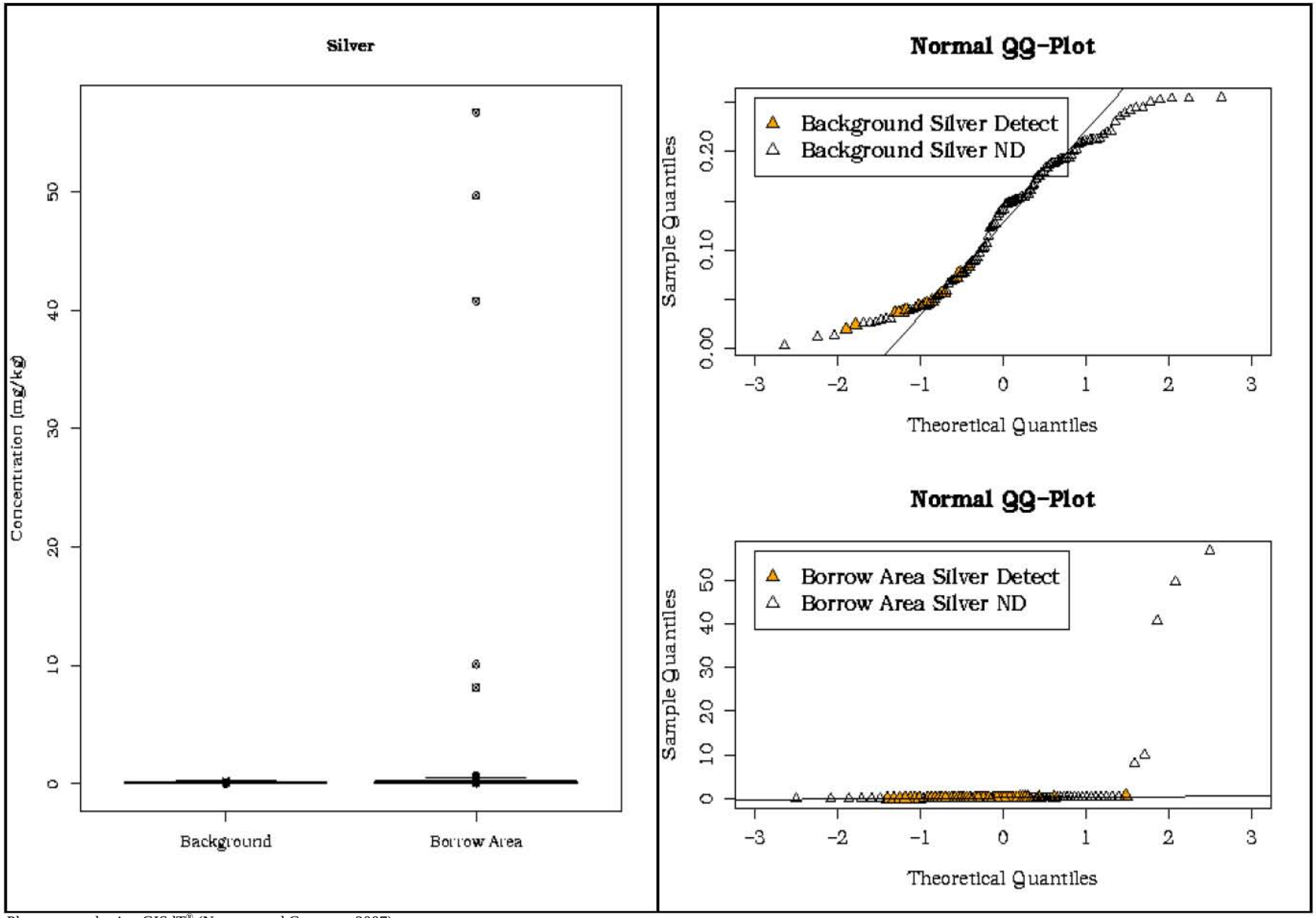

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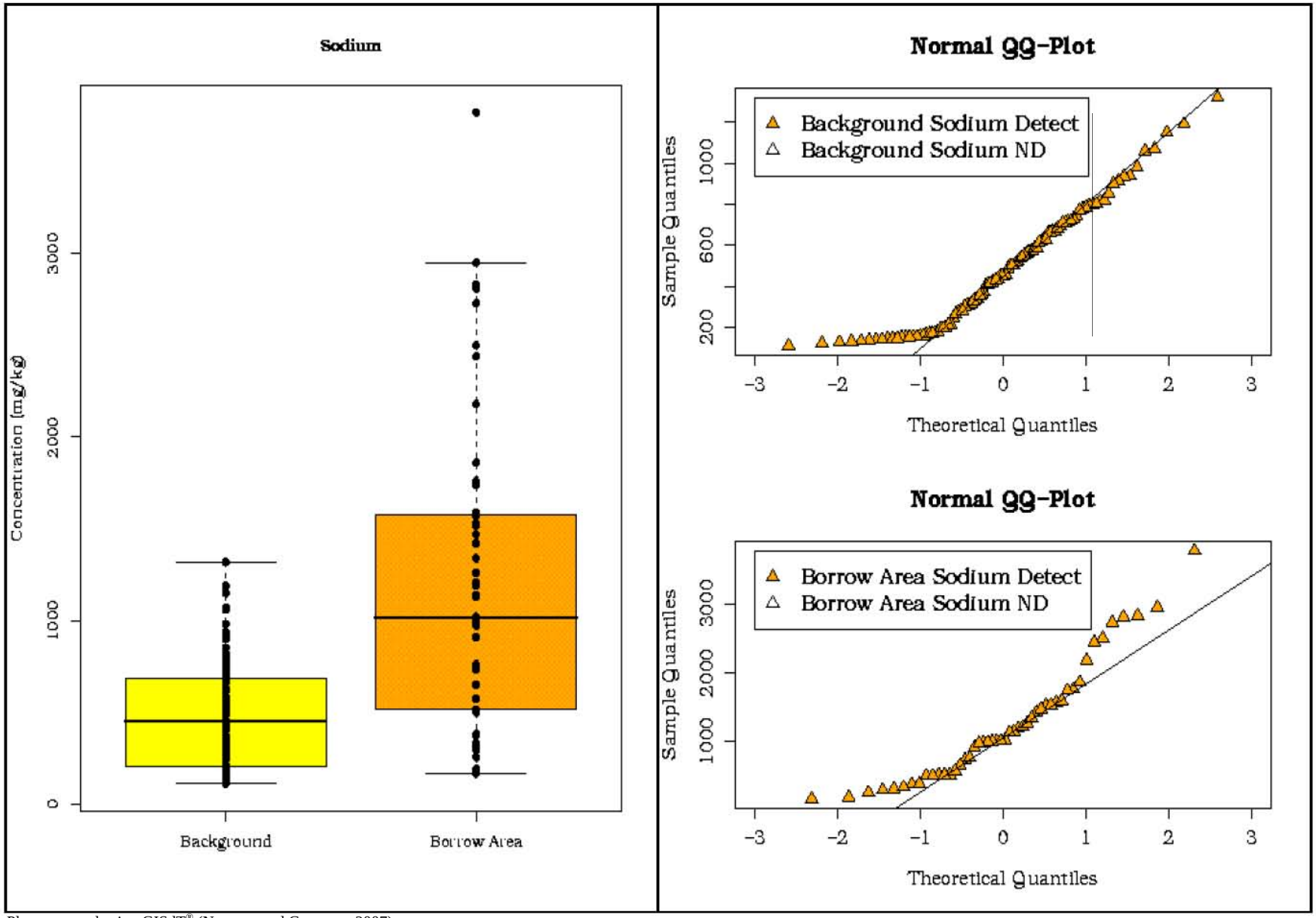

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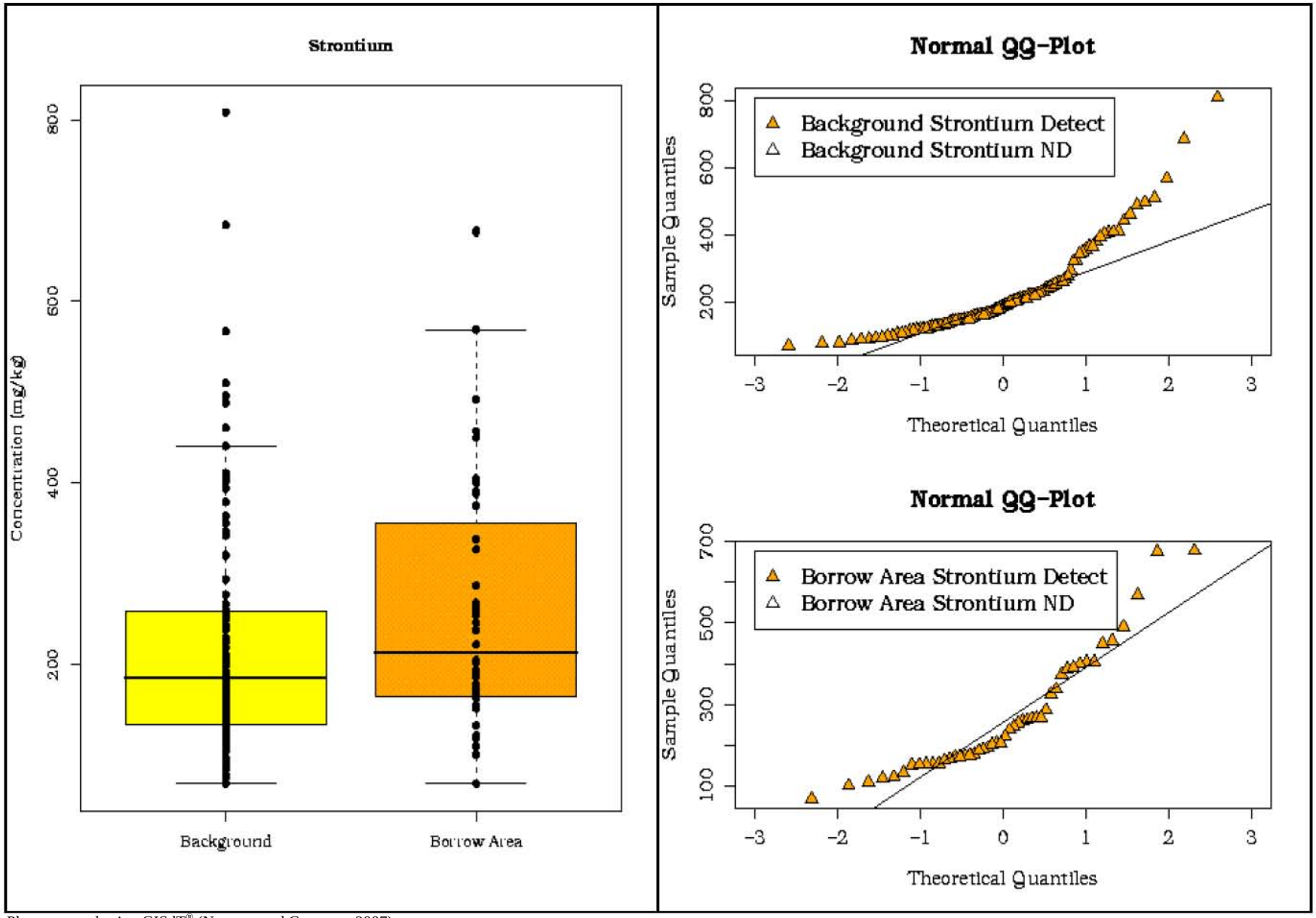

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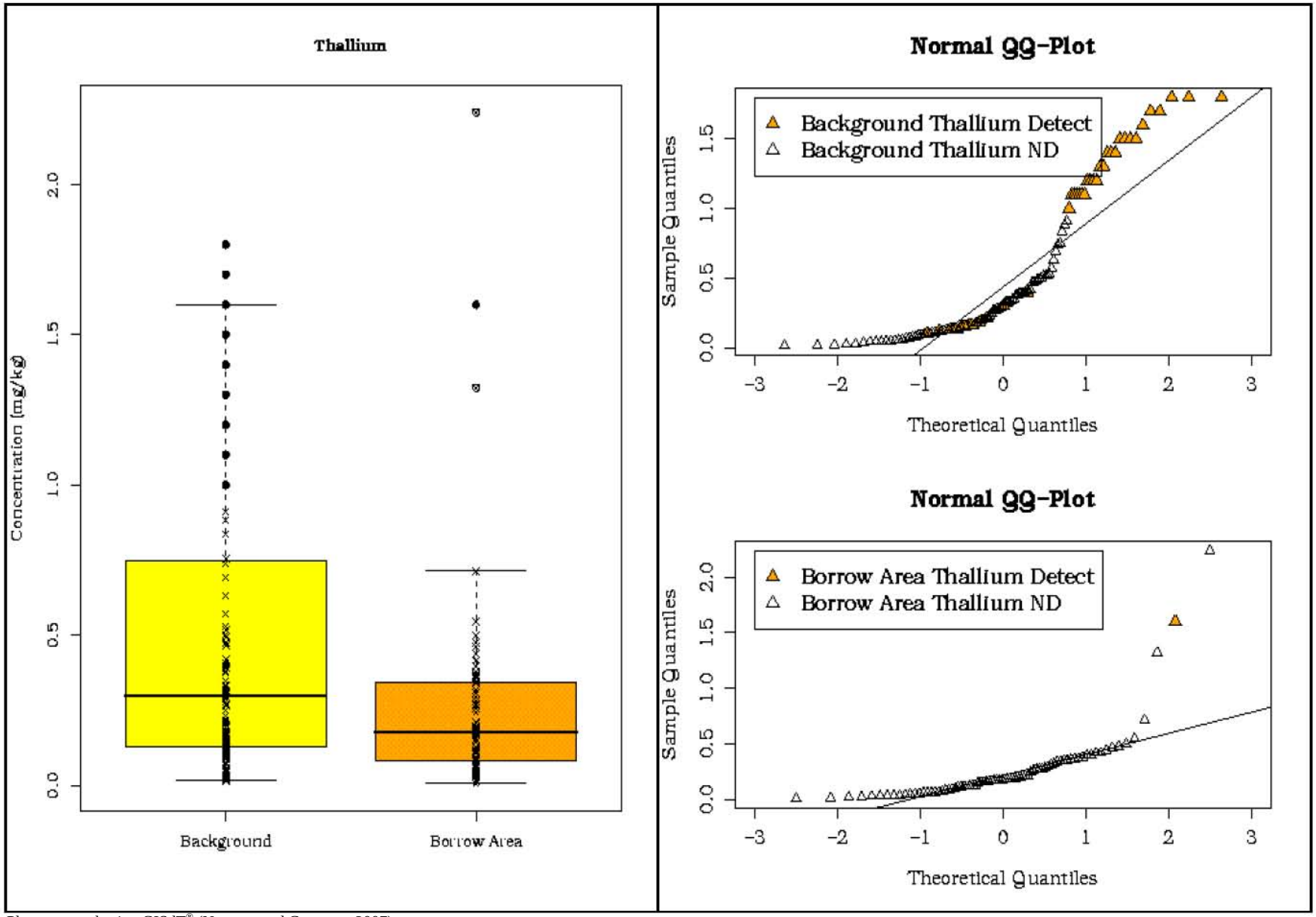

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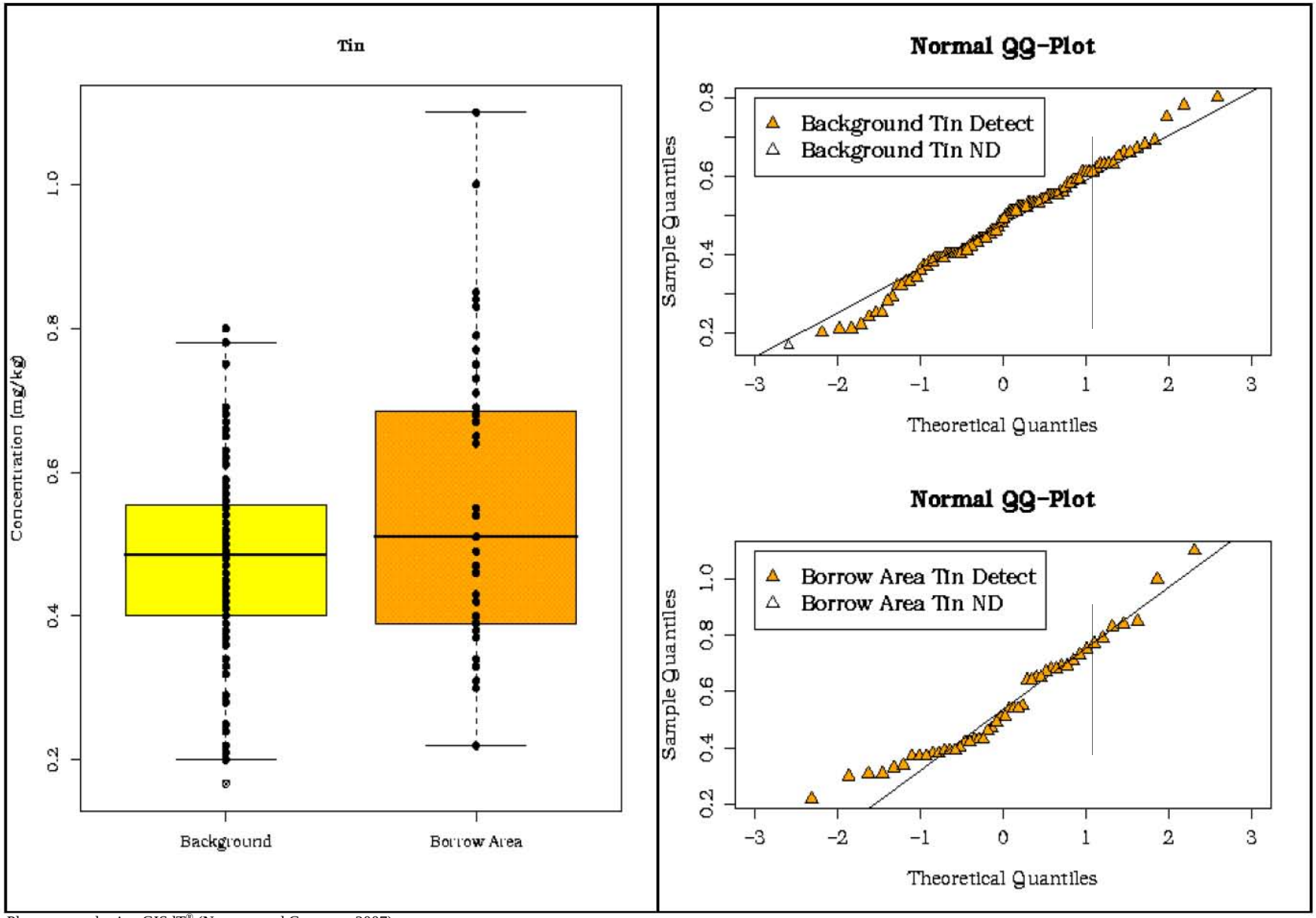

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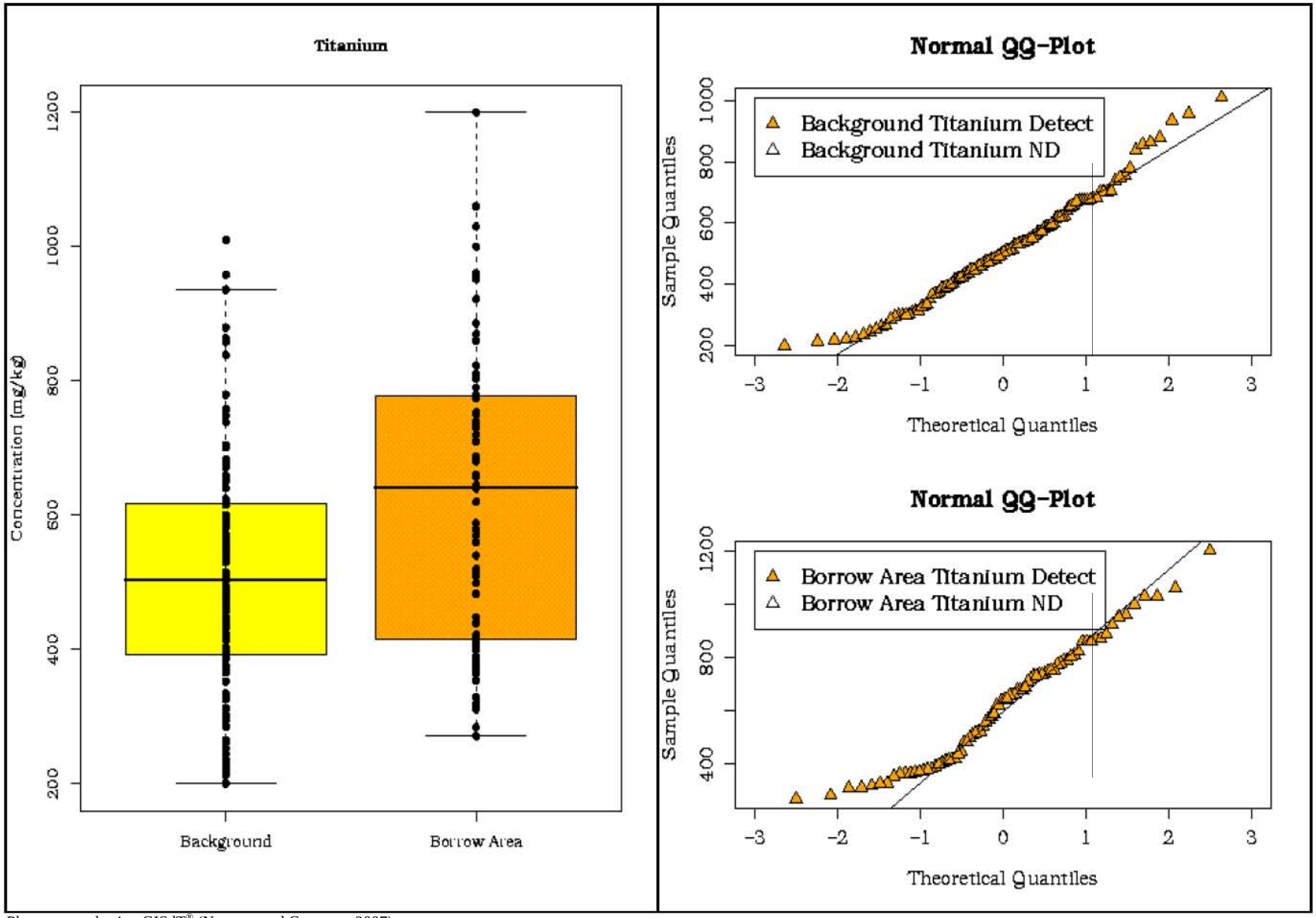

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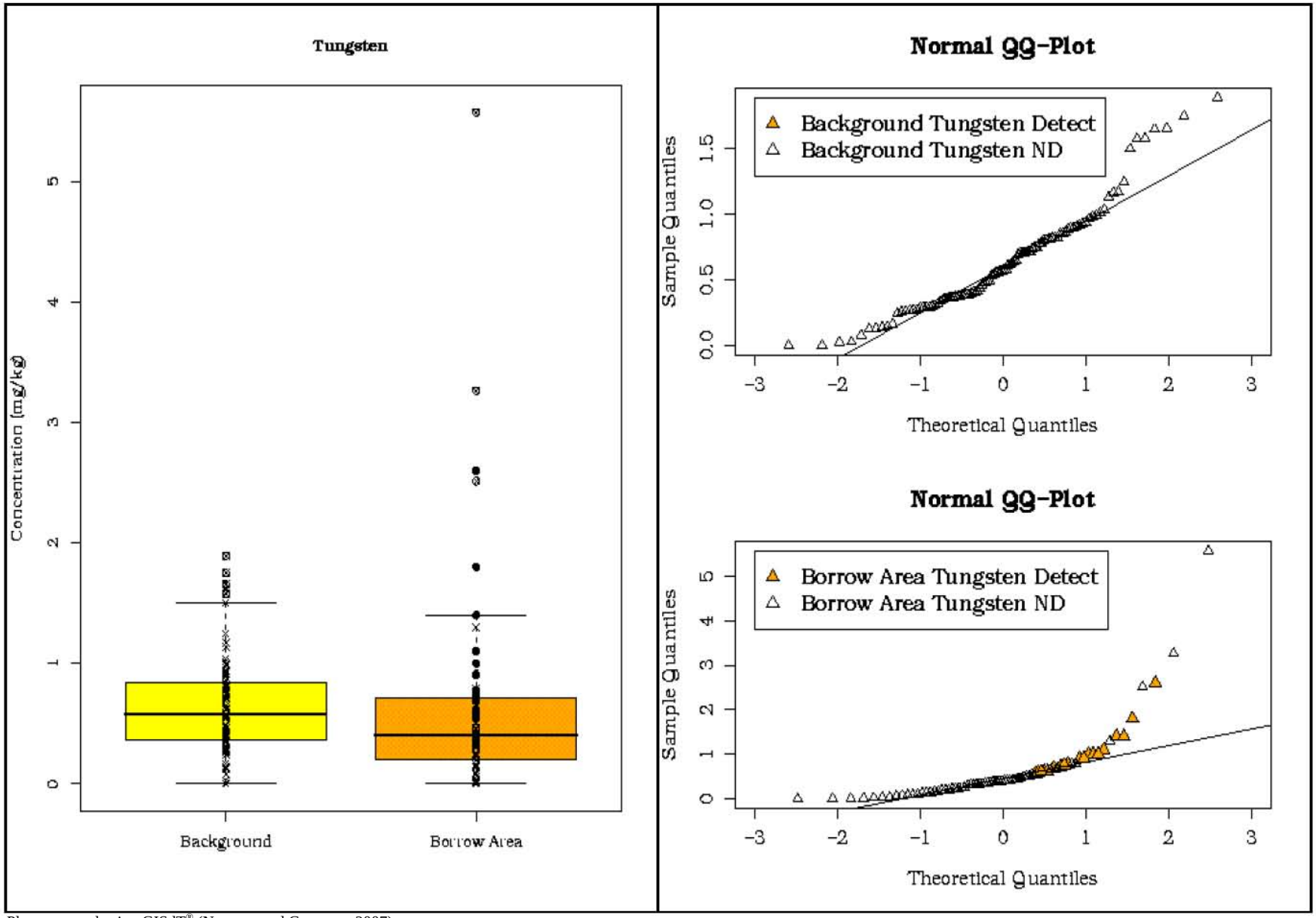

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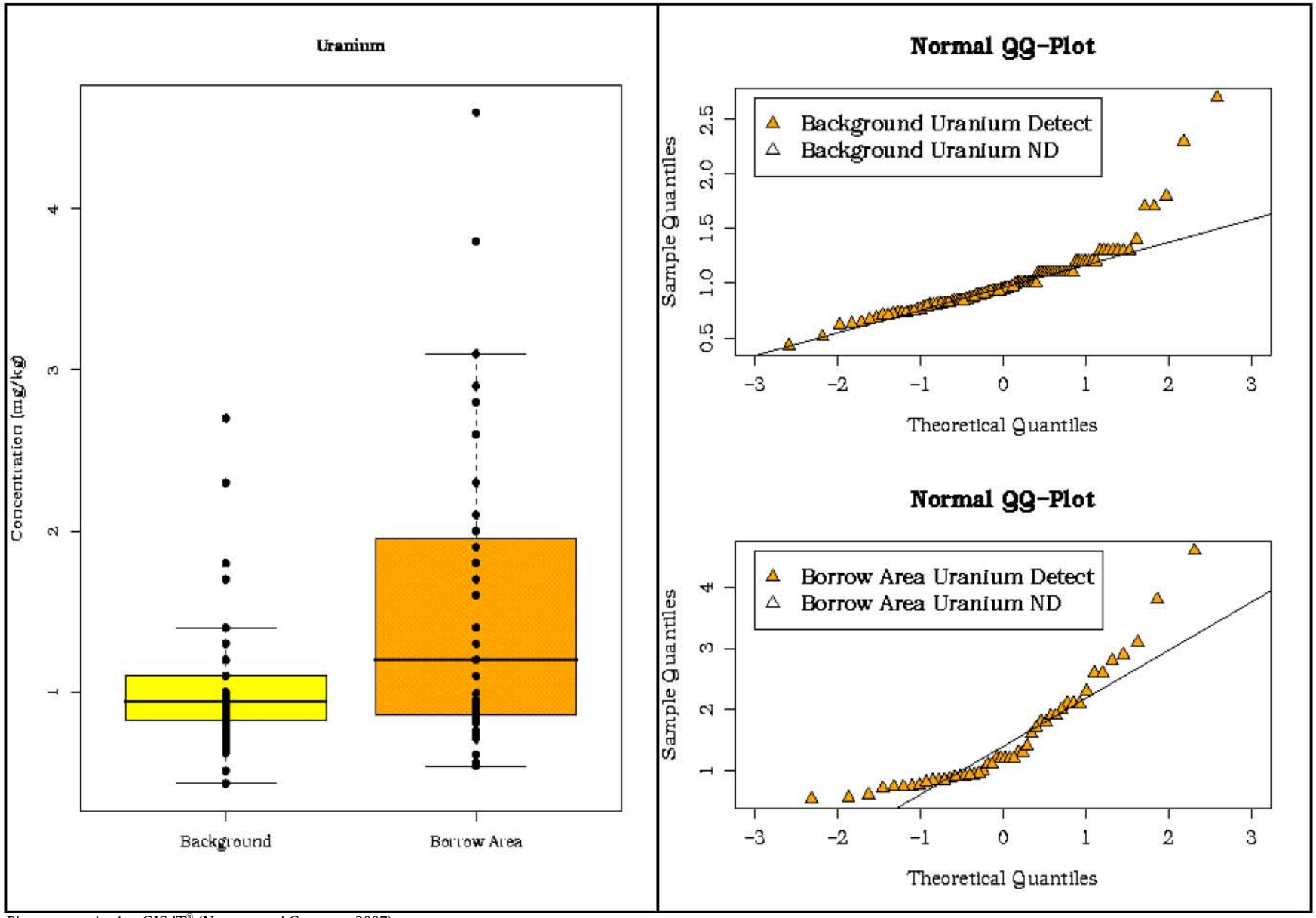

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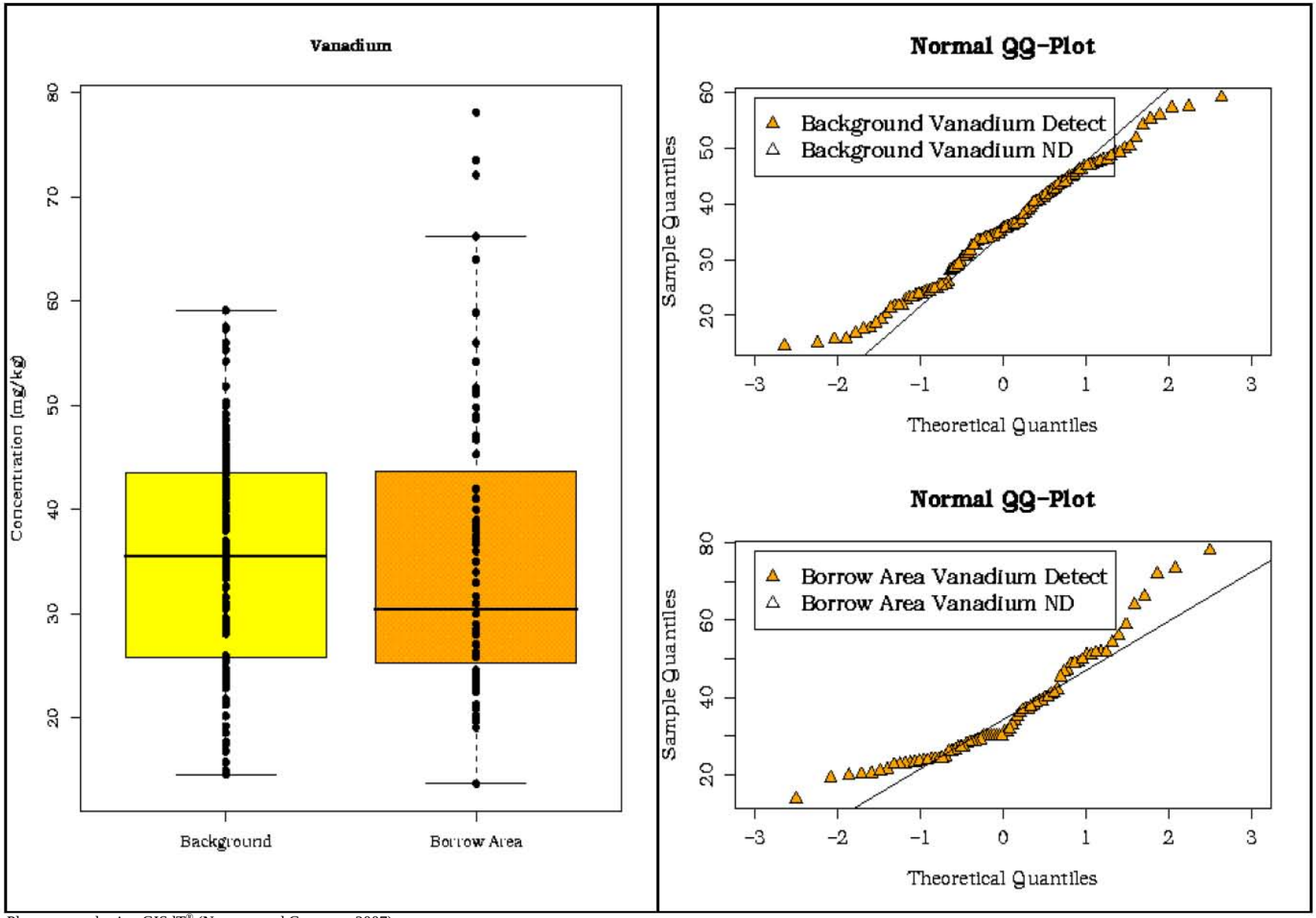

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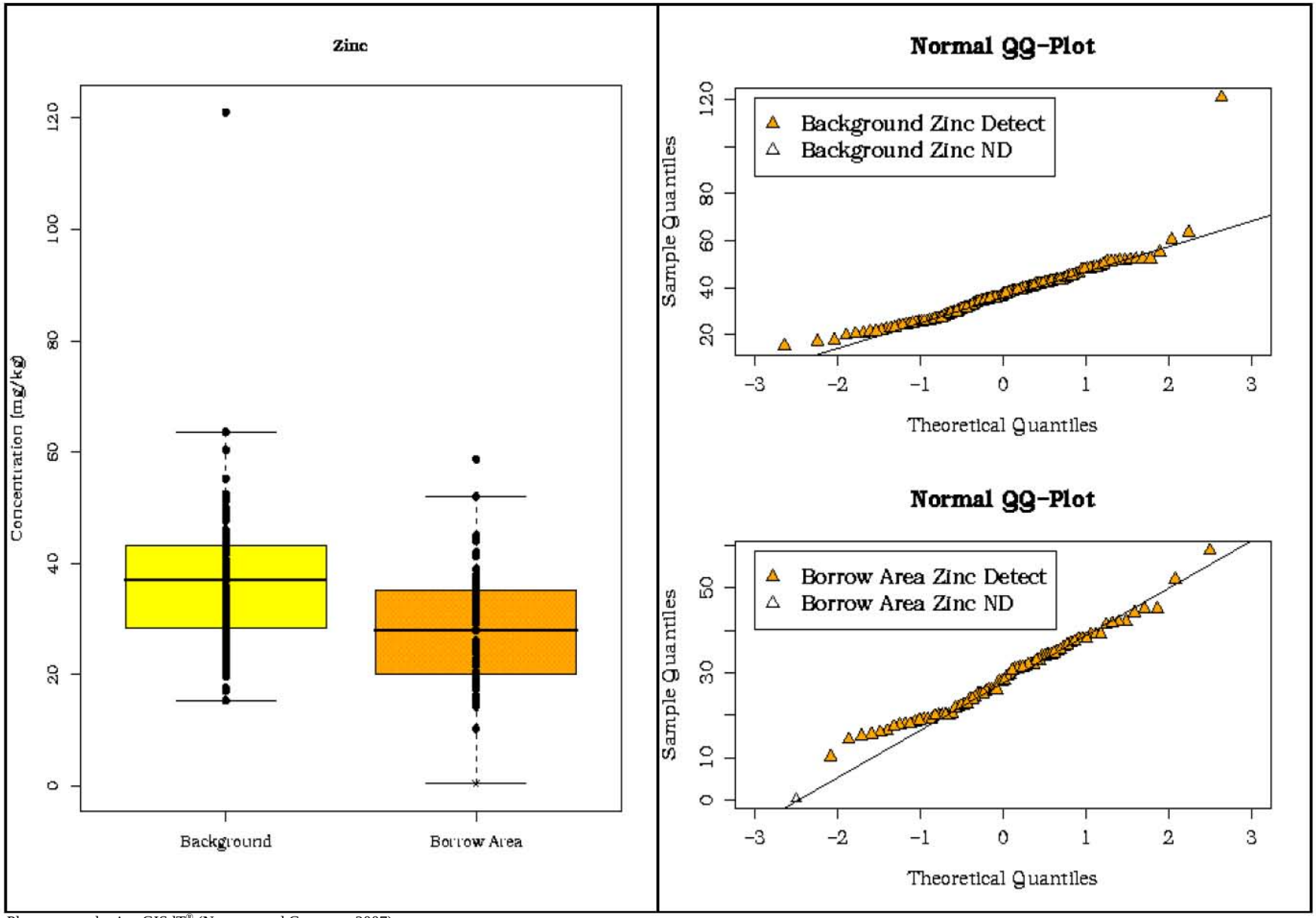

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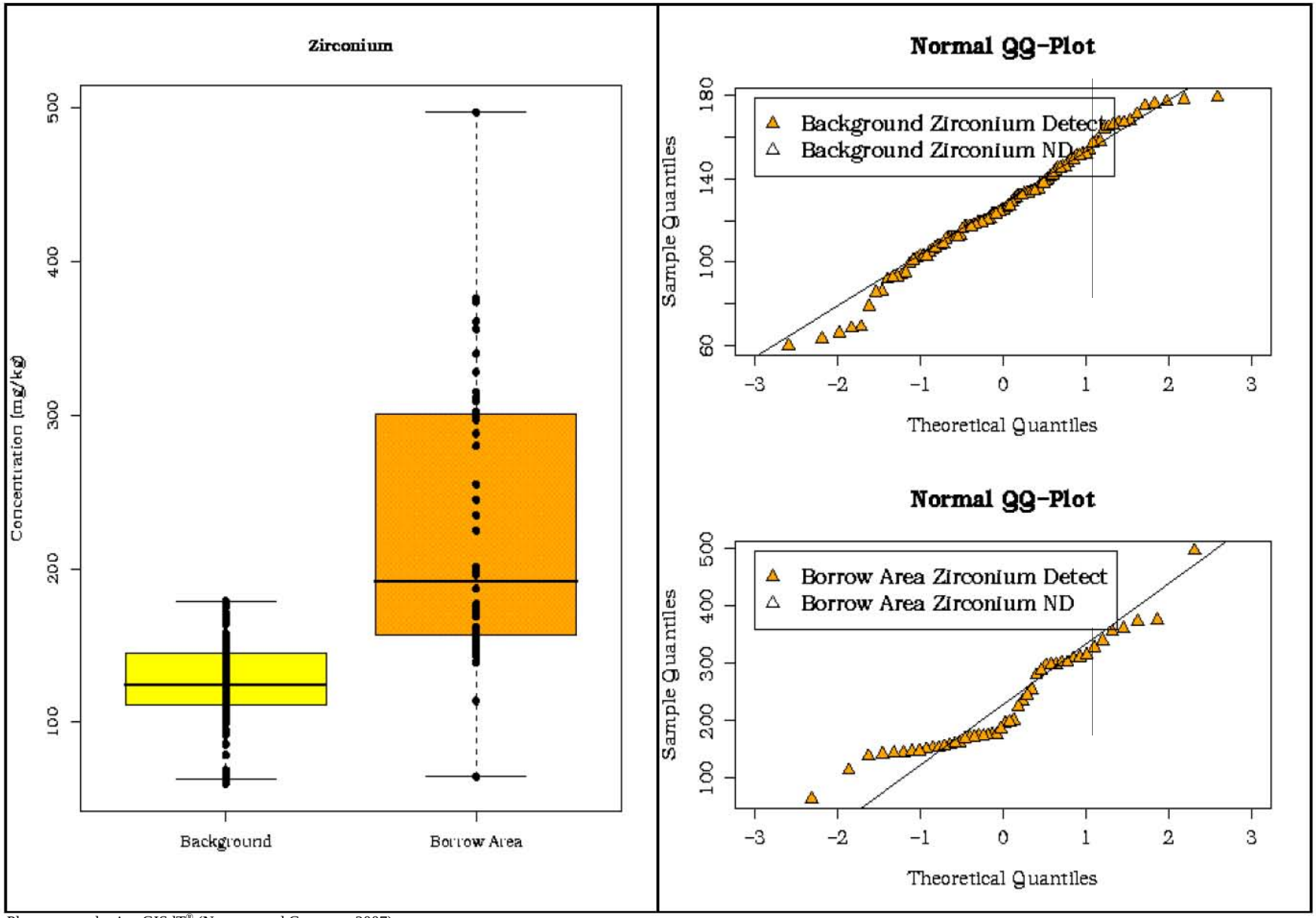

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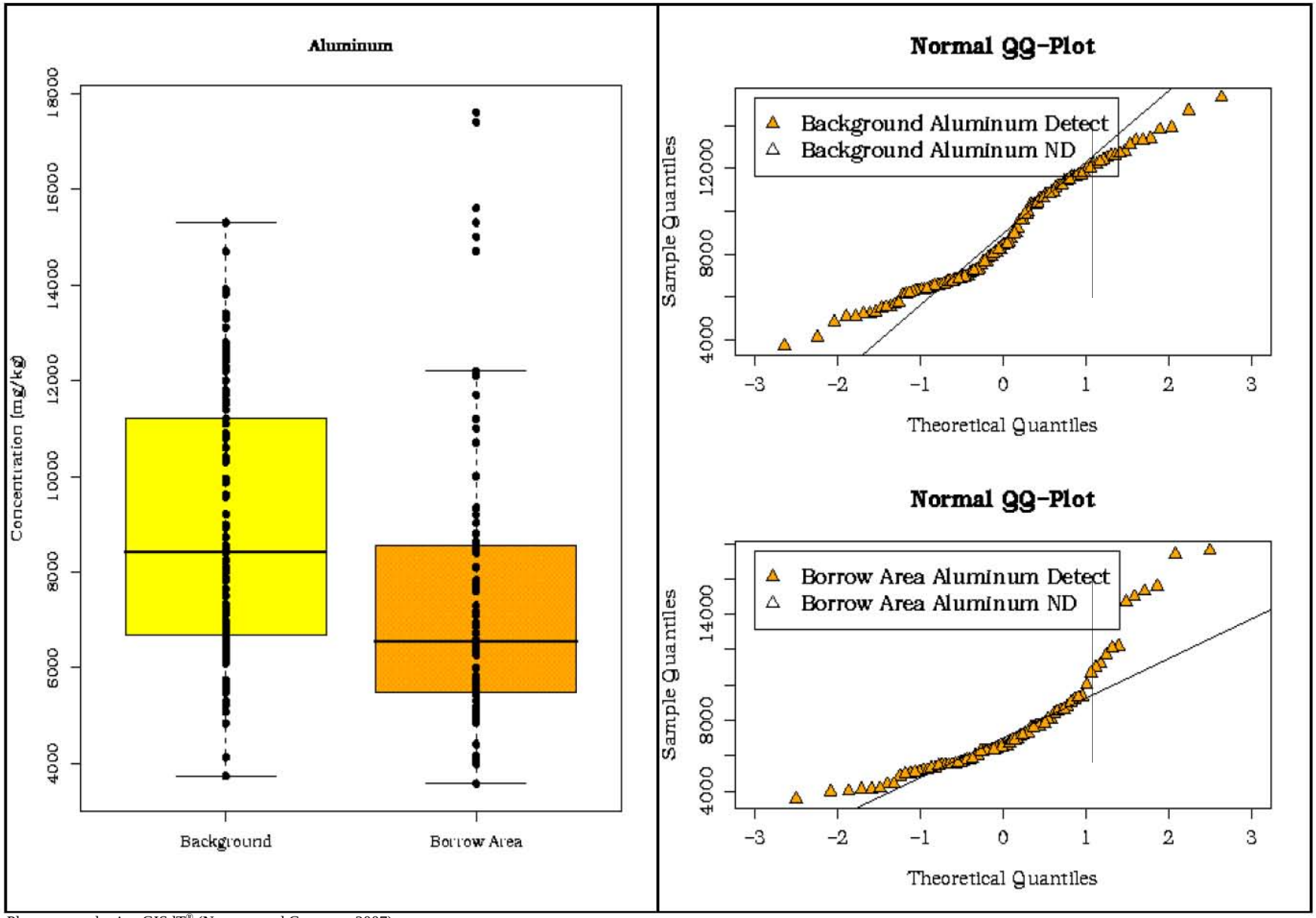

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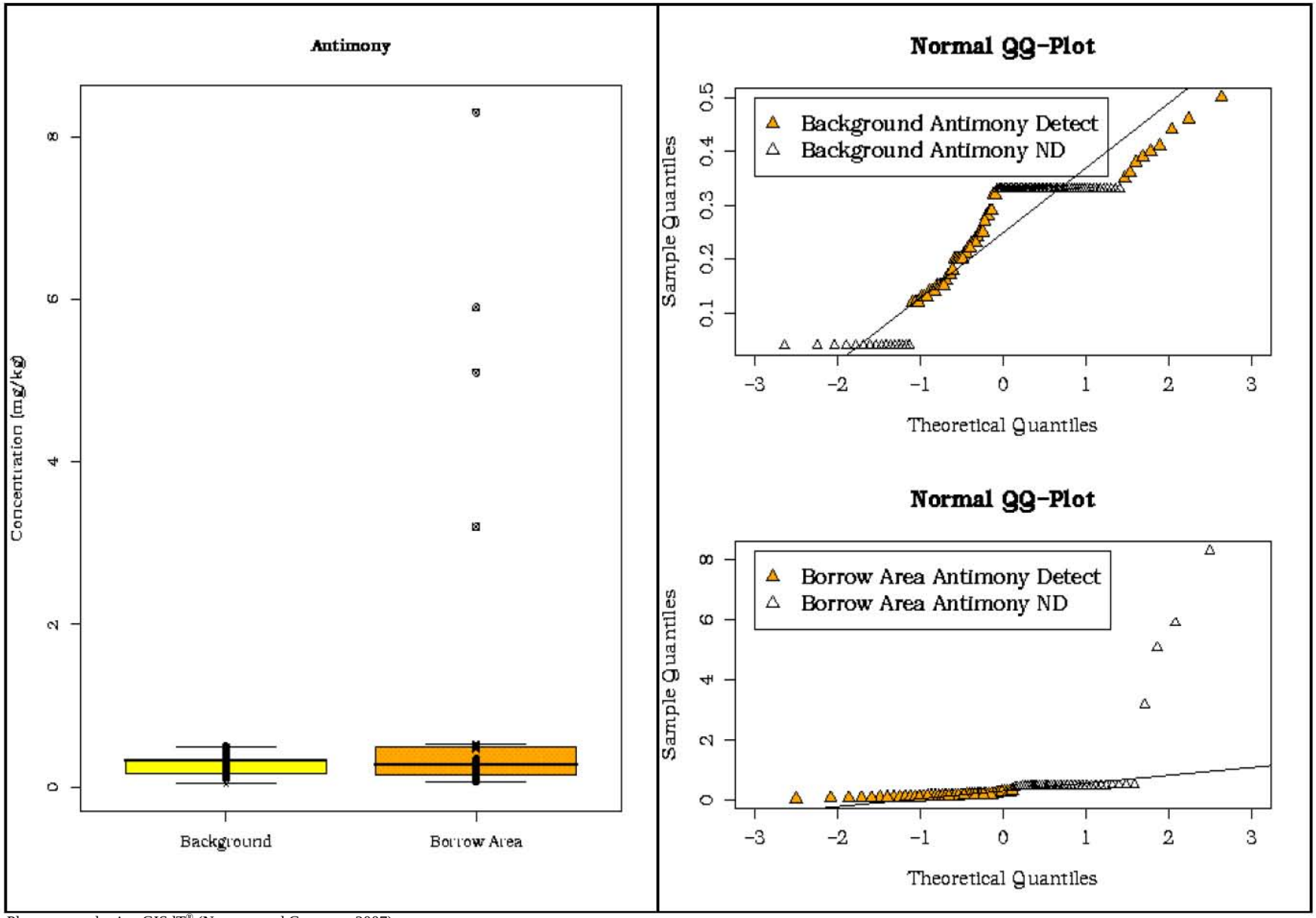

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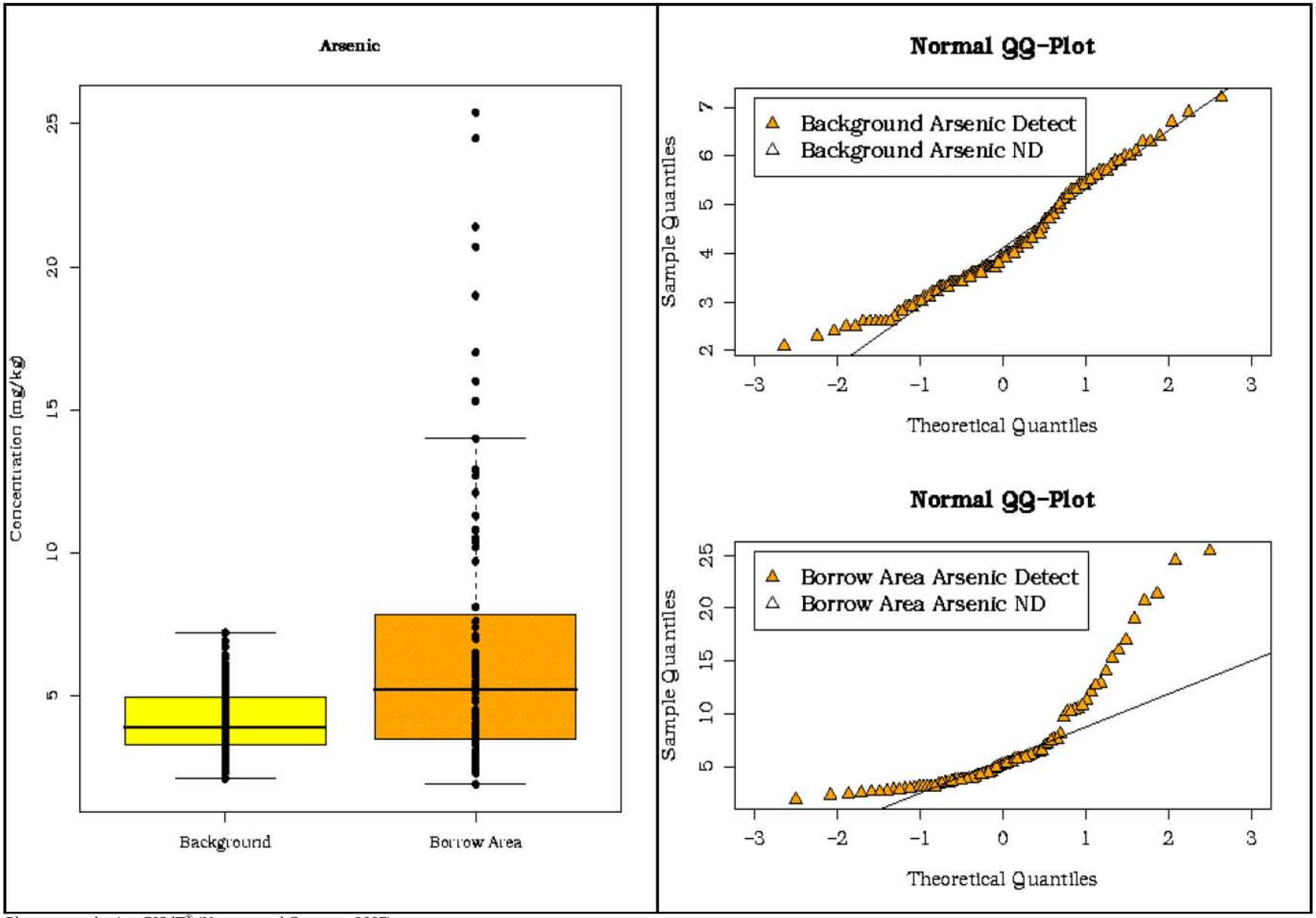

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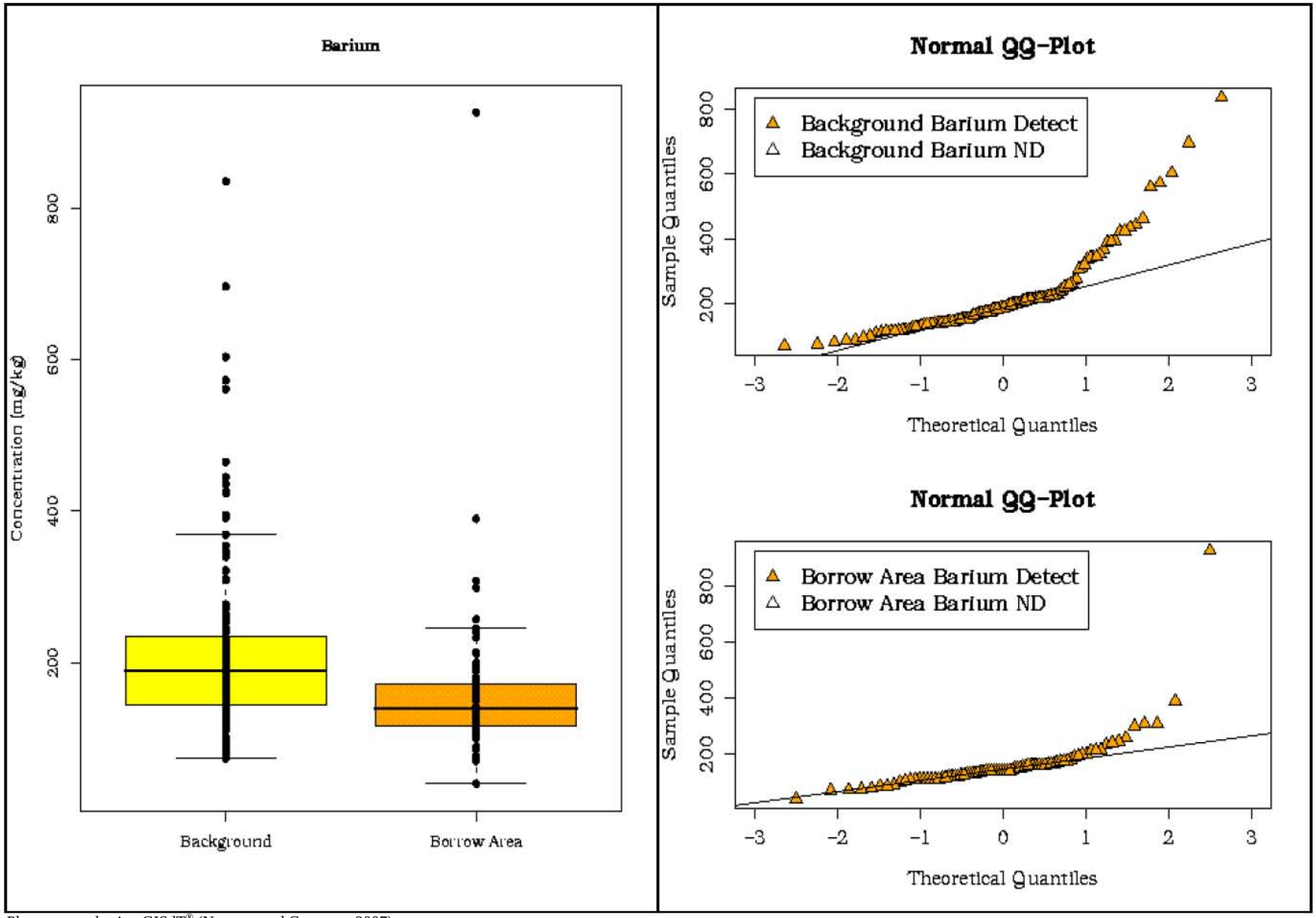

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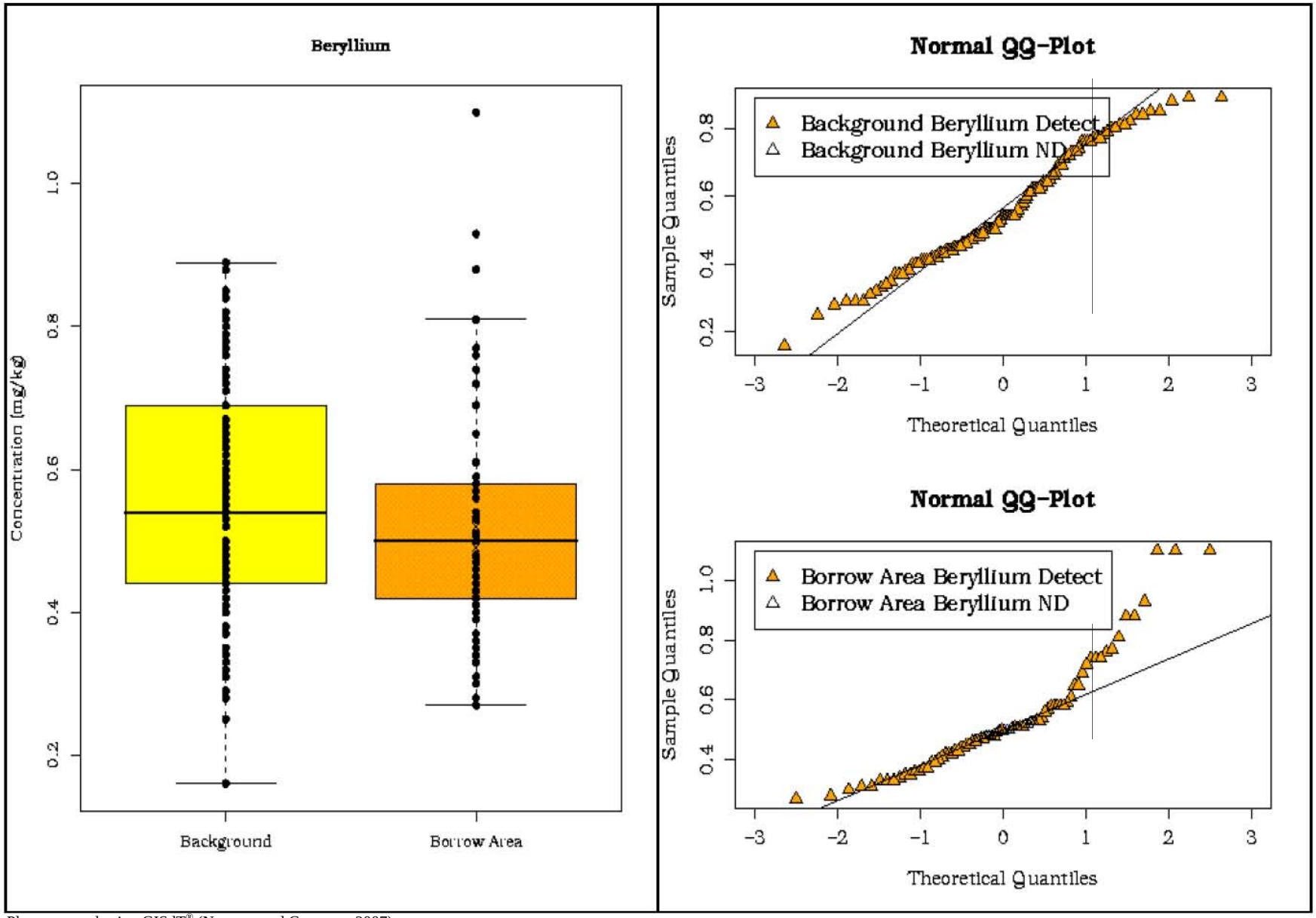

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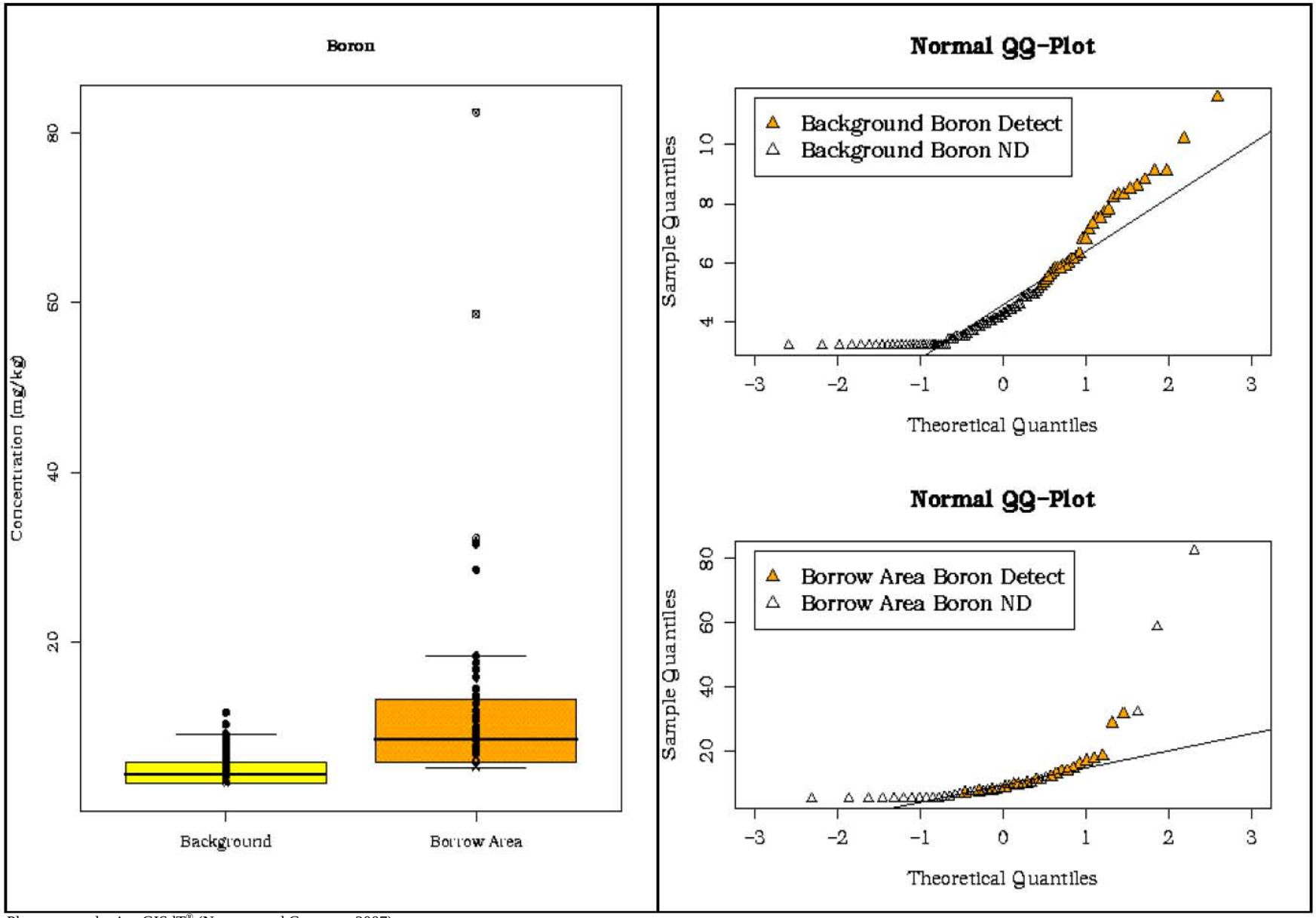

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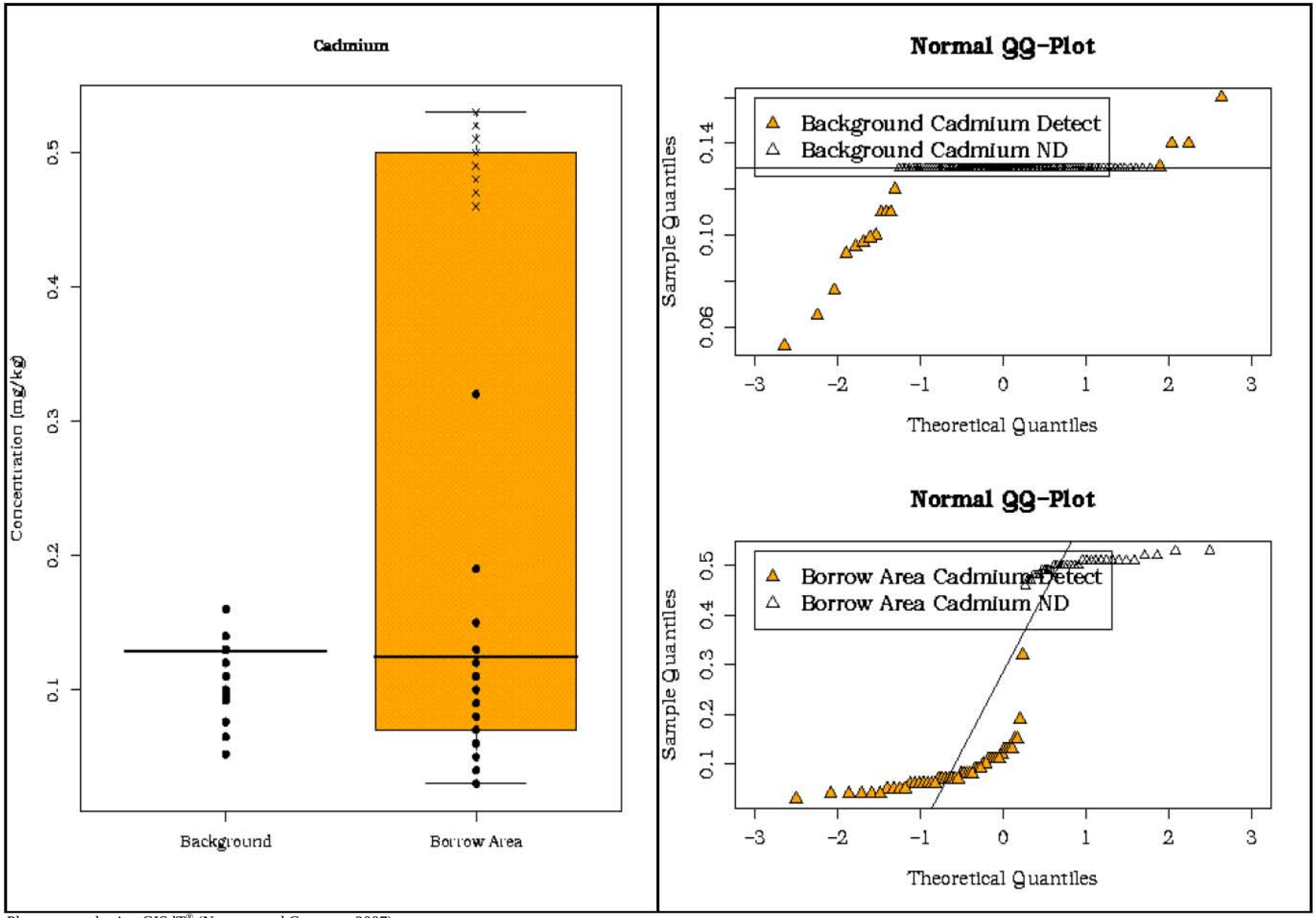

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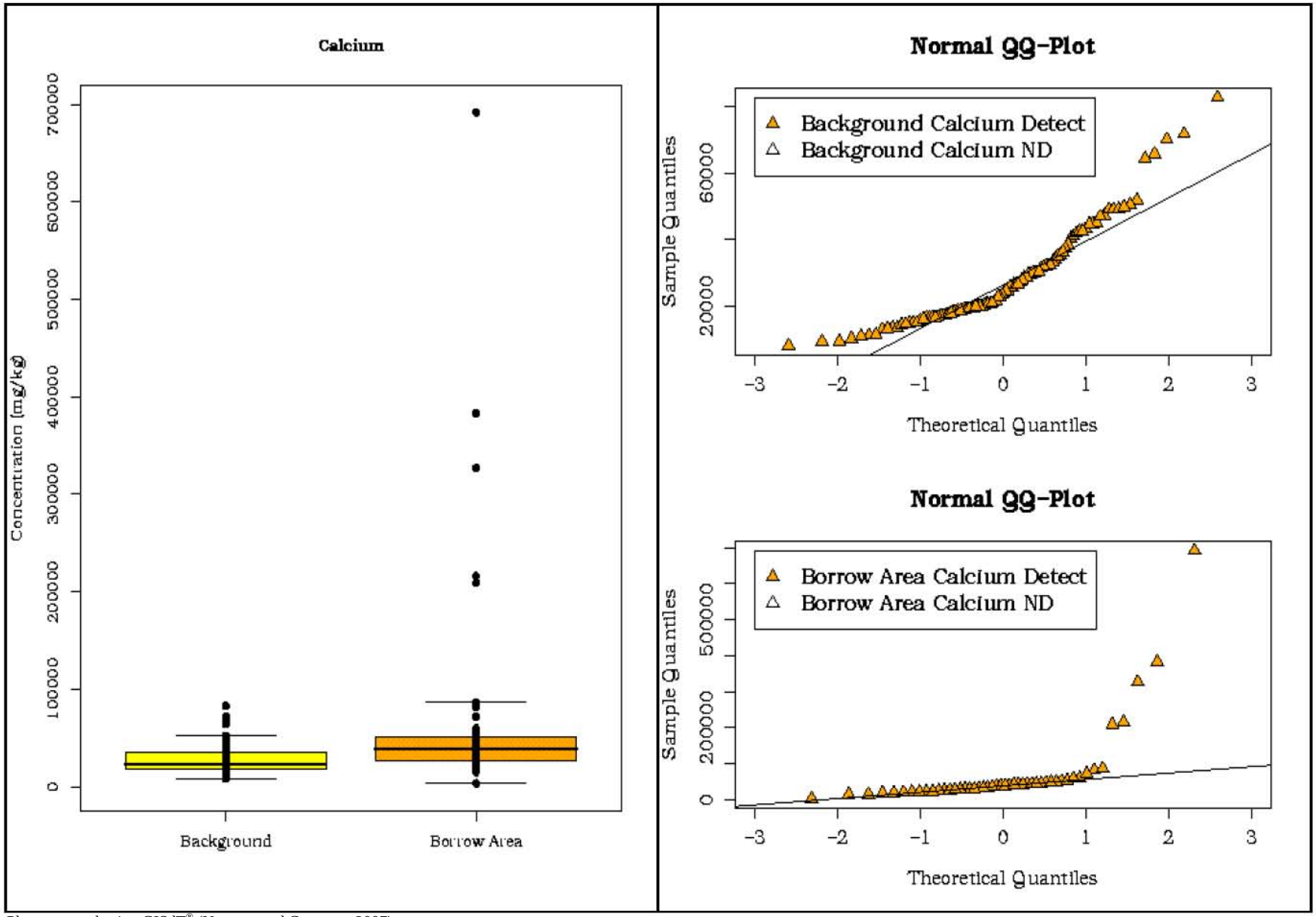

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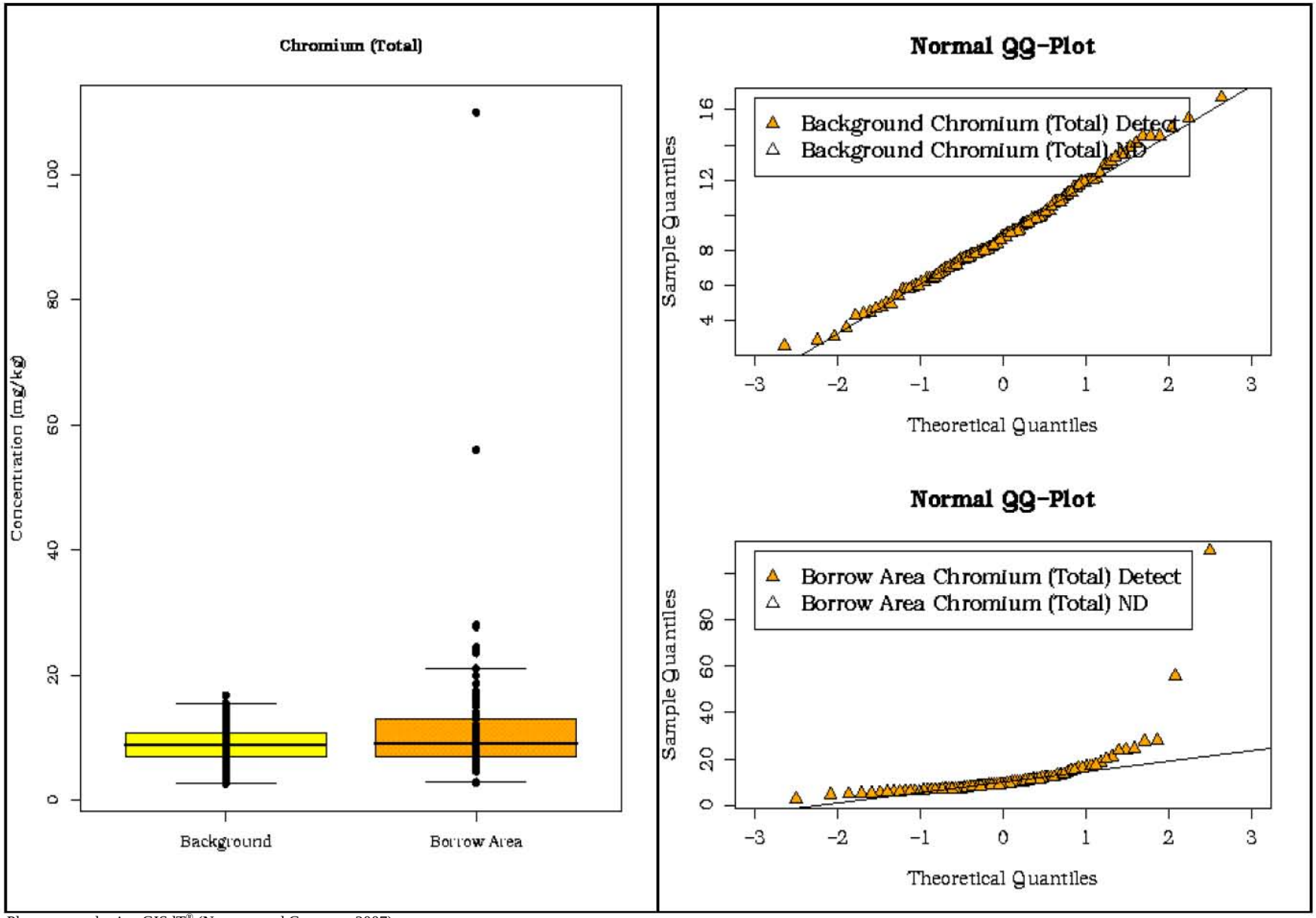

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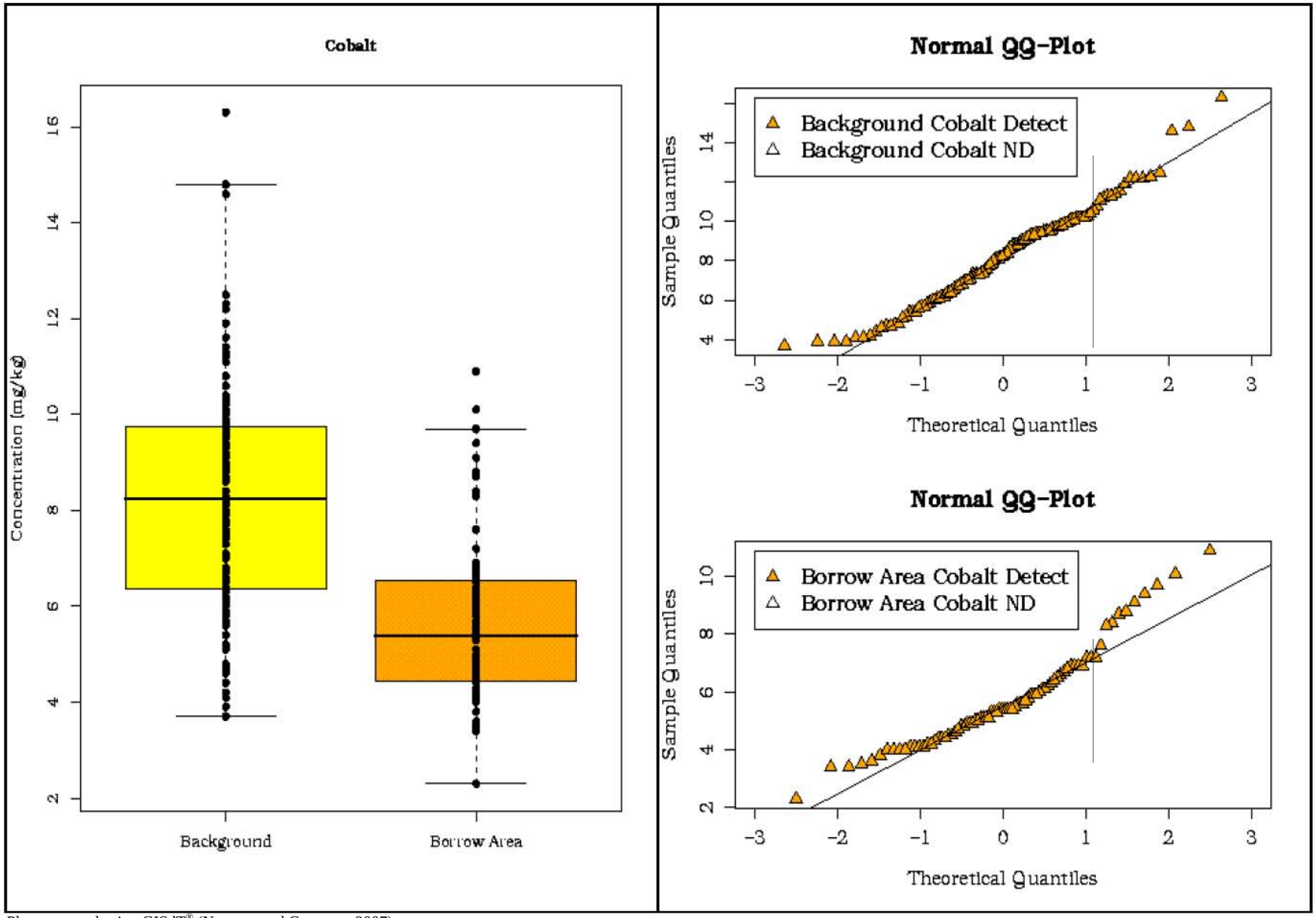

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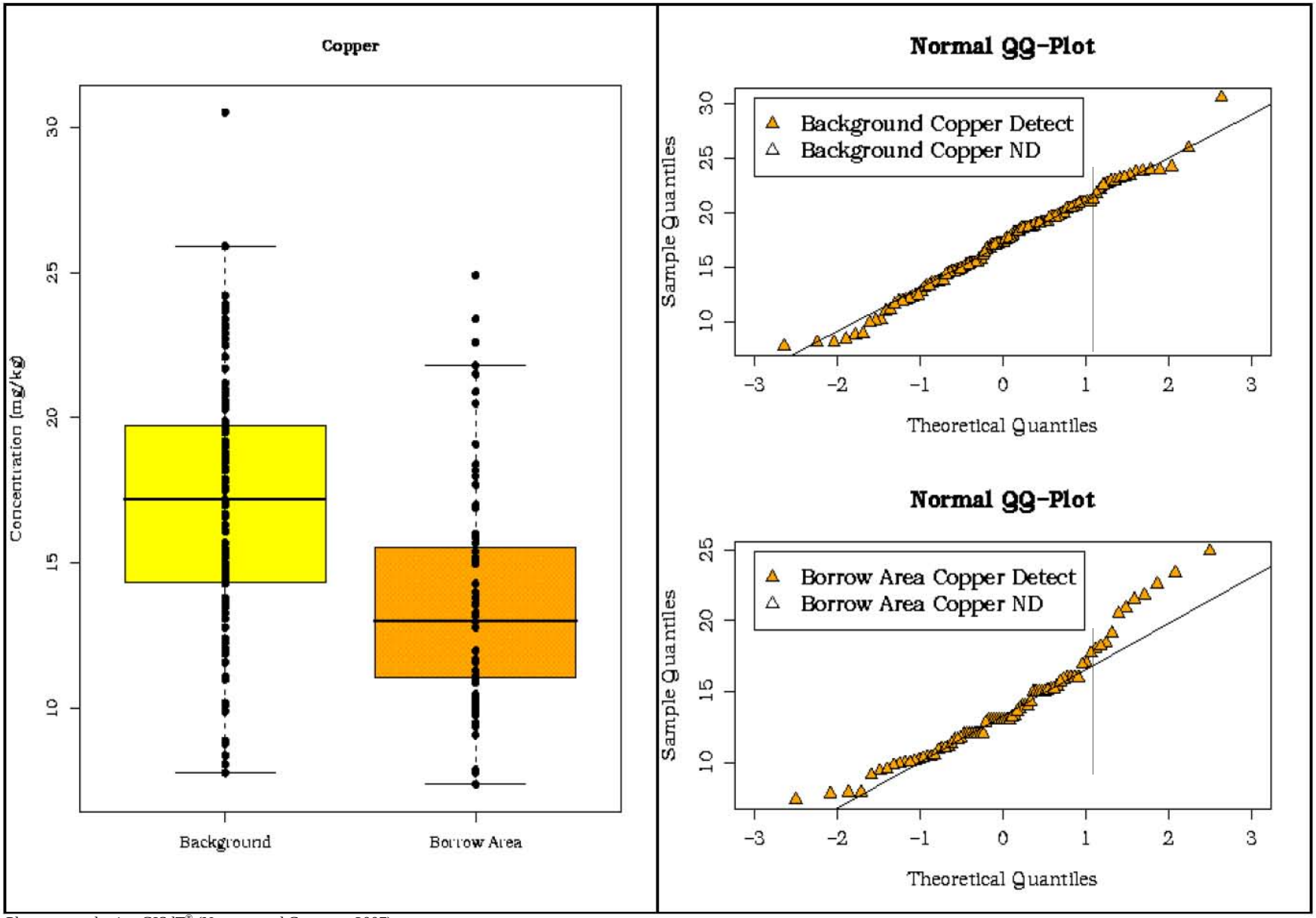

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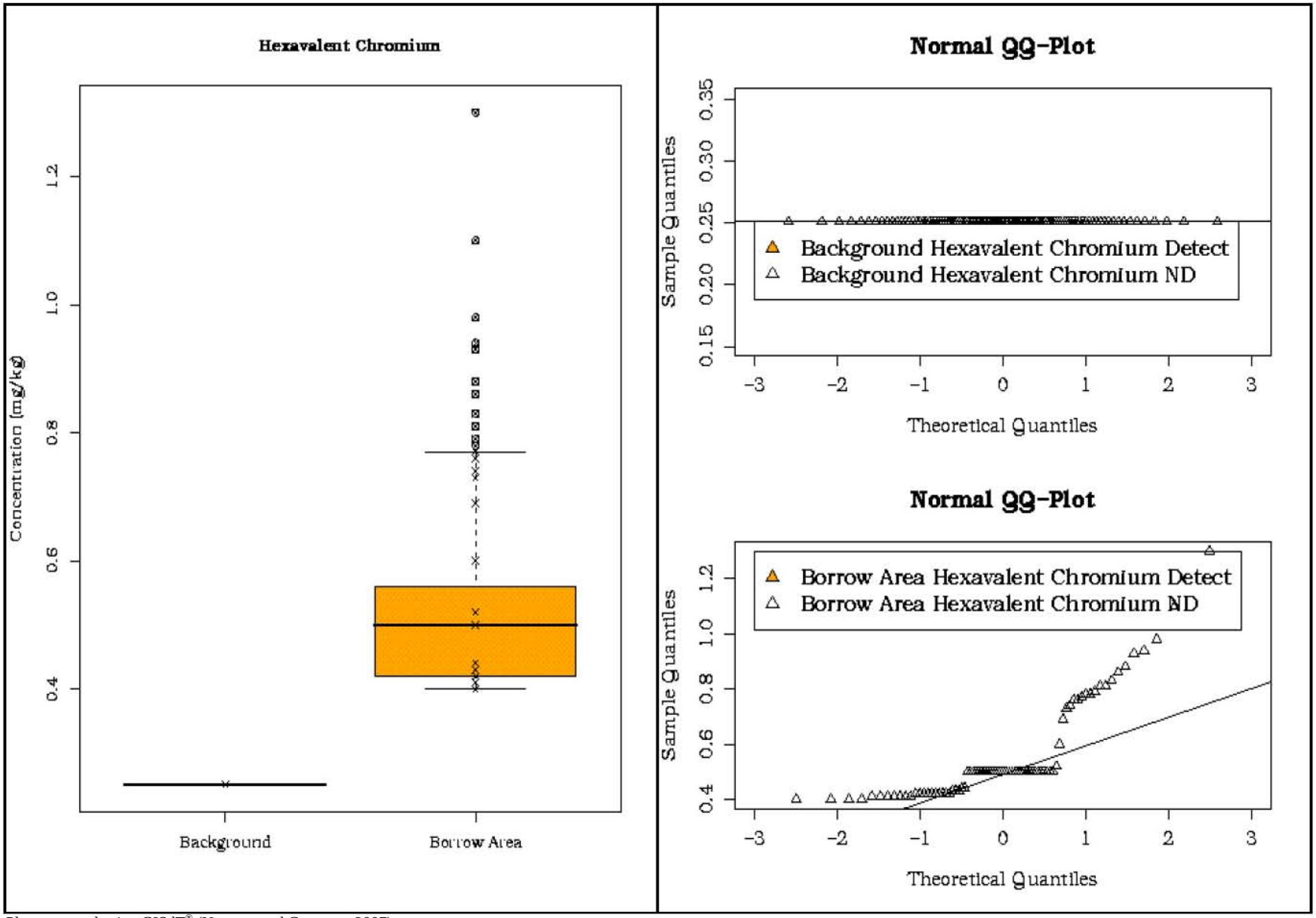

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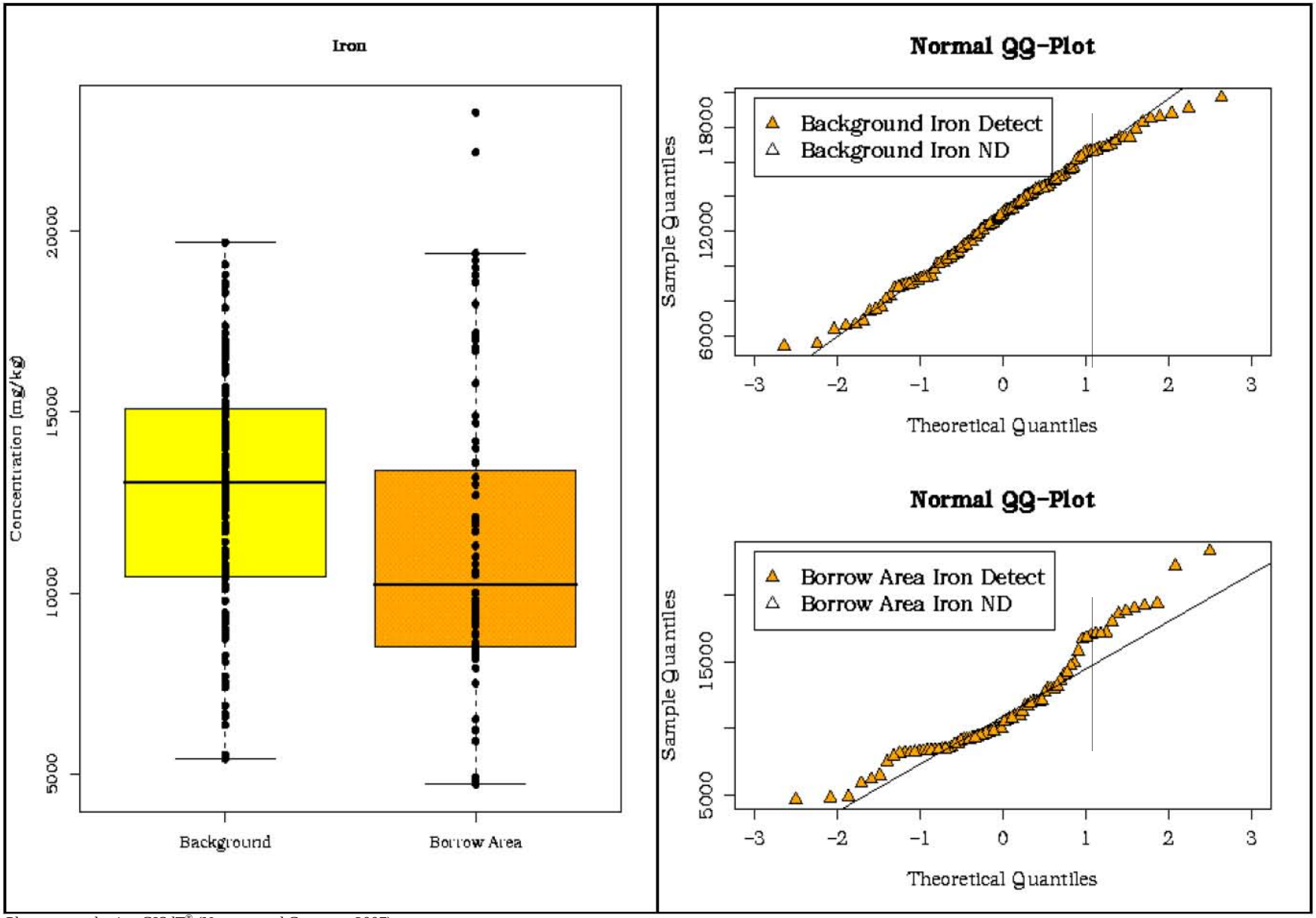

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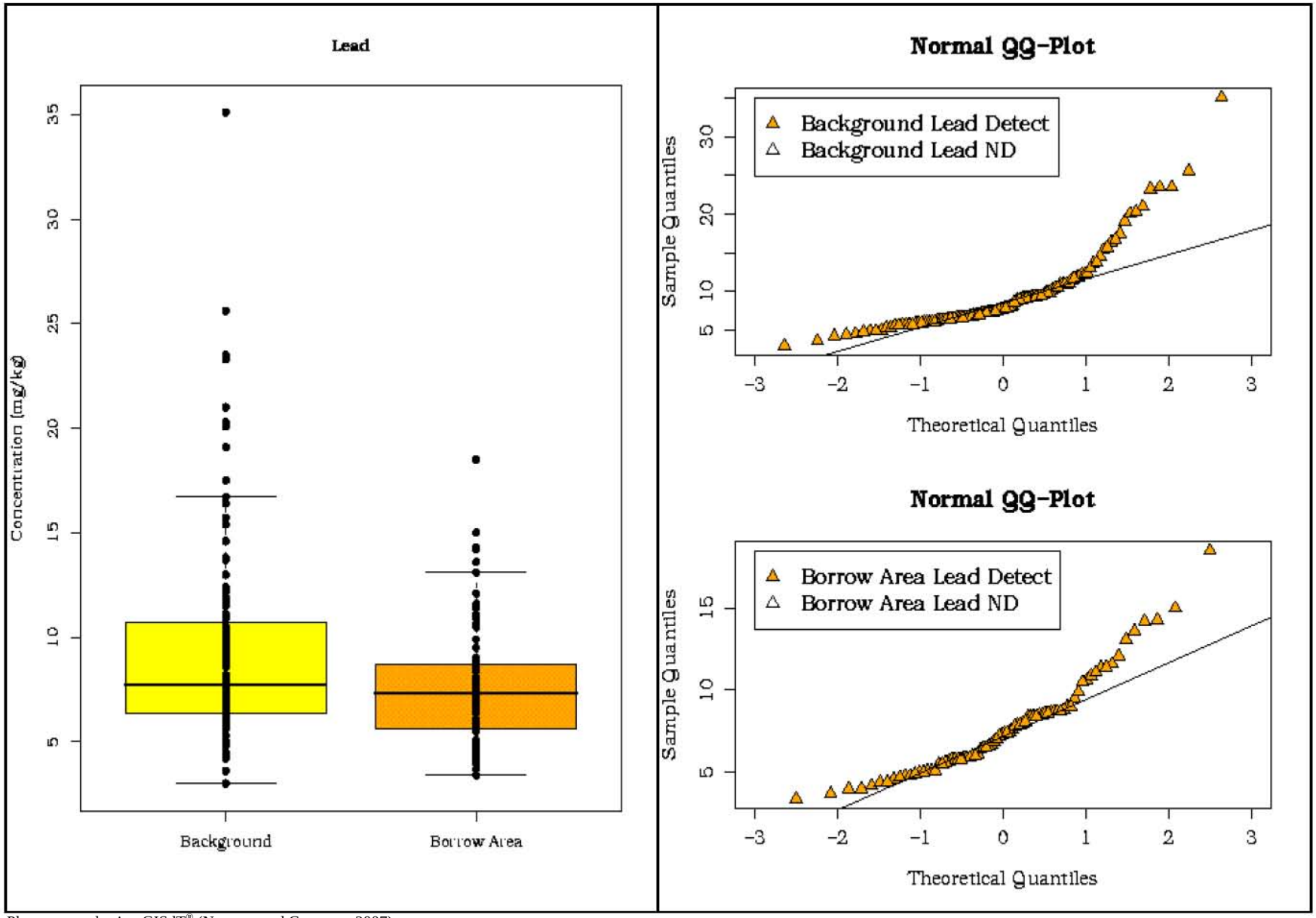

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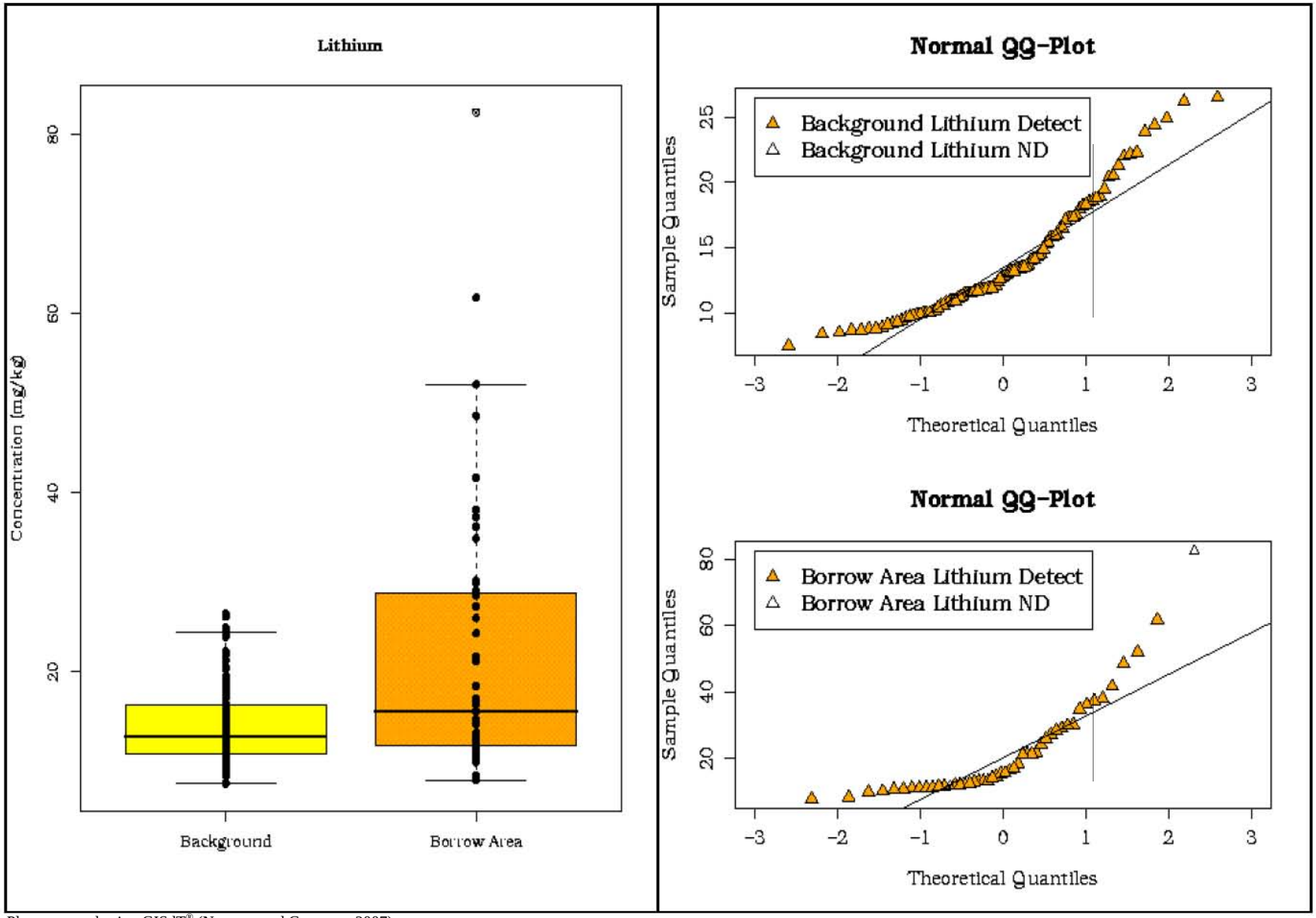

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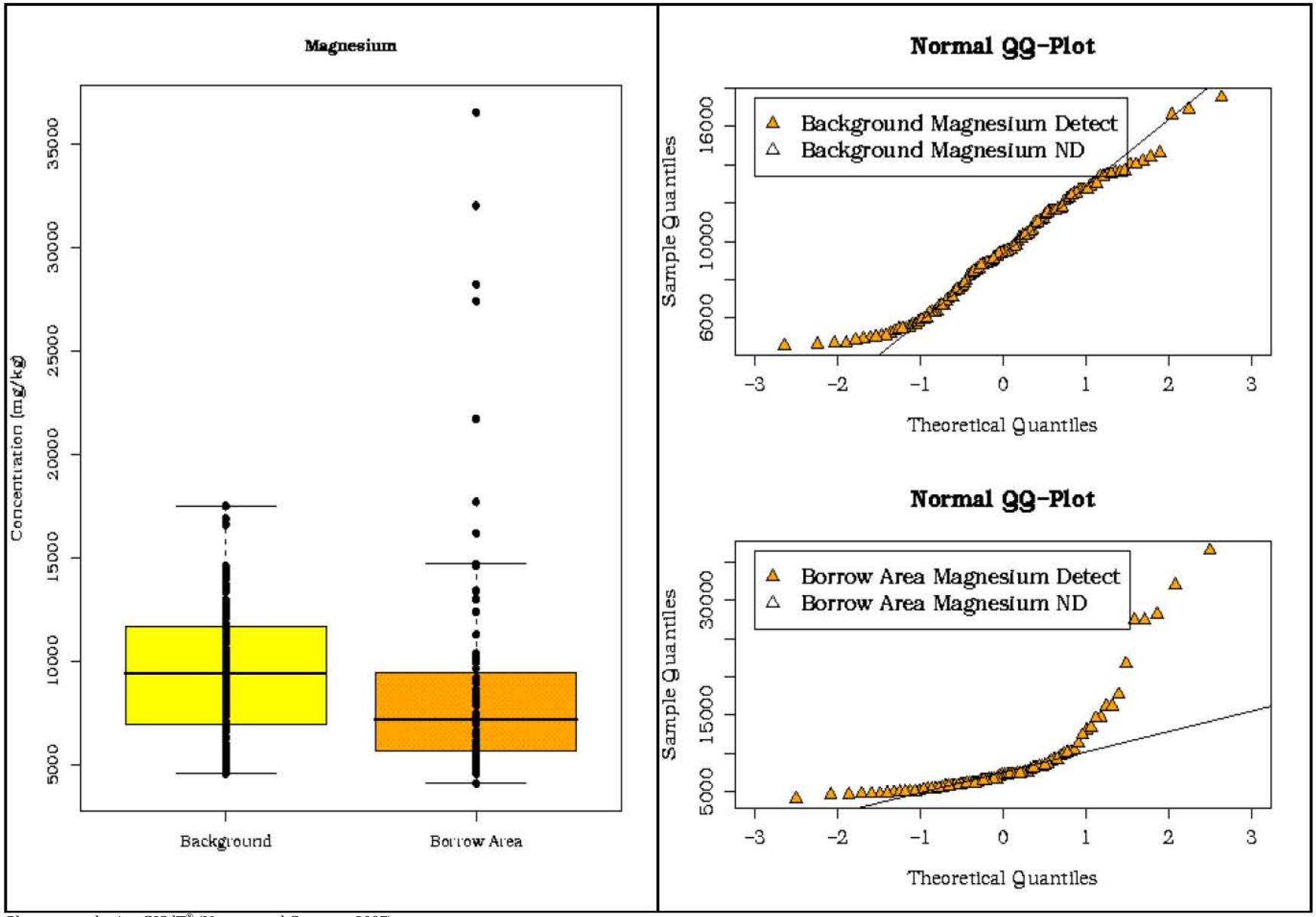

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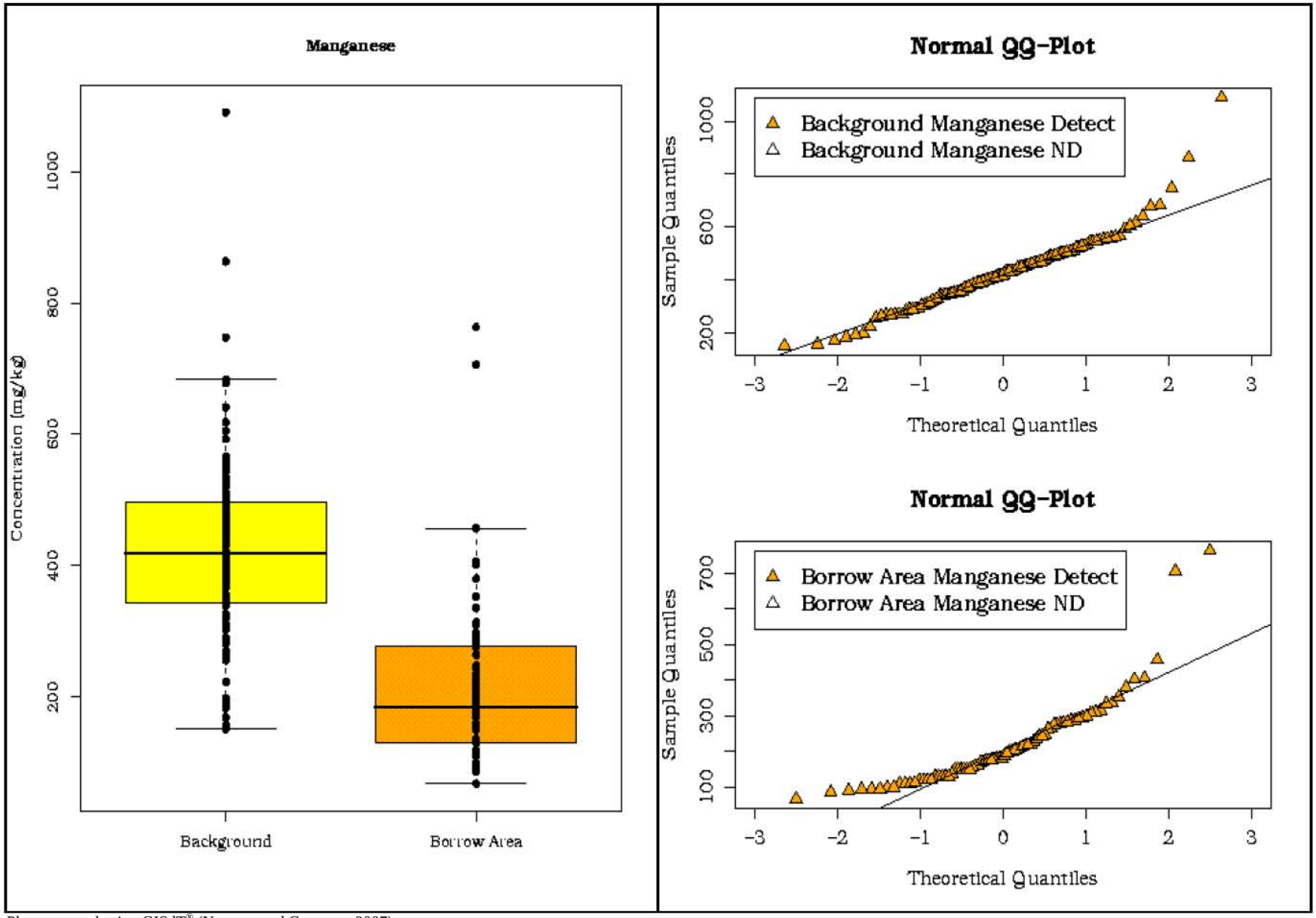

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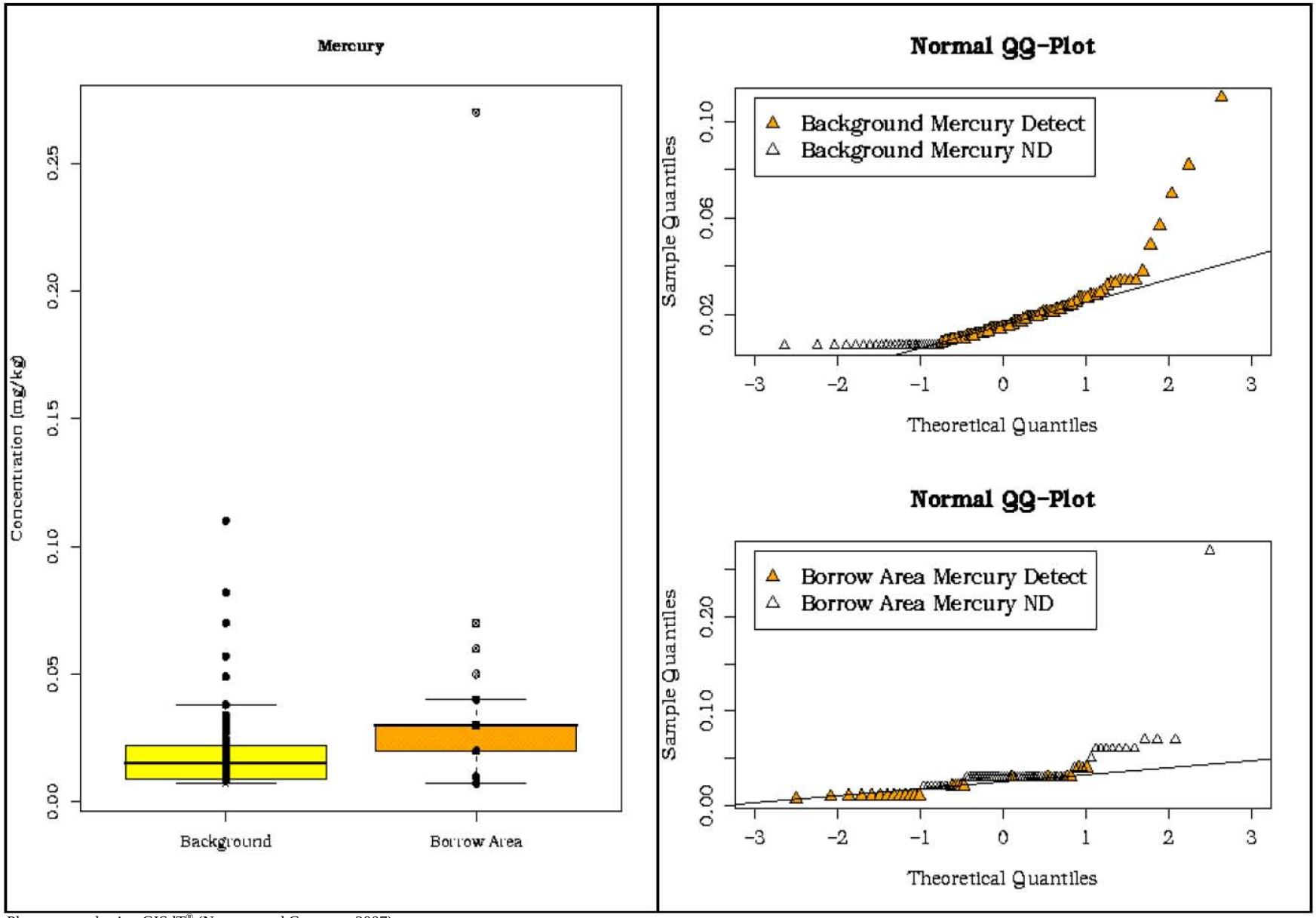

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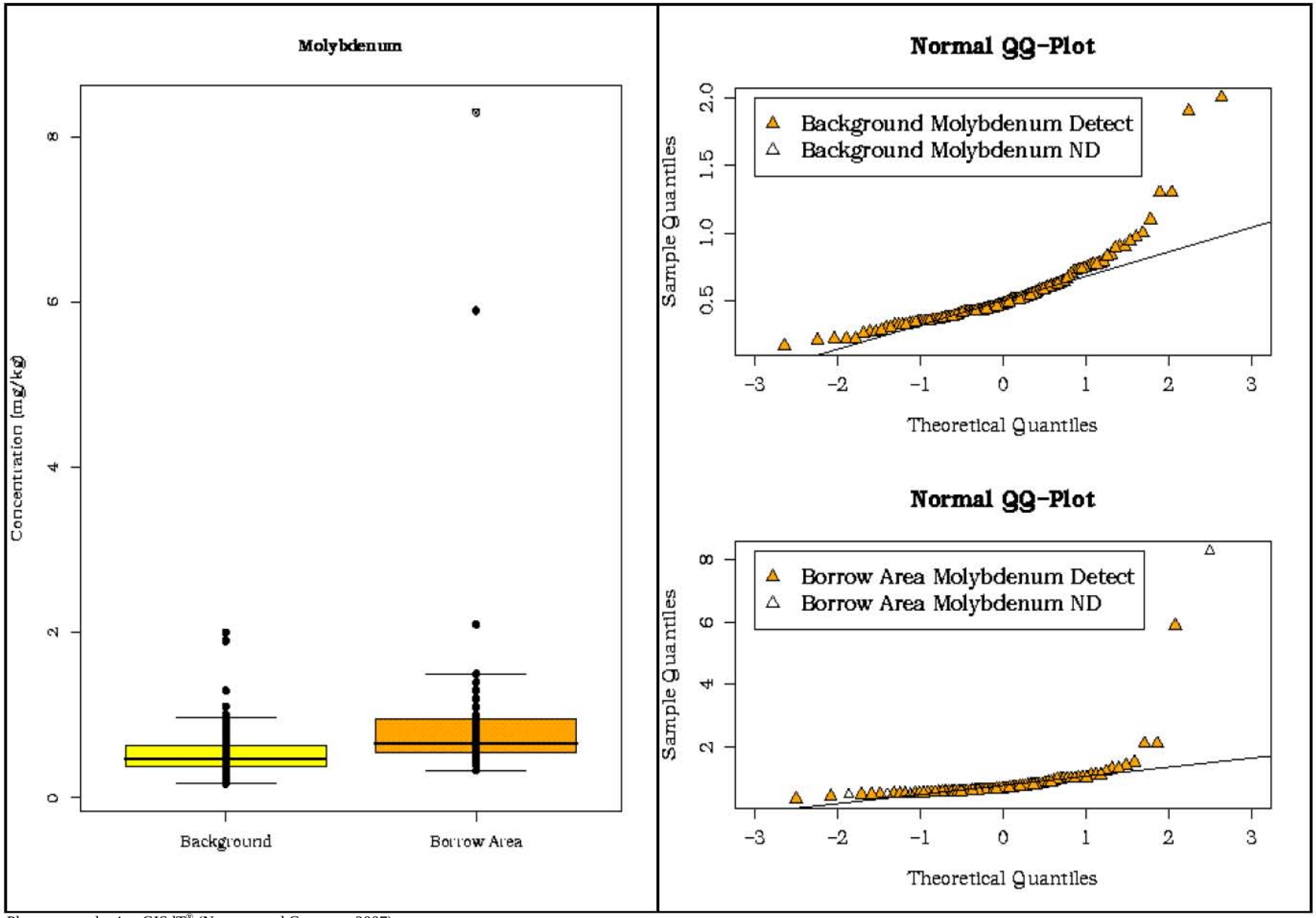

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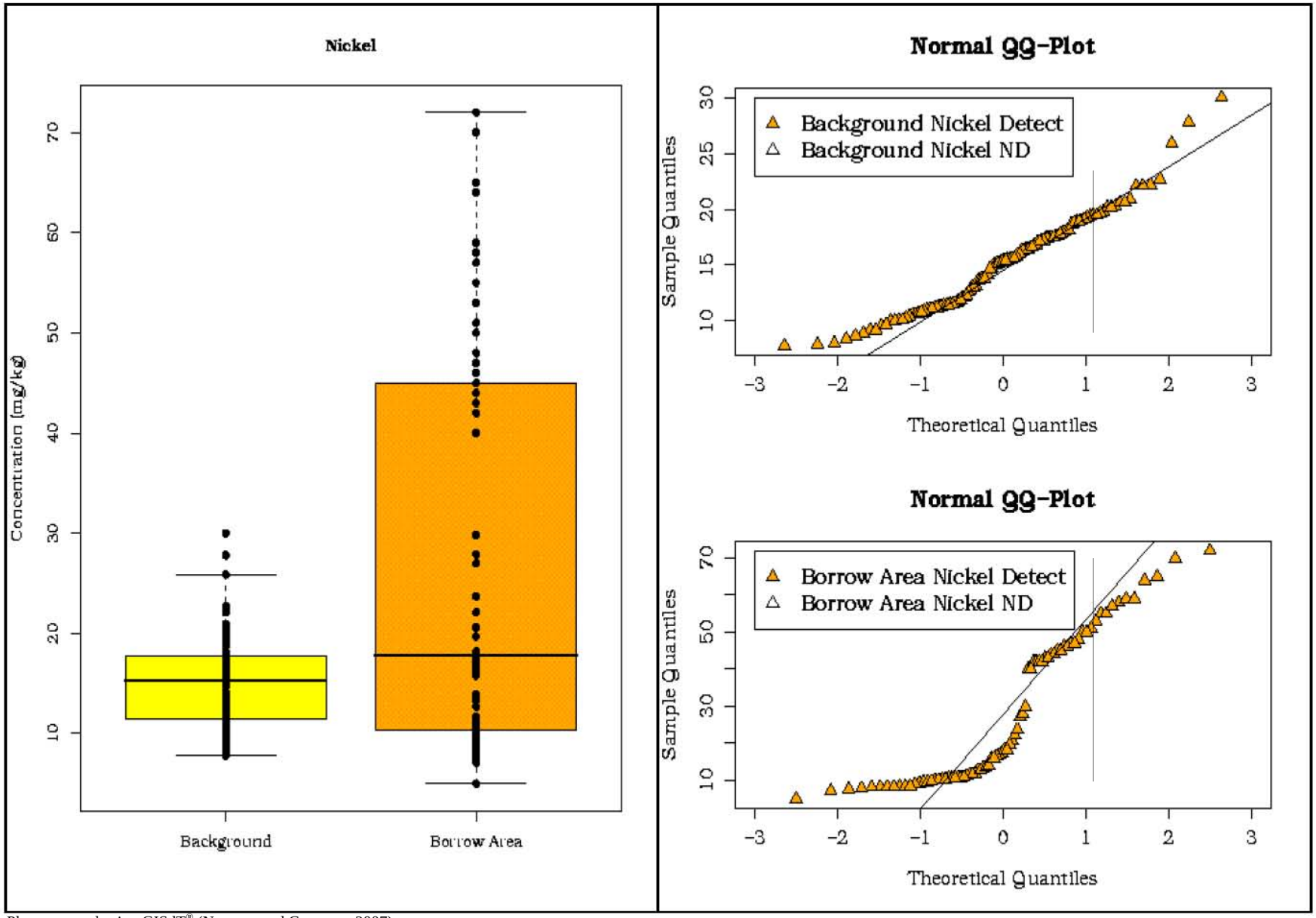

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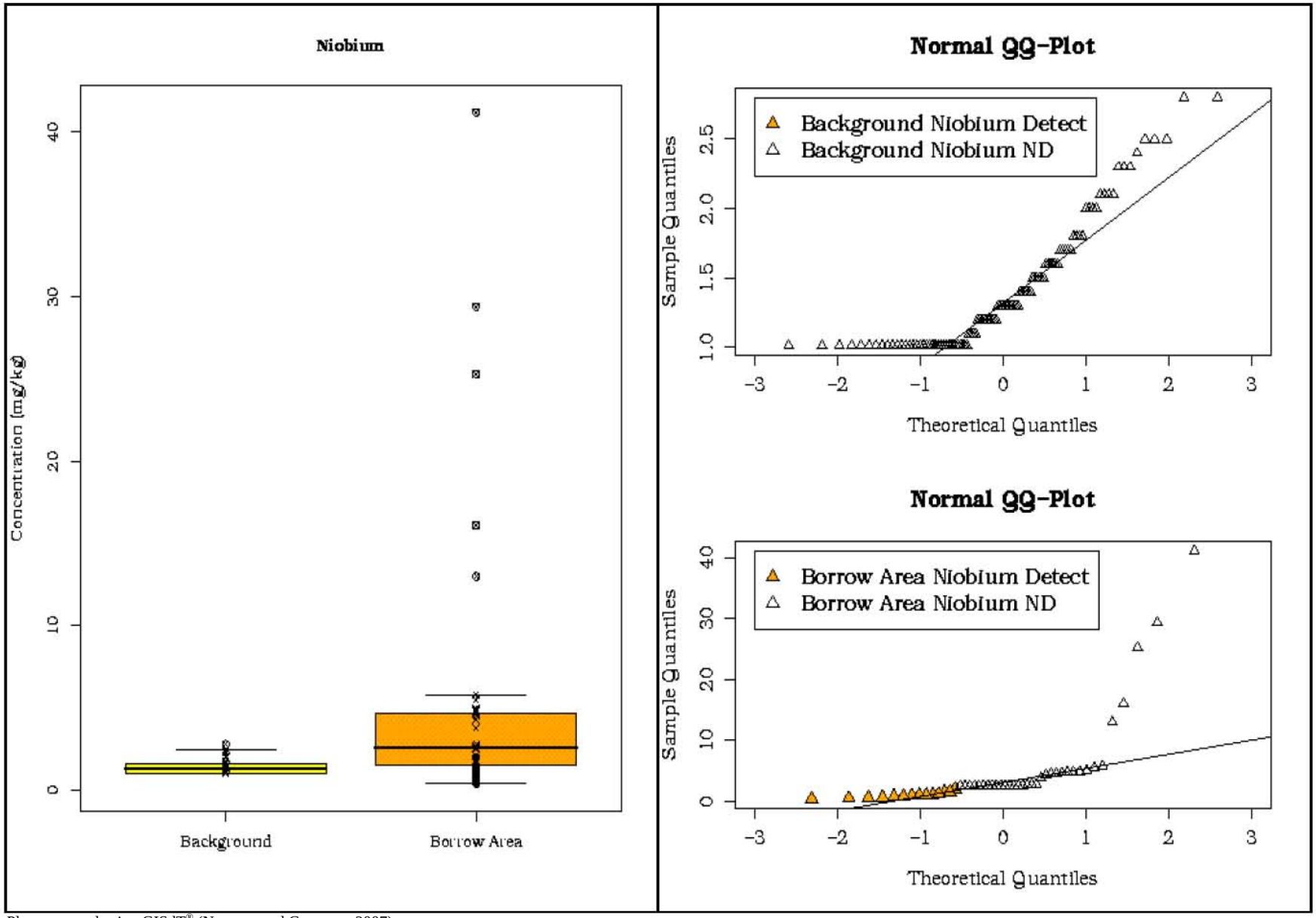

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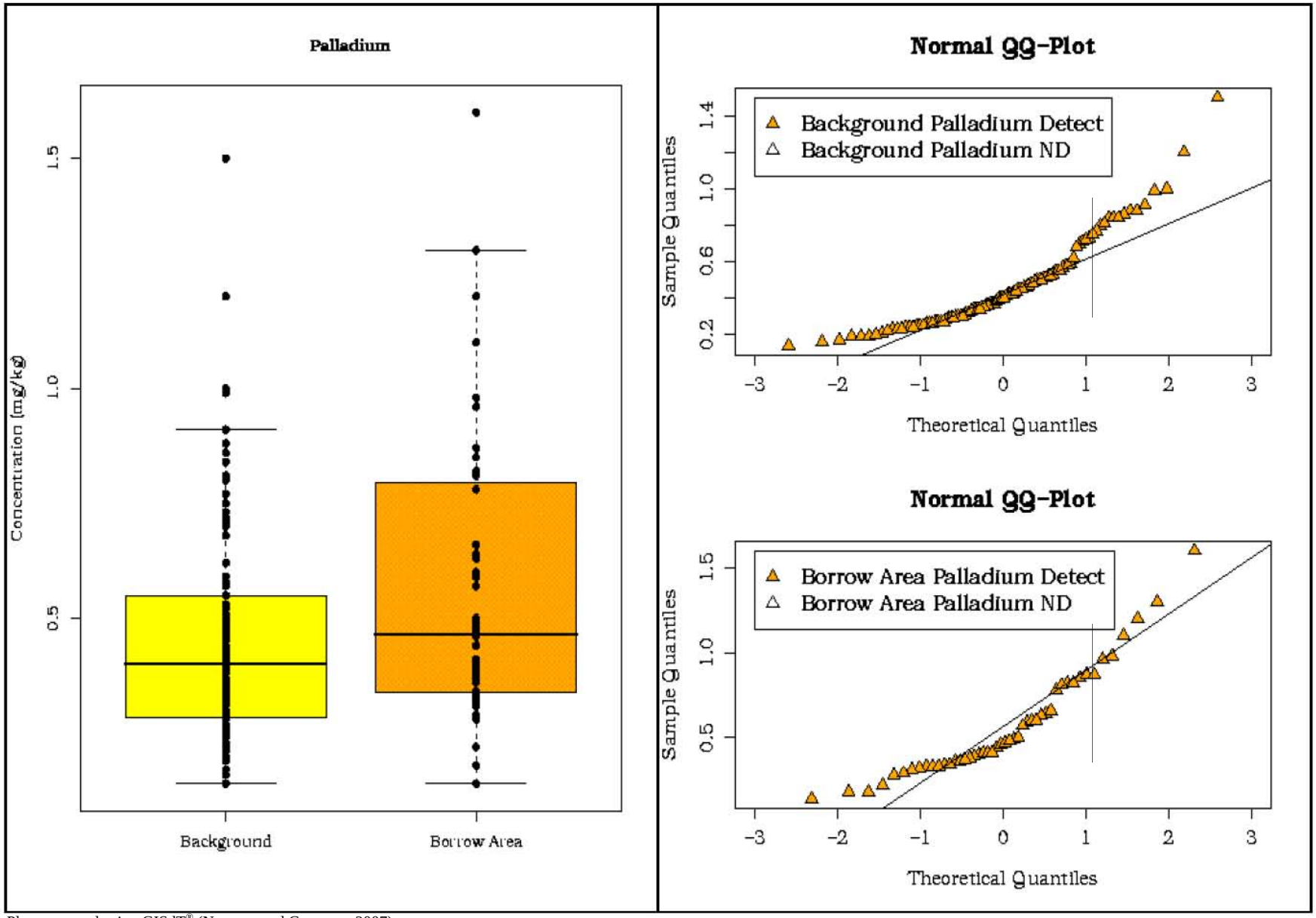

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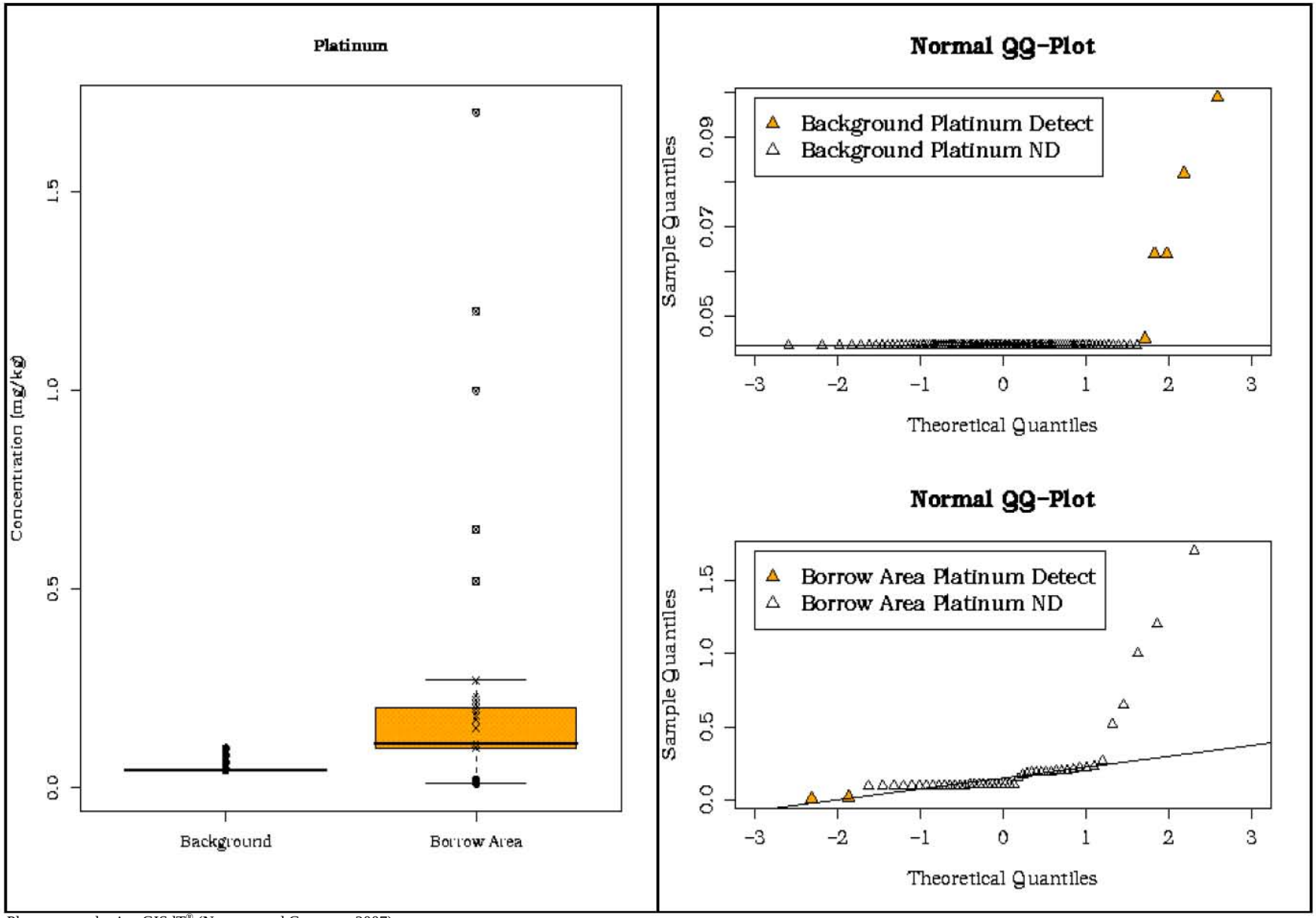

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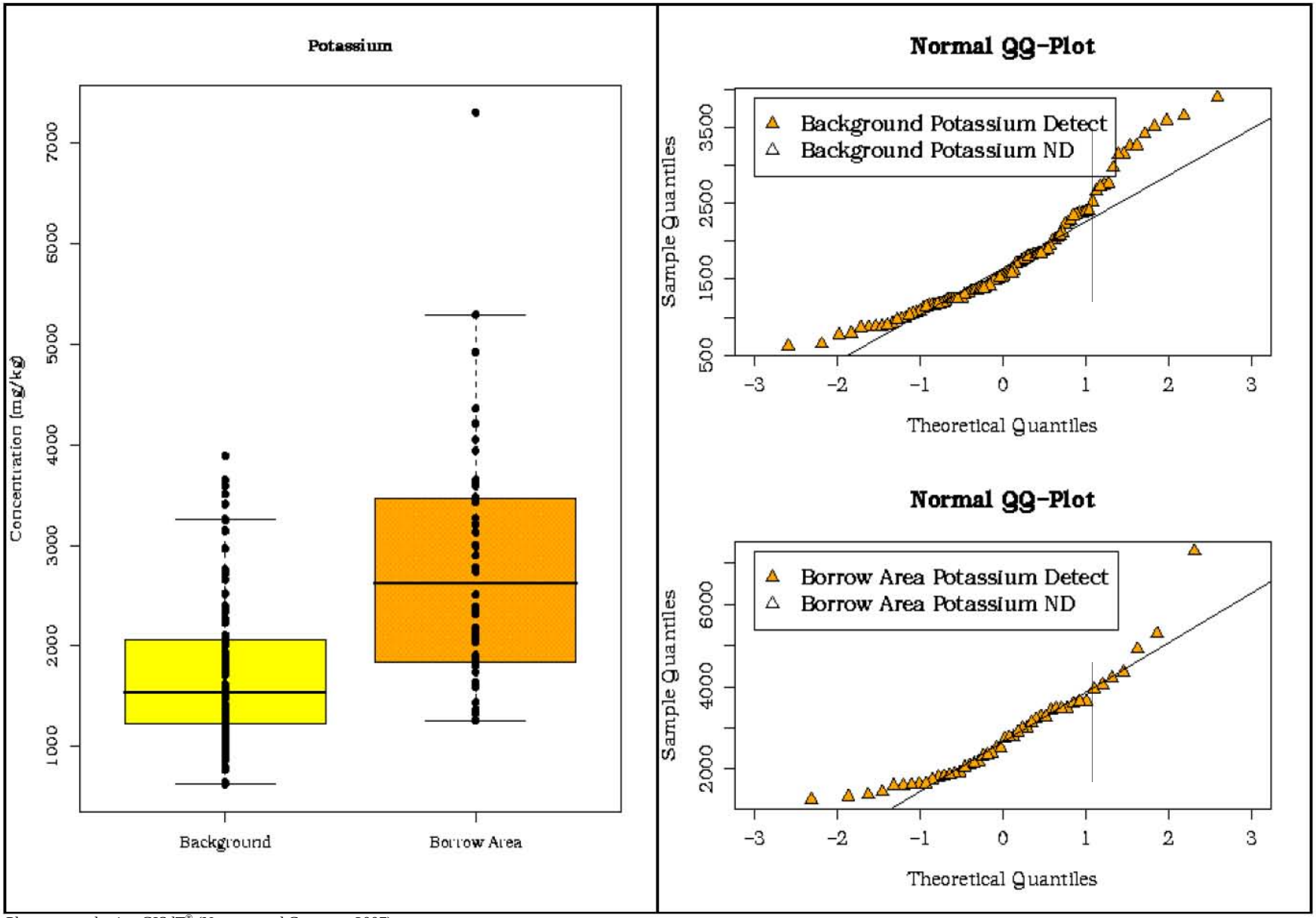

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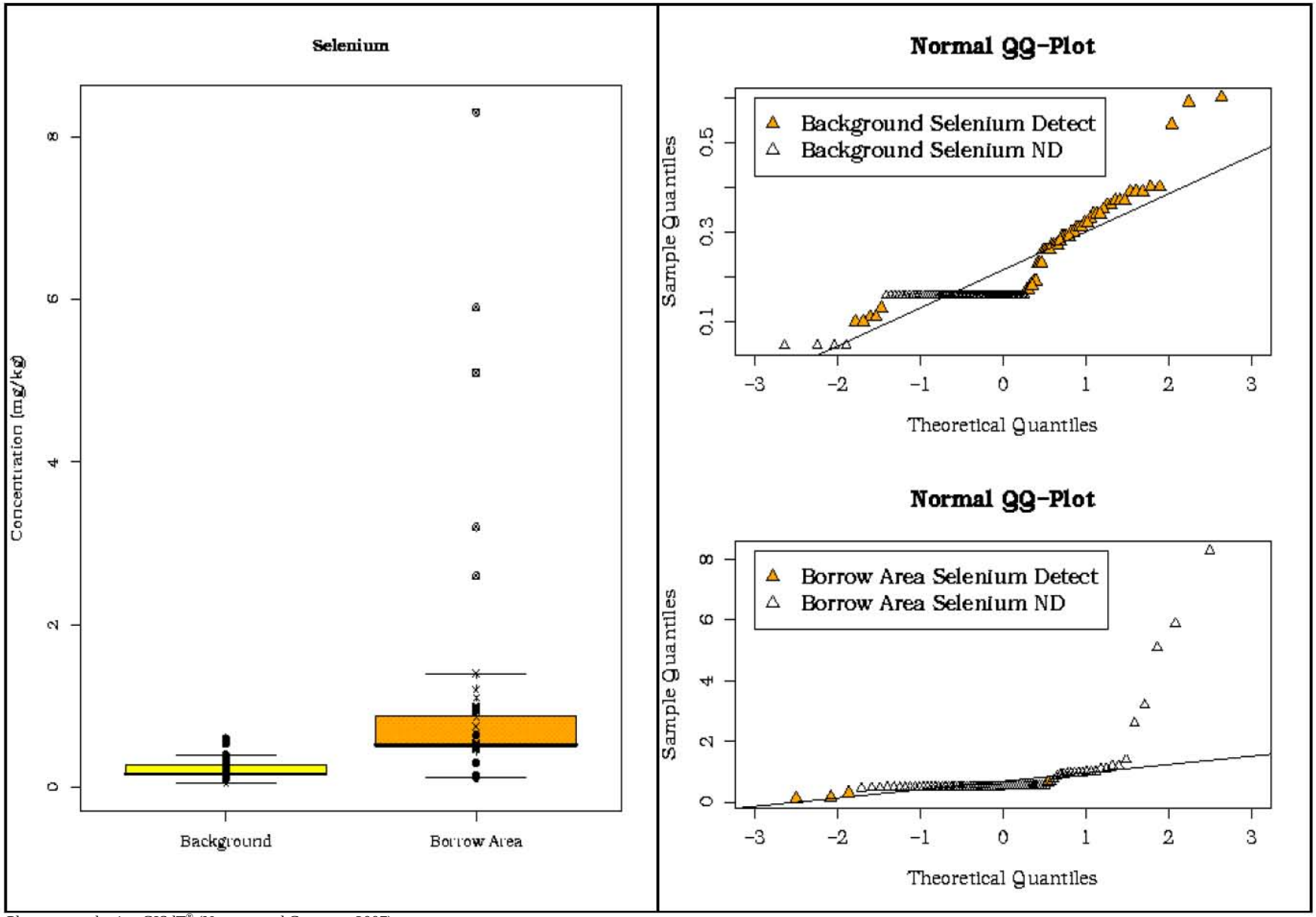

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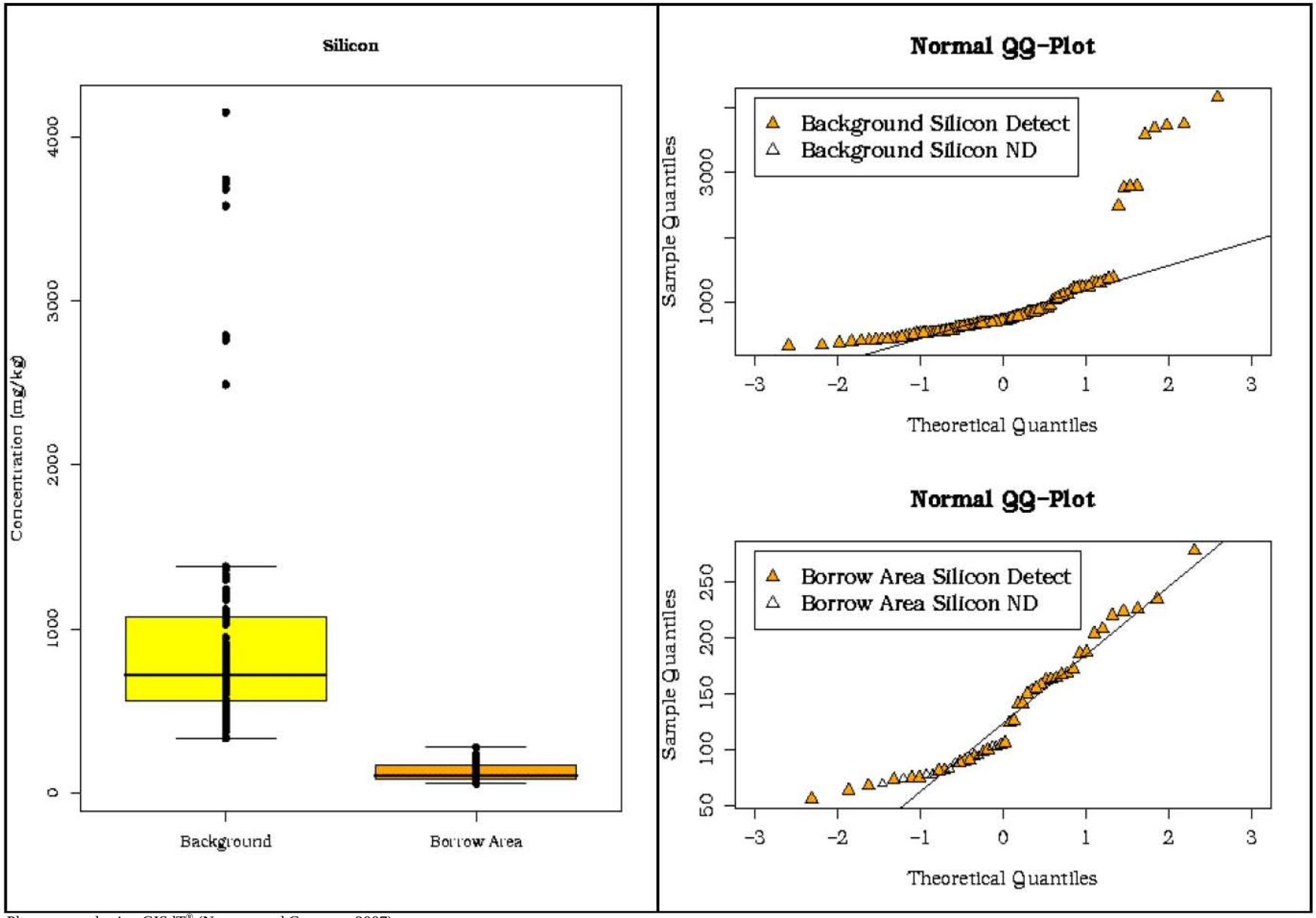

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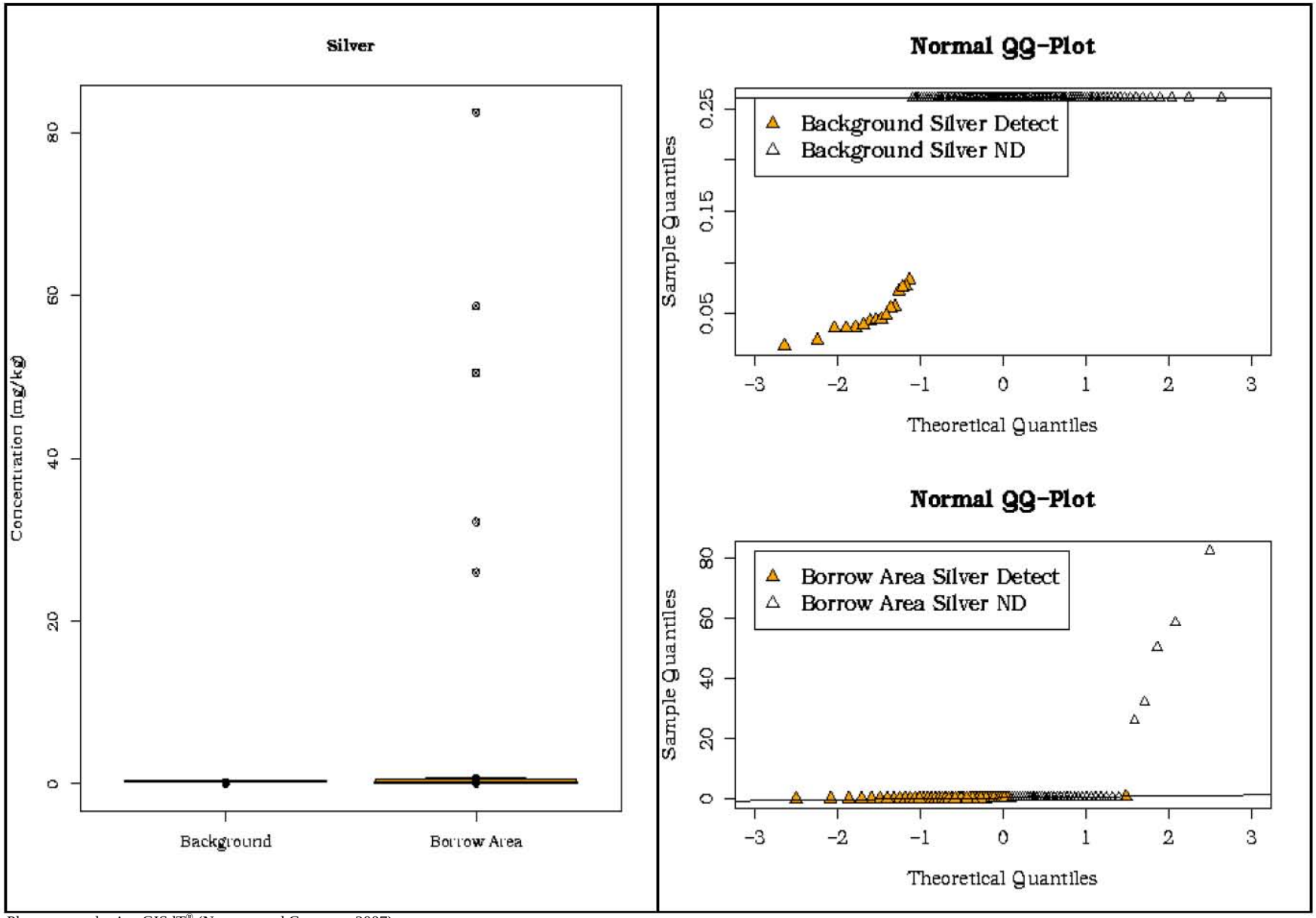

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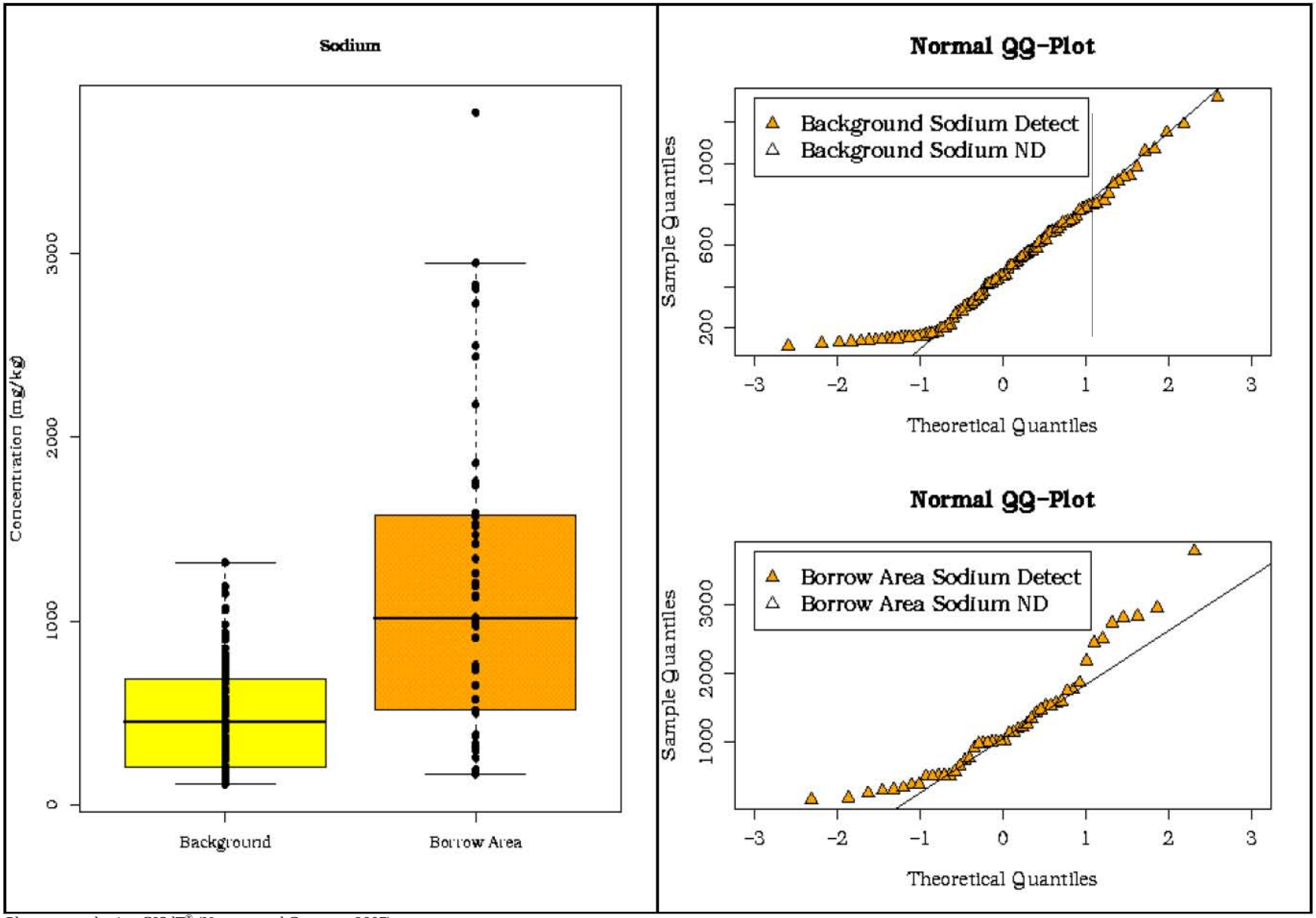

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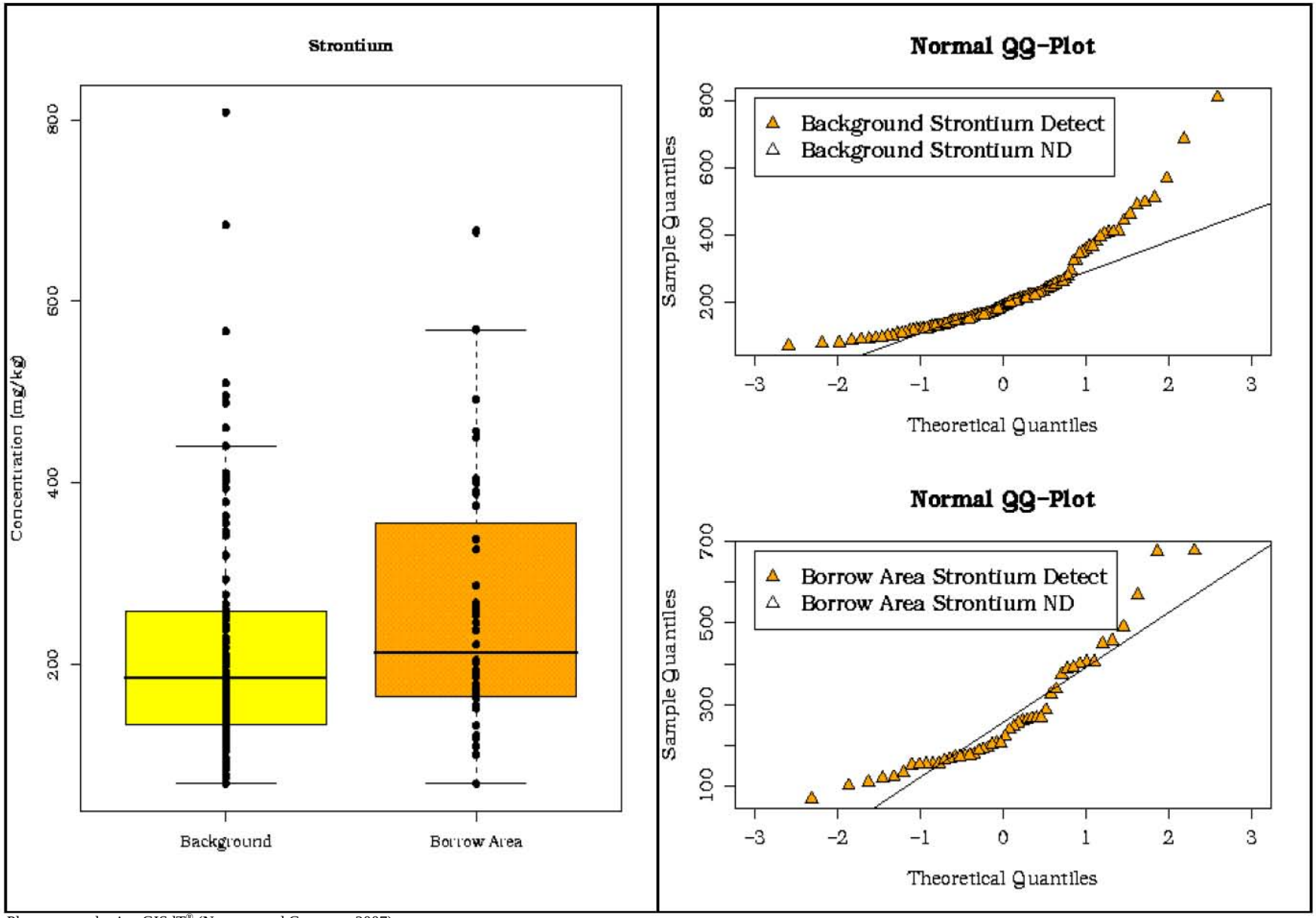

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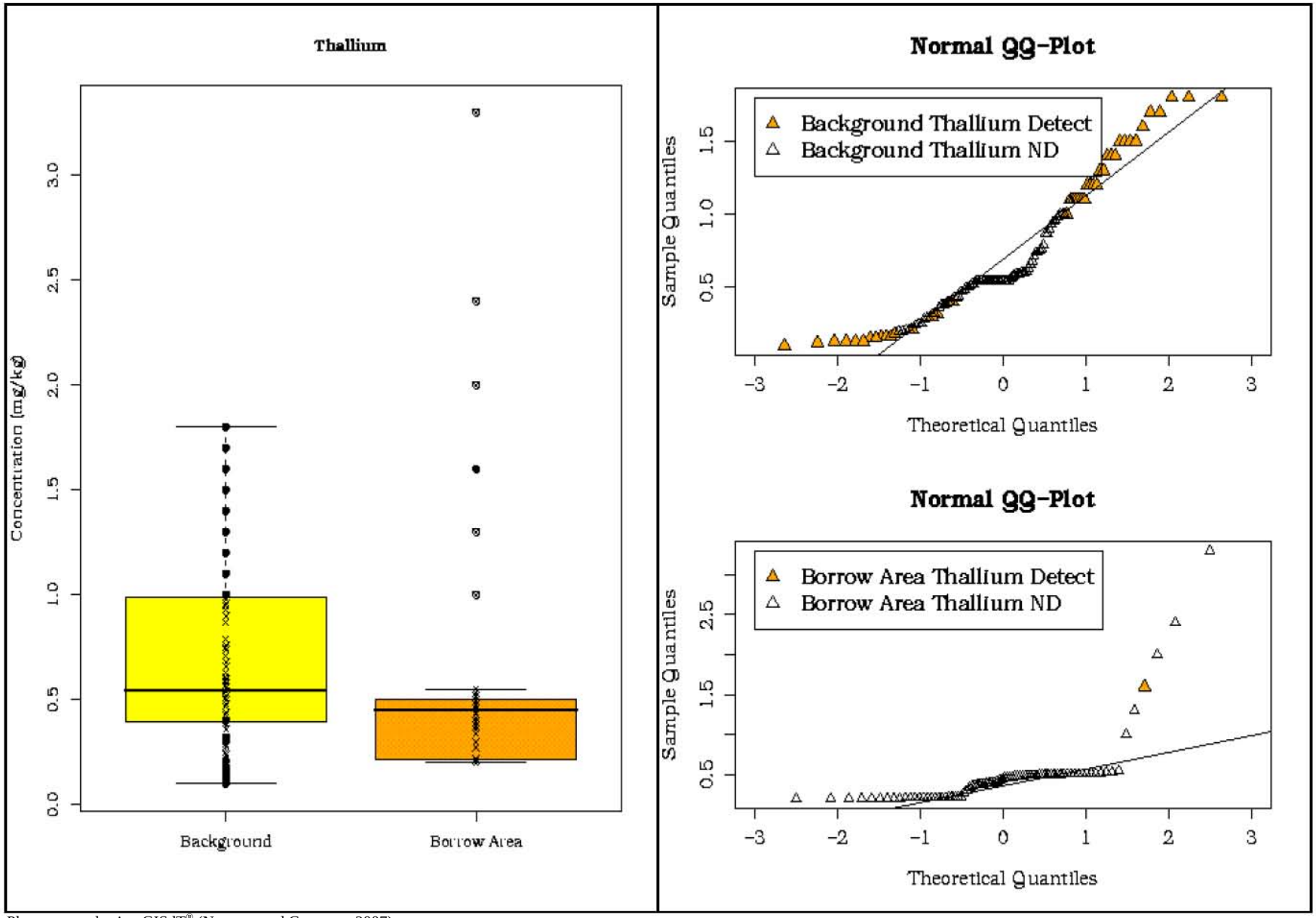

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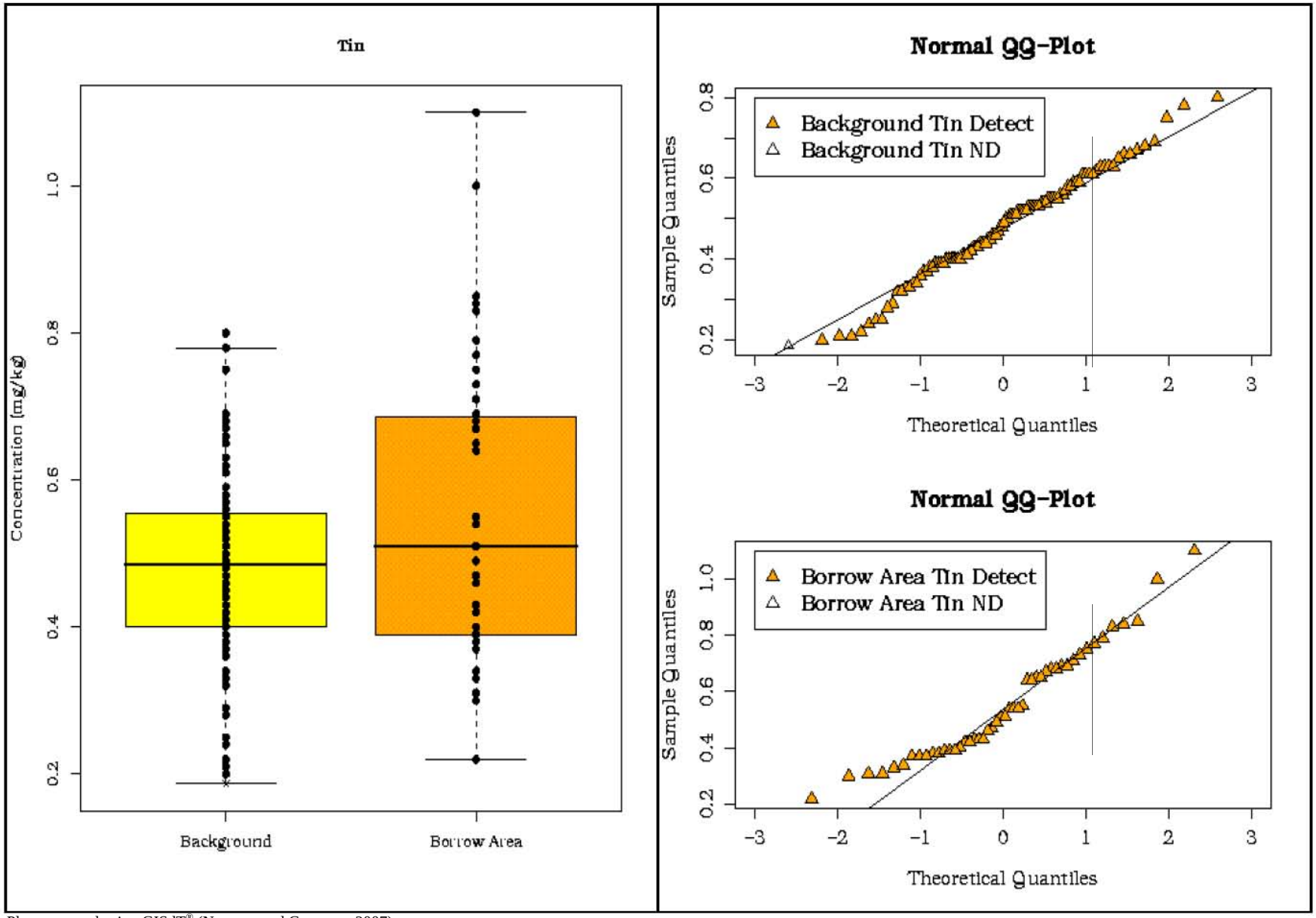

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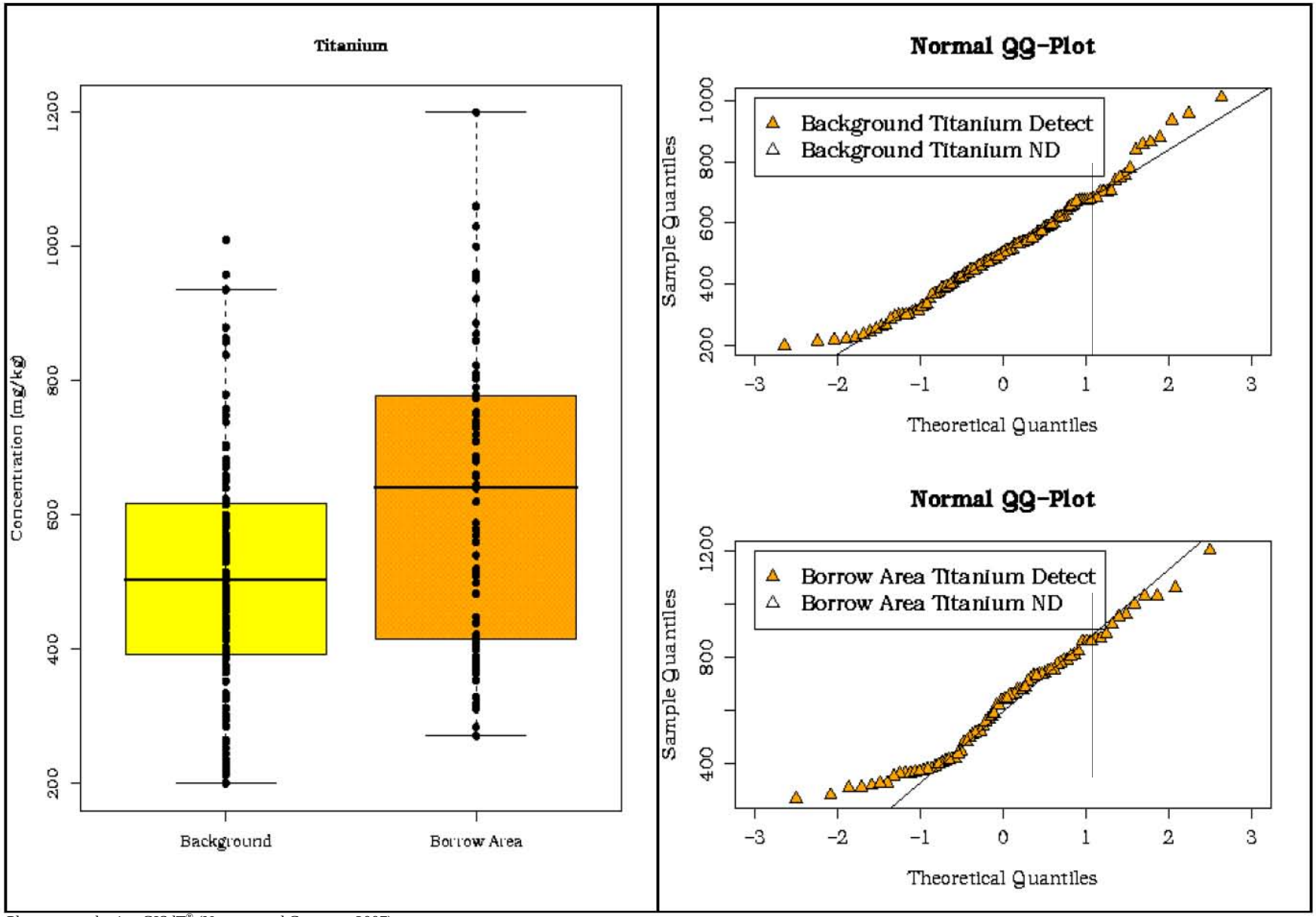

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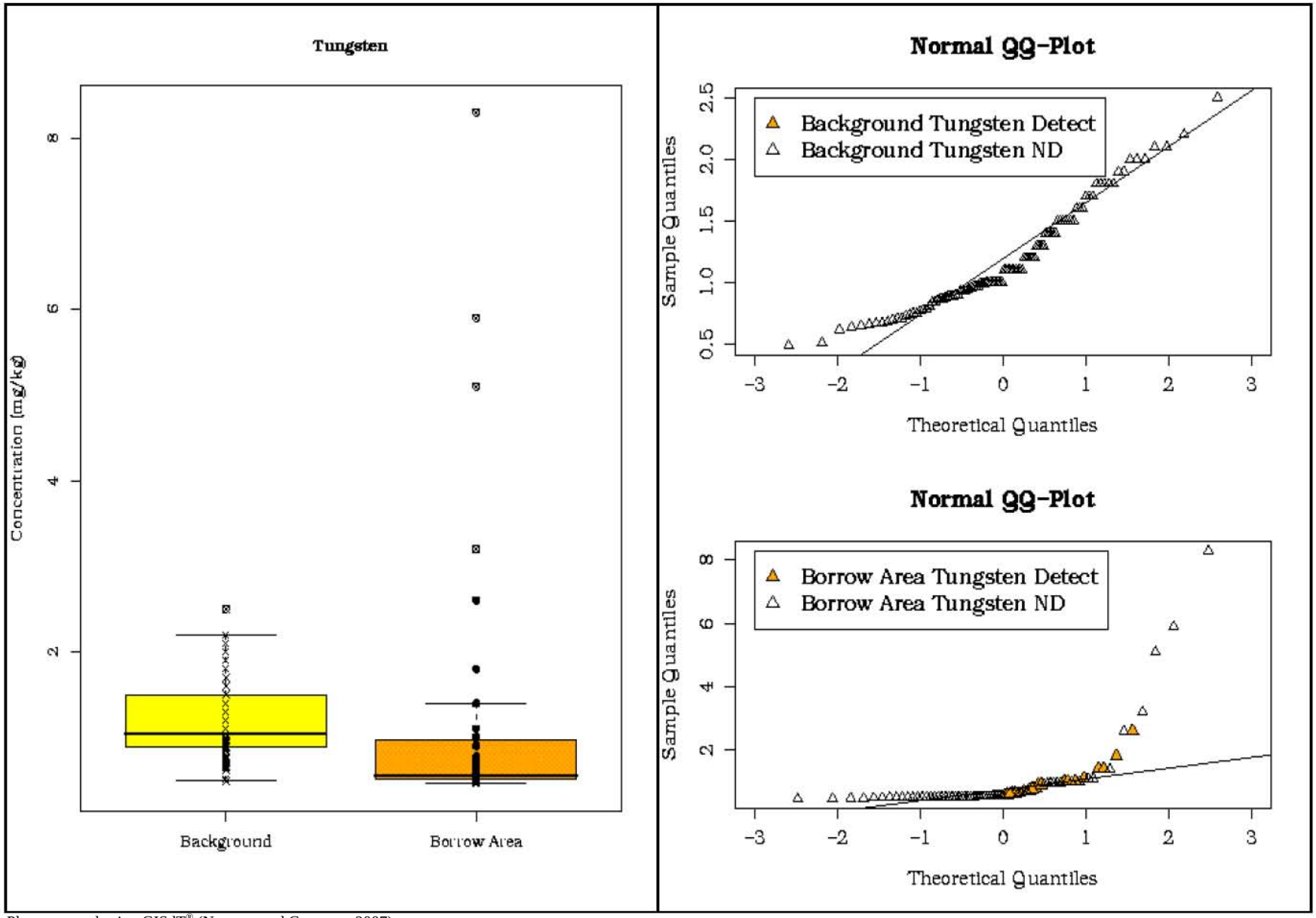
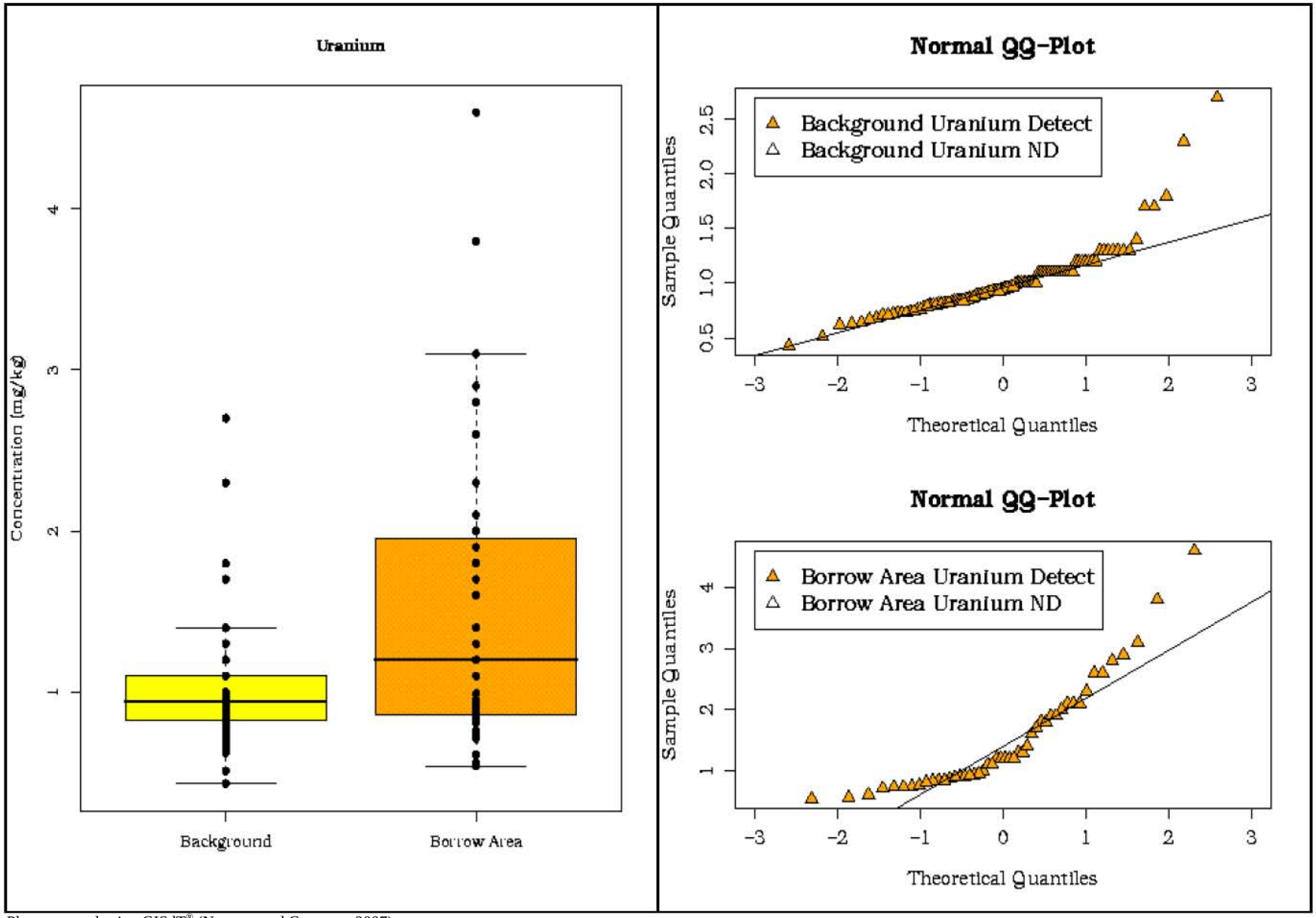


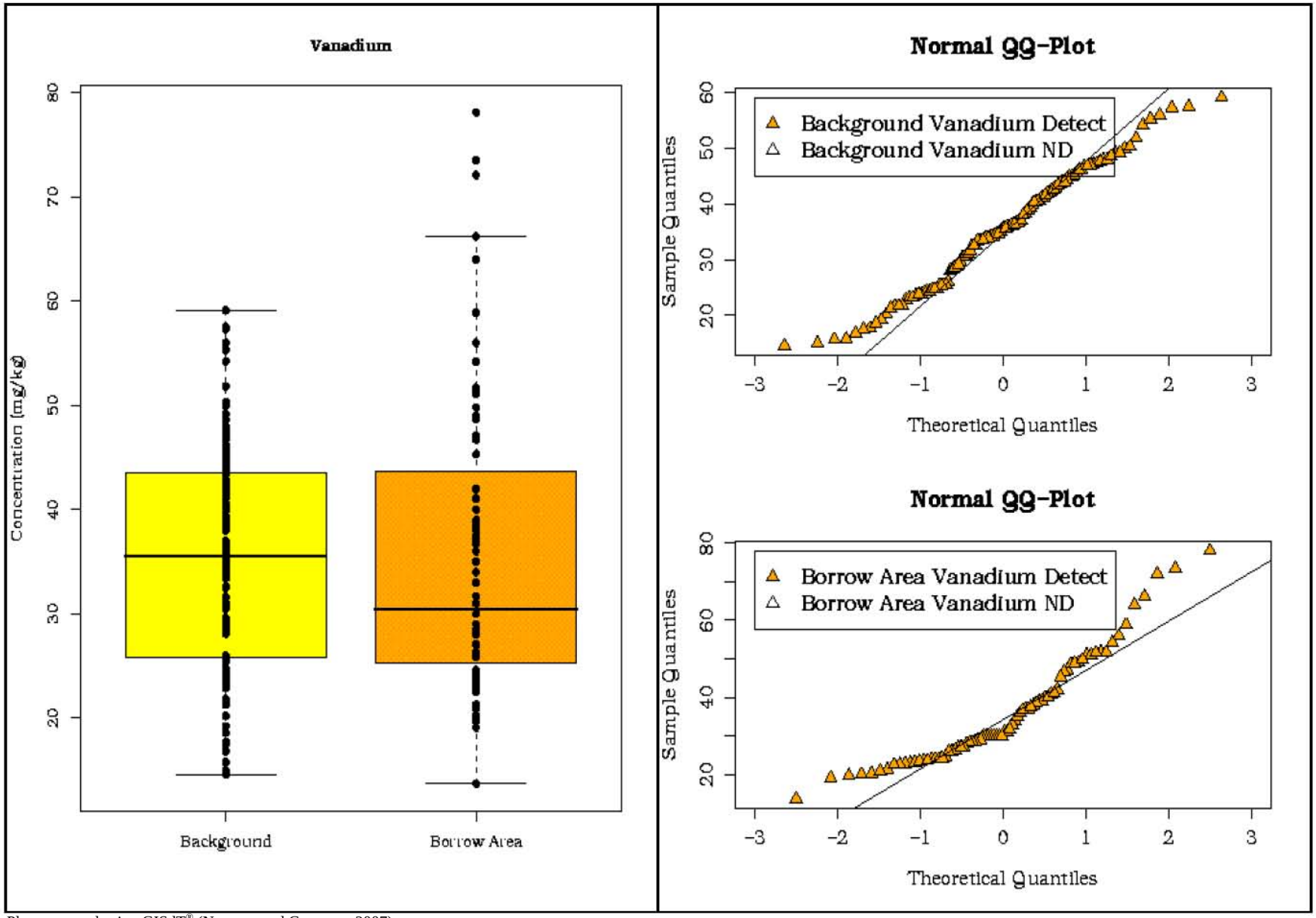
Plots prepared using GISdT® (Neptune and Company 2007).

BOXPLOTS AND NORMAL QQ PLOTS FOR METALS – USING DETECTION LIMIT FOR NON-DETECTS



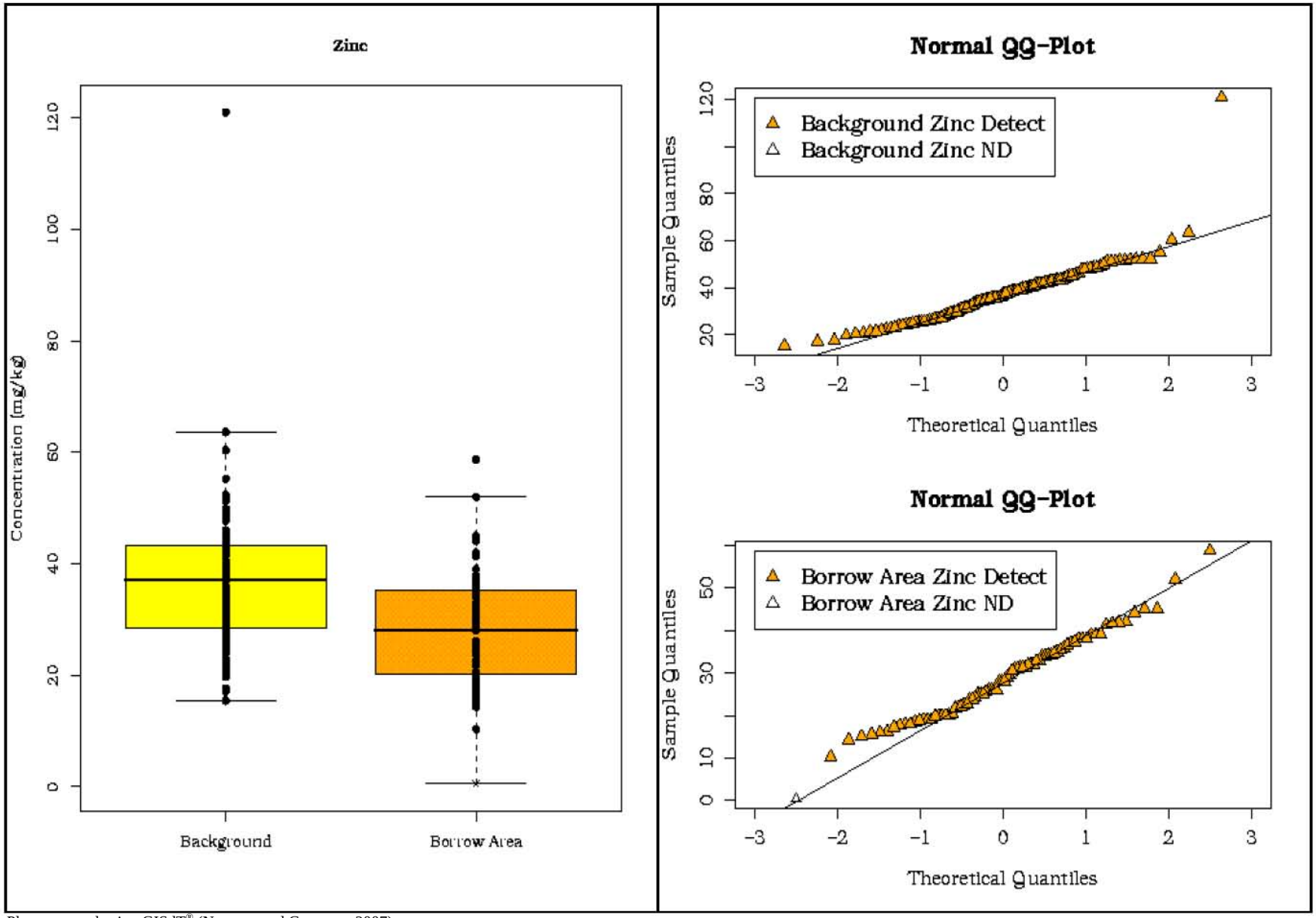
Plots prepared using GISdT® (Neptune and Company 2007).

BOXPLOTS AND NORMAL QQ PLOTS FOR METALS – USING DETECTION LIMIT FOR NON-DETECTS



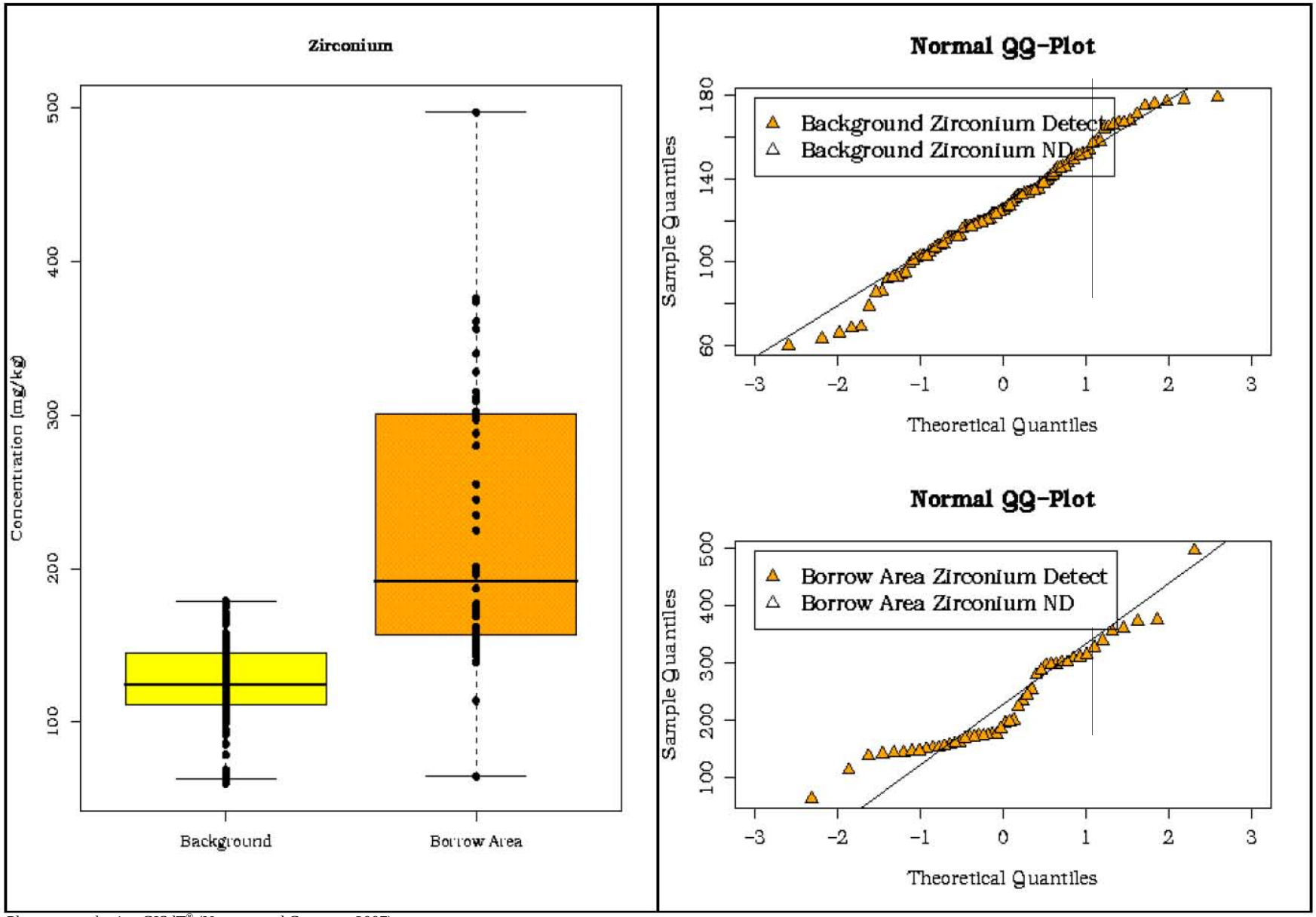
Plots prepared using GISdT® (Neptune and Company 2007).

BOXPLOTS AND NORMAL QQ PLOTS FOR METALS – USING DETECTION LIMIT FOR NON-DETECTS



Plots prepared using GISdT® (Neptune and Company 2007).

BOXPLOTS AND NORMAL QQ PLOTS FOR METALS – USING DETECTION LIMIT FOR NON-DETECTS



Plots prepared using GISdT® (Neptune and Company 2007).

ATTACHMENT E-2

COMPARISON STATISTICS

TABLE E2-1
BACKGROUND COMPARISON SUMMARY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 6)

Chemical	Background										Site									
	No. of Detects	Total Samples	% Detects	Minimum Detect	Maximum Detect	1st Quantile	Median	Mean	3rd Quantile	Standard Deviation	No. of Detects	Total Samples	% Detects	Minimum Detect	Maximum Detect	1st Quantile	Median	Mean	3rd Quantile	Standard Deviation
Aluminum	120	120	100%	3740	15300	6708	8420	8899	11200	2653	80	80	100%	3580	17600	5500	6550	7519	8525	3111
Antimony	49	120	41%	0.12	0.5	0.16	0.16	0.18	0.20	0.09	44	80	55%	0.07	0.34	0.15	0.24	0.34	0.25	0.61
Arsenic	120	120	100%	2.1	7.2	3.3	3.9	4.1	4.9	1.1	80	80	100%	1.9	25	3.5	5.2	7.0	7.7	5.3
Barium	120	120	100%	73	836	145	190	223	233	126	80	80	100%	40	927	118	140	162	172	104
Beryllium	120	120	100%	0.16	0.9	0.44	0.54	0.56	0.69	0.16	65	80	81%	0.27	1.1	0.33	0.44	0.48	0.58	0.21
Boron	34	104	33%	5.2	11.6	1.7	2.1	3.6	5.8	2.6	19	48	40%	6.7	32	2.9	5.3	9.2	13	8.7
Cadmium	16	120	13%	0.052	0.2	0.065	0.065	0.070	0.065	0.017	48	80	60%	0.03	0.32	0.07	0.13	0.15	0.25	0.09
Calcium	104	104	100%	8160	82800	17530	23650	28130	35230	14860	48	48	100%	3170	692000	26230	38700	71440	50100	117600
Chromium (Total)	120	120	100%	2.6	17	7.0	8.8	8.9	10.8	2.9	79	80	99%	2.8	110	6.9	9.1	12	13	13
Cobalt	120	120	100%	3.7	16	6.4	8.3	8.2	9.7	2.5	80	80	100%	2.3	11	4.5	5.4	5.7	6.5	1.7
Copper	120	120	100%	7.8	31	14	17	17	20	4.2	80	80	100%	7.4	25	11	13	14	15	3.7
Iron	120	120	100%	5410	19700	10480	13050	12810	15100	3263	80	80	100%	4700	23300	8495	10250	11480	13300	4050
Lead	120	120	100%	3	35	6.4	7.8	9.4	10.6	5.1	80	80	100%	3.4	19	5.7	7.4	7.7	8.7	2.9
Lithium	104	104	100%	7.5	27	11	13	14	16	4.3	46	48	96%	7.9	62	12	16	21	29	13
Magnesium	120	120	100%	4580	17500	6970	9425	9505	11700	3046	80	80	100%	4110	36500	5723	7200	9217	9315	6458
Manganese	120	120	100%	151	1090	344	419	425	496	135	80	80	100%	68	763	130	186	217	277	120
Mercury	93	120	78%	0.0084	0.1	0.009	0.015	0.018	0.022	0.015	24	80	30%	0.0071	0.040	0.010	0.010	0.017	0.020	0.016
Molybdenum	120	120	100%	0.17	2.0	0.38	0.48	0.55	0.62	0.28	76	80	95%	0.33	5.9	0.6	0.66	0.86	1.0	0.76
Nickel	120	120	100%	7.8	30	11	15	15	18	4.2	80	80	100%	5.0	72	10	18	28	45	20
Niobium	0	104	0%	NA	NA	1	1	1	1	0	14	48	29%	0.40	2.0	1.3	1.3	2.6	2.3	3.8
Palladium	104	104	100%	0.14	1.5	0.29	0.40	0.46	0.55	0.24	48	48	100%	0.14	1.6	0.34	0.47	0.57	0.79	0.31
Platinum	5	104	5%	0.045	0.1	0.022	0.022	0.024	0.022	0.011	2	48	4%	0.01	0.020	0.05	0.05	0.11	0.10	0.15
Potassium	104	104	100%	625	3890	1233	1535	1730	2058	733	48	48	100%	1260	7300	1843	2625	2789	3470	1190

TABLE E2-1
BACKGROUND COMPARISON SUMMARY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 2 of 6)

	Background										Site									
Chemical	**No. of Detects**	**Total Samples**	**% Detects**	**Minimum Detect**	**Maximum Detect**	**1st Quantile**	**Median**	**Mean**	**3rd Quantile**	**Standard Deviation**	**No. of Detects**	**Total Samples**	**% Detects**	**Minimum Detect**	**Maximum Detect**	**1st Quantile**	**Median**	**Mean**	**3rd Quantile**	**Standard Deviation**
Selenium	52	120	43%	0.1	0.6	0.079	0.079	0.17	0.27	0.13	4	80	5%	0.12	0.64	0.25	0.26	0.45	0.45	0.60
Silicon	104	104	100%	335	4150	563	720	981	1068	780	39	48	81%	56	278	72	105	122	165	64
Silver	16	120	13%	0.019	0.1	0.13	0.13	0.12	0.13	0.03	44	80	55%	0.05	0.70	0.08	0.17	1.7	0.25	6.6
Sodium	104	104	100%	111	1320	210	452	486	685	286	48	48	100%	167	3770	516	1015	1238	1575	846
Strontium	104	104	100%	69	808	135	186	223	258	132	48	48	100%	69	678	165	214	265	347	144
Thallium	42	120	35%	0.1	1.8	0.21	0.27	0.50	0.49	0.48	1	80	1%	1.6	1.6	0.11	0.23	0.25	0.25	0.28
Tin	103	104	99%	0.2	0.8	0.40	0.49	0.48	0.55	0.13	48	48	100%	0.22	1.1	0.39	0.51	0.55	0.68	0.20
Titanium	120	120	100%	200	1010	393	504	510	618	171	80	80	100%	271	1200	416	641	622	776	219
Tungsten	0	104	0%	NA	NA	0	1	1	1	0	19	76	25%	0.56	2.6	0.25	0.29	0.63	0.69	0.69
Uranium	103	103	100%	0.43	2.7	0.82	0.94	1.0	1.10	0.31	48	48	100%	0.54	4.6	0.86	1.2	1.5	1.9	0.89
Vanadium	120	120	100%	14.6	59	26	36	35	43	11	80	80	100%	14	78	26	31	36	43	14
Zinc	120	120	100%	15.4	121	29	37	37	43	13	79	80	99%	10	59	20	28	29	35	10
Zirconium	104	104	100%	60.1	179	112	125	126	145	27	48	48	100%	65	497	158	192	227	300	89
Actinium-228	120	120	100%	1.11	3.4	1.5	1.8	1.8	2.0	0.38	43	49	88%	1.1	3.0	1.7	1.9	1.8	2.1	0.5
Bismuth-210	1	104	1%	2.2	2.2	0.20	0.60	0.61	0.90	0.58	12	12	100%	0.10	1.5	0.6	0.80	0.83	1.1	0.44
Bismuth-212	68	120	57%	0.71	1.8	0.77	1.0	1.0	1.2	0.34	5	49	10%	1.1	1.4	1.1	1.5	1.5	1.7	0.38
Bismuth-214	120	120	100%	0.52	1.6	0.80	0.93	0.95	1.1	0.21	22	49	45%	0.94	1.8	0.37	0.45	0.76	1.2	0.46
Lead-210	2	120	2%	1.9	2.2	0.30	0.67	0.72	1.1	0.64	3	49	6%	1.5	2.3	1.5	4.7	8.0	7.3	10.3
Lead-212	120	120	100%	0.94	2.1	1.3	1.5	1.5	1.7	0.26	49	49	100%	0.73	2.9	1.6	1.8	1.8	2.0	0.37
Lead-214	120	120	100%	0.61	1.7	0.8	0.9	1.0	1.1	0.22	49	49	100%	0.71	2.6	1.2	1.3	1.4	1.5	0.31
Polonium-210	1	104	1%	2.2	2.2	0.20	0.60	0.61	0.90	0.58	12	12	100%	0.10	1.5	0.6	0.80	0.83	1.1	0.44
Polonium-212	64	104	62%	0.46	1.2	0.50	0.61	0.65	0.78	0.22	12	12	100%	0.38	0.91	0.5	0.66	0.65	0.74	0.16
Polonium-214	104	104	100%	0.52	1.6	0.81	0.93	1.0	1.1	0.21	12	12	100%	0.94	1.6	1.2	1.2	1.3	1.4	0.19

TABLE E2-1
BACKGROUND COMPARISON SUMMARY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 3 of 6)

	Background										Site									
Chemical	**No. of Detects**	**Total Samples**	**% Detects**	**Minimum Detect**	**Maximum Detect**	**1st Quantile**	**Median**	**Mean**	**3rd Quantile**	**Standard Deviation**	**No. of Detects**	**Total Samples**	**% Detects**	**Minimum Detect**	**Maximum Detect**	**1st Quantile**	**Median**	**Mean**	**3rd Quantile**	**Standard Deviation**
Polonium-216	104	104	100%	1.08	2.1	1.3	1.6	1.5	1.7	0.25	12	12	100%	1.8	2.6	2.0	2.0	2.1	2.3	0.28
Polonium-218	96	104	92%	0.494	2.4	0.9	1.1	1.1	1.2	0.35	12	12	100%	1.7	3.0	1.8	2.3	2.2	2.5	0.41
Potassium-40	120	120	100%	17.8	35	23	25	25	27	3.3	49	49	100%	9.4	31	24	26	25	28	5.1
Protactinium-234	0	104	0%	NA	NA	NA	NA	NA	NA	NA	12	12	100%	1.2	1.7	1.4	1.5	1.5	1.5	0.14
Radium-224	104	104	100%	1.08	2.1	1.3	1.6	1.5	1.7	0.25	12	12	100%	3.3	8.7	3.6	4.1	4.4	4.5	1.5
Radium-226	96	104	92%	0.494	2.4	0.9	1.1	1.1	1.2	0.35	49	49	100%	0.93	4.5	1.5	1.9	2.0	2.4	0.70
Radium-228	68	84	81%	1.15	2.9	1.7	2.0	1.9	2.2	0.40	45	49	92%	0.78	3.3	1.8	2.0	2.1	2.4	0.59
Radon-220	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12	12	100%	1.79	2.64	NA	NA	NA	NA	NA
Radon-222	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12	12	100%	1.72	2.99	NA	NA	NA	NA	NA
Thallium-208	120	120	100%	0.33	0.7	0.48	0.54	0.54	0.60	0.09	49	49	100%	0.23	1.0	0.50	0.56	0.56	0.62	0.12
Thorium-228	120	120	100%	1.07	2.3	1.5	1.7	1.7	1.9	0.28	49	49	100%	0.55	2.6	1.49	1.75	1.71	1.96	0.43
Thorium-230	120	120	100%	0.66	3.0	1.0	1.2	1.2	1.4	0.38	49	49	100%	0.84	3.4	1.2	1.6	1.7	2.0	0.56
Thorium-232	120	120	100%	1.1	2.2	1.4	1.6	1.6	1.8	0.27	49	49	100%	0.55	2.64	1.4	1.5	1.5	1.8	0.37
Thorium-234	65	120	54%	1.11	2.5	0.75	1.3	1.2	1.6	0.63	13	49	27%	1.2	2.3	1.5	1.8	2.1	2.6	0.83
Uranium-234	61	120	51%	0.53	2.8	0.83	1.0	1.1	1.2	0.46	49	49	100%	0.56	3.7	1.1	1.5	1.6	2.0	0.61
Uranium-235	54	120	45%	0.037	0.21	0.043	0.059	0.066	0.089	0.038	33	49	67%	0.019	0.24	0.04	0.06	0.12	0.10	0.17
Uranium-238	120	120	100%	0.45	2.4	0.86	1.0	1.1	1.2	0.37	49	49	100%	0.58	2.7	1.0	1.4	1.4	1.6	0.47

Note: Summary and background comparison statistics were performed using one-half the detection limit for metals and using GISdT® (Neptune and Company 2007).
BOLD with Highlight indicates Site concentrations are greater than background.
WRS = Wilcoxon Rank Sum Test with the Gehan Modification
mg/kg - milligrams per kilogram
pCi/g - picoCuries per gram

TABLE E2-1
BACKGROUND COMPARISON SUMMARY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 4 of 6)

Chemical	T Test *p*	Quantile Test *p*	Slippage Test *p*	WRS Test *p*	Greater than Background?	Units	Basis
Aluminum	1.0 E+0	9.9 E-1	6.3 E-2	1.0 E+0	NO	mg/kg	Multiple tests
Antimony	8.4 E-2	NA	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests
Arsenic	4.3 E-6	8.3 E-8	7.8 E-11	9.2 E-5	YES	mg/kg	Multiple tests
Barium	1.0 E+0	1.0 E+0	4.0 E-1	1.0 E+0	NO	mg/kg	Multiple tests
Beryllium	9.9 E-1	9.0 E-1	2.4 E-2	1.0 E+0	YES	mg/kg	Slippage, Site Max > Background
Boron	3.6 E-5	NA	7.4 E-7	8.9 E-3	YES	mg/kg	Multiple tests
Cadmium	1.1 E-12	NA	8.0 E-2	4.0 E-2	YES	mg/kg	Proportion of detects higher for site vs background; marginal slippage and WRS results; t-test
Calcium	7.2 E-3	7.8 E-3	7.9 E-4	1.1 E-5	YES	mg/kg	Multiple tests
Chromium (Total)	1.2 E-2	1.8 E-2	3.6 E-6	6.6 E-2	YES	mg/kg	Multiple tests
Cobalt	1.0 E+0	1.0 E+0	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests
Copper	1.0 E+0	1.0 E+0	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests
Iron	9.9 E-1	7.0 E-1	1.6 E-1	1.0 E+0	NO	mg/kg	Multiple tests
Lead	1.0 E+0	9.6 E-1	1.0 E+0	9.9 E-1	NO	mg/kg	Multiple tests
Lithium	1.7 E-4	NA	7.0 E-8	1.6 E-3	YES	mg/kg	Multiple tests
Magnesium	6.4 E-1	8.2 E-1	1.4 E-3	1.0 E+0	YES	mg/kg	Slippage, Site Max 2x Background
Manganese	1.0 E+0	1.0 E+0	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests
Mercury	2.5 E-1	NA	1.0 E+0	1.0 E+0	NO	mg/kg	Slippage and WRS, Low detection frequency for t-test
Molybdenum	4.0 E-4	NA	6.1 E-2	7.2 E-9	YES	mg/kg	Multiple tests
Nickel	1.6 E-7	5.7 E-12	6.4 E-15	1.7 E-2	YES	mg/kg	Multiple tests
Niobium	5.5 E-4	NA	NA	5.8 E-4	YES	mg/kg	Low background detection frequency & higher detect proportion in site data; supported by results of multiple tests
Palladium	2.2 E-2	1.2 E-1	3.2 E-1	2.1 E-2	YES	mg/kg	Multiple tests
Platinum	9.8 E-5	NA	1.0 E+0	8.2 E-1	NO	mg/kg	Slippage and WRS, Low detection frequency for t-test
Potassium	1.8 E-7	3.4 E-6	2.3 E-4	1.6 E-9	YES	mg/kg	Multiple tests

TABLE E2-1
BACKGROUND COMPARISON SUMMARY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 5 of 6)

Chemical	T Test *p*	Quantile Test *p*	Slippage Test *p*	WRS Test *p*	Greater than Background?	Units	Basis
Selenium	6.8 E-5	NA	3.2 E-1	1.0 E+0	NO	mg/kg	Slippage and WRS, Low detection frequency for t-test
Silicon	1.0 E+0	1.0 E+0	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests
Silver	1.6 E-2	NA	8.6 E-5	1.3 E-5	YES	mg/kg	Multiple tests
Sodium	9.4 E-8	1.3 E-11	7.1 E-11	6.4 E-10	YES	mg/kg	Multiple tests
Strontium	4.4 E-2	2.3 E-1	1.0 E+0	1.8 E-2	NO	mg/kg	Slippage, Quantile, t-test and Site Max < Back Ground
Thallium	1.0 E+0	NA	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests; plots presented in Appendix D
Tin	1.1 E-2	1.3 E-5	2.7 E-3	5.3 E-2	YES	mg/kg	Multiple tests
Titanium	9.0 E-5	3.5 E-6	2.4 E-2	2.7 E-4	YES	mg/kg	Multiple tests
Tungsten	3.0 E-1	NA	NA	1.8 E-3	YES	mg/kg	Elevated DLs for site and background overlap sufficiently that statistical differences cannot be defined or defended; Higher proportion of detects in site vs background.
Uranium	2.0 E-4	7.7 E-7	2.8 E-3	1.1 E-3	YES	mg/kg	Multiple tests
Vanadium	4.1 E-1	1.8 E-1	9.5 E-3	7.4 E-1	YES	mg/kg	Slippage, Site Max > Background
Zinc	1.0 E+0	1.0 E+0	1.0 E+0	1.0 E+0	NO	mg/kg	Multiple tests
Zirconium	2.2 E-10	5.4 E-13	1.1 E-15	5.1 E-16	YES	mg/kg	Multiple tests
Actinium-228	7.0 E-1	3.9 E-1	1.0 E+0	3.3 E-1	NO	mg/kg	Multiple tests
Bismuth-210	6.6 E-2	NA	1.0 E+0	2.1 E-18	YES	mg/kg	U-238 > background, if in equilibrium all U-238 decay products also > background
Bismuth-212	1.1 E-10	NA	1.0 E+0	9.0 E-1	NO	mg/kg	Slippage, WRS; Th-232, Ac-228< background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Bismuth-214	1.0 E+0	NA	2.9 E-1	9.9 E-1	YES	mg/kg	U-238 > background, if in equilibrium all U-238 decay products also > background
Lead-210	5.1 E-6	NA	1.1 E-1	1.2 E-2	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background
Lead-212	1.8 E-6	1.4 E-7	4.7 E-4	1.9 E-8	NO	mg/kg	Th-232, Ac-228< background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Lead-214	2.3 E-11	9.7 E-11	2.3 E-2	1.5 E-14	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background
Polonium-210	6.6 E-2	NA	1.0 E+0	2.1 E-18	YES	mg/kg	U-238 > background, if in equilibrium all U-238 decay products also > background
Polonium-212	5.0 E-1	NA	1.0 E+0	2.3 E-1	NO	mg/kg	Multiple tests
Polonium-214	7.1 E-5	1.5 E-3	1.0 E+0	2.9 E-5	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background

TABLE E2-1
BACKGROUND COMPARISON SUMMARY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 6 of 6)

Chemical	T Test *p*	Quantile Test *p*	Slippage Test *p*	WRS Test *p*	Greater than Background?	Units	Basis
Polonium-216	6.0 E-6	4.2 E-7	6.9 E-5	5.8 E-8	NO	mg/kg	Multiple tests; Th-232, Ac-228< background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Polonium-218	3.6 E-7	NA	6.9 E-5	3.2 E-8	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background
Potassium-40	7.9 E-1	2.4 E-1	1.0 E+0	1.5 E-1	NO	mg/kg	Multiple tests
Protactinium-234	3.9 E-14	NA	NA	4.9 E-27	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background
Radium-224	1.6 E-5	2.0 E-10	1.5 E-16	7.7 E-9	NO	mg/kg	Th-232, Ac-228 < background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Radium-226	3.7 E-12	NA	7.1 E-9	6.7 E-16	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background
Radium-228	9.1 E-3	NA	5.2 E-2	2.3 E-2	NO	mg/kg	Slippage; Th-232, Ac-228 < background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Radon-220	NA	NA	NA	NA	NO	mg/kg	Th-232, Ac-228< background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Radon-222	NA	NA	NA	NA	YES	mg/kg	U-238 > background, if in equilibrium all U-238 decay products also > background
Thallium-208	2.1 E-1	2.9 E-1	2.9 E-1	1.3 E-1	NO	mg/kg	Multiple tests; Th-232, Ac-228 < background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Thorium-228	3.8 E-1	2.0 E-1	6.5 E-3	3.0 E-1	NO	mg/kg	Multiple tests; Th-232, Ra-228< background; Th-228 plots < background, if in equilibrium all Th-232 decay products also < background
Thorium-230	3.1 E-6	4.3 E-5	8.3 E-2	1.3 E-7	YES	mg/kg	U-238 > background, if in equilibrium all U-238 decay products also > background
Thorium-232	9.4 E-1	7.1 E-1	2.9 E-1	9.2 E-1	NO	mg/kg	Multiple tests
Thorium-234	1.1 E-10	NA	1.0 E+0	4.6 E-1	YES	mg/kg	U-238 > background, if in equilibrium all U-238 decay products also > background
Uranium-234	1.6 E-6	NA	8.3 E-2	7.8 E-11	YES	mg/kg	Multiple tests; U-238 > background, if in equilibrium all U-238 decay products also > background
Uranium-235	1.9 E-2	NA	2.6 E-1	5.8 E-1	NO	mg/kg	Multiple tests
Uranium-238	4.6 E-5	2.1 E-4	8.3 E-2	1.4 E-5	YES	mg/kg	Multiple tests

Note: Summary and background comparison statistics were performed using one-half the detection limit for metals and using GISdT® (Neptune and Company 2007).
BOLD with Highlight indicates Site concentrations are greater than background.
WRS = Wilcoxon Rank Sum Test with the Gehan Modification
mg/kg - milligrams per kilogram
pCi/g - picoCuries per gram

TABLE E2-2
GISdT OUTPUT FROM THE QUANTILE TEST
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 5)

Sample Identification	Data Subset	Sample Size	Number of Detects	Mean	Standard Deviation	Test Quantile	Sample Size for Test	NDs Greater Than Test Quantile?	Test Quantile Value	N Above the Test Quantile	Test Statistic	p-value
Background	Aluminum	120	120	8899	2653	-	120	-	-	28	-	-
Borrow Area	Aluminum	80	80	7519	3111	0.8	80	FALSE	11200	9	9	0.9918
Background	Antimony	120	49	0.24	0.1252	-	120	-	-	NA	-	-
Borrow Area	Antimony	80	44	0.3361	0.6107	0.8	80	TRUE	0.5	NA	NA	NA
Background	Arsenic	120	120	4.132	1.135	-	120	-	-	9	-	-
Borrow Area	Arsenic	80	80	6.967	5.271	0.8	80	FALSE	5.92	31	31	8.297E-08
Background	Barium	120	120	222.5	125.6	-	120	-	-	31	-	-
Borrow Area	Barium	80	80	162.1	104.3	0.8	80	FALSE	230.2	9	9	0.9973
Background	Beryllium	120	120	0.5566	0.1634	-	120	-	-	27	-	-
Borrow Area	Beryllium	80	65	0.4834	0.2135	0.8	80	FALSE	0.712	13	13	0.8977
Background	Boron	104	34	3.601	2.623	-	104	-	-	NA	-	-
Borrow Area	Boron	48	19	9.168	8.743	0.8	48	TRUE	8.46	NA	NA	NA
Background	Cadmium	120	16	0.07008	0.01736	-	120	-	-	NA	-	-
Borrow Area	Cadmium	80	48	0.1526	0.08854	0.8	80	TRUE	0.13	NA	NA	NA
Background	Calcium	104	104	28130	14860	-	104	-	-	15	-	-
Borrow Area	Calcium	48	48	71440	117600	0.8	48	FALSE	44760	16	16	0.007751
Background	Chromium (Total)	120	120	8.937	2.886	-	120	-	-	16	-	-
Borrow Area	Chromium (Total)	80	79	12.43	13.31	0.8	80	FALSE	12	21	21	0.01772
Background	Cobalt	120	120	8.225	2.479	-	120	-	-	34	-	-
Borrow Area	Cobalt	80	80	5.688	1.677	0.8	80	FALSE	9.5	3	3	1
Background	Copper	120	120	17.07	4.235	-	120	-	-	31	-	-
Borrow Area	Copper	80	80	13.74	3.732	0.8	80	FALSE	19.6	7	7	0.9996
Background	Iron	120	120	12810	3263	-	120	-	-	25	-	-
Borrow Area	Iron	80	80	11480	4050	0.8	80	FALSE	15520	15	15	0.7038
Background	Lead	120	120	9.447	5.059	-	120	-	-	27	-	-
Borrow Area	Lead	80	80	7.704	2.923	0.8	80	FALSE	10.9	11	11	0.96
Background	Lithium	104	104	13.85	4.32	-	104	-	-	NA	-	-
Borrow Area	Lithium	48	46	21.21	12.96	0.8	48	TRUE	20.22	NA	NA	NA

TABLE E2-2
GISdT OUTPUT FROM THE QUANTILE TEST
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Sample Identification	Data Subset	Sample Size	Number of Detects	Mean	Standard Deviation	Test Quantile	Sample Size for Test	NDs Greater Than Test Quantile?	Test Quantile Value	N Above the Test Quantile	Test Statistic	p-value
Background	Magnesium	120	120	9505	3046	-	120	-	-	26	-	-
Borrow Area	Magnesium	80	80	9217	6458	0.8	80	FALSE	12220	14	14	0.8161
Background	Manganese	120	120	424.9	135.3	-	120	-	-	38	-	-
Borrow Area	Manganese	80	80	216.6	119.5	0.8	80	FALSE	469.4	2	2	1
Background	Mercury	120	93	0.01762	0.01539	-	120	-	-	NA	-	-
Borrow Area	Mercury	80	24	0.01914	0.01543	0.8	80	TRUE	0.03	NA	NA	NA
Background	Molybdenum	120	120	0.5467	0.2792	-	120	-	-	NA	-	-
Borrow Area	Molybdenum	80	76	0.8553	0.7633	0.8	80	TRUE	0.792	NA	NA	NA
Background	Nickel	120	120	15.12	4.238	-	120	-	-	5	-	-
Borrow Area	Nickel	80	80	27.53	19.66	0.8	80	FALSE	22.12	35	35	5.684E-12
Background	Niobium	104	0	0.7102	0.2299	-	104	-	-	NA	-	-
Borrow Area	Niobium	48	14	2.63	3.821	0.8	48	TRUE	2.58	NA	NA	NA
Background	Palladium	104	104	0.4615	0.2423	-	104	-	-	18	-	-
Borrow Area	Palladium	48	48	0.566	0.3142	0.8	48	FALSE	0.708	13	13	0.1211
Background	Platinum	104	5	0.02411	0.01129	-	104	-	-	NA	-	-
Borrow Area	Platinum	48	2	0.114	0.1539	0.8	48	TRUE	0.11	NA	NA	NA
Background	Potassium	104	104	1730	732.8	-	104	-	-	10	-	-
Borrow Area	Potassium	48	48	2789	1190	0.8	48	FALSE	2876	21	21	0.000003382
Background	Selenium	120	52	0.1779	0.1279	-	120	-	-	NA	-	-
Borrow Area	Selenium	80	4	0.4522	0.6043	0.8	80	TRUE	0.52	NA	NA	NA
Background	Silicon	104	104	981	780.1	-	104	-	-	31	-	-
Borrow Area	Silicon	48	39	121.7	63.61	0.8	48	FALSE	906	0	0	1
Background	Silver	120	16	0.1197	0.02846	-	120	-	-	NA	-	-
Borrow Area	Silver	80	44	1.724	6.554	0.8	80	TRUE	0.2609	NA	NA	NA
Background	Sodium	104	104	485.7	285.9	-	104	-	-	5	-	-
Borrow Area	Sodium	48	48	1238	845.6	0.8	48	FALSE	1008	26	26	1.332E-11
Background	Strontium	104	104	222.9	132.1	-	104	-	-	19	-	-
Borrow Area	Strontium	48	48	265.2	143.5	0.8	48	FALSE	341.2	12	12	0.2274

TABLE E2-2
GISdT OUTPUT FROM THE QUANTILE TEST
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Sample Identification	Data Subset	Sample Size	Number of Detects	Mean	Standard Deviation	Test Quantile	Sample Size for Test	NDs Greater Than Test Quantile?	Test Quantile Value	N Above the Test Quantile	Test Statistic	p-value
Background	Thallium	120	42	0.5048	0.4806	-	120	-	-	NA	-	-
Borrow Area	Thallium	80	1	0.2563	0.2771	0.8	80	TRUE	0.906	NA	NA	NA
Background	Tin	104	103	0.4759	0.1317	-	104	-	-	9	-	-
Borrow Area	Tin	48	48	0.549	0.1966	0.8	48	FALSE	0.63	19	19	0.0000128
Background	Titanium	120	120	510.3	170.8	-	120	-	-	11	-	-
Borrow Area	Titanium	80	80	622.1	219.4	0.8	80	FALSE	722	29	29	0.00000354
Background	Tungsten	104	0	0.5888	0.213	-	104	-	-	NA	-	-
Borrow Area	Tungsten	76	19	0.6314	0.692	0.8	76	TRUE	1.4	NA	NA	NA
Background	Uranium	103	103	1.001	0.3143	-	103	-	-	6	-	-
Borrow Area	Uranium	48	48	1.499	0.8864	0.8	48	FALSE	1.3	19	19	7.708E-07
Background	Vanadium	120	120	35.41	10.54	-	120	-	-	21	-	-
Borrow Area	Vanadium	80	80	35.82	13.81	0.8	80	FALSE	46.12	19	19	0.1832
Background	Zinc	120	120	37.23	12.62	-	120	-	-	35	-	-
Borrow Area	Zinc	80	79	28.54	9.973	0.8	80	FALSE	42.38	5	5	1
Background	Zirconium	104	104	126.3	26.69	-	104	-	-	4	-	-
Borrow Area	Zirconium	48	48	227.2	88.97	0.8	48	FALSE	175.8	27	27	5.366E-13
Background	Actinium-228	120	120	1.804	0.3775	-	120	-	-	23	-	-
Borrow Area	Actinium-228	49	43	1.762	0.5172	0.8	49	FALSE	2.084	11	11	0.3868
Background	Bismuth-210	104	1	0.6053	0.5762	-	104	-	-	NA	-	-
Borrow Area	Bismuth-210	12	12	0.8267	0.44	0.8	12	TRUE	2	NA	NA	NA
Background	Bismuth-212	120	68	1.014	0.3367	-	120	-	-	NA	-	-
Borrow Area	Bismuth-212	49	5	1.463	0.3759	0.8	49	TRUE	2.528	NA	NA	NA
Background	Bismuth-214	120	120	0.9495	0.2106	-	120	-	-	NA	-	-
Borrow Area	Bismuth-214	49	22	0.7636	0.458	0.8	49	TRUE	1.18	NA	NA	NA
Background	Lead-210	120	2	0.7241	0.6393	-	120	-	-	NA	-	-
Borrow Area	Lead-210	49	3	7.968	10.28	0.8	49	TRUE	3.8	NA	NA	NA
Background	Lead-212	120	120	1.497	0.262	-	120	-	-	11	-	-
Borrow Area	Lead-212	49	49	1.788	0.3668	0.8	49	FALSE	1.864	23	23	0.000000141

TABLE E2-2
GISdT OUTPUT FROM THE QUANTILE TEST
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Sample Identification	Data Subset	Sample Size	Number of Detects	Mean	Standard Deviation	Test Quantile	Sample Size for Test	NDs Greater Than Test Quantile?	Test Quantile Value	N Above the Test Quantile	Test Statistic	p-value
Background	Lead-214	120	120	0.9672	0.2189	-	120	-	-	8	-	-
Borrow Area	Lead-214	49	49	1.35	0.3124	0.8	49	FALSE	1.284	26	26	9.699E-11
Background	Polonium-210	104	1	0.6053	0.5762	-	104	-	-	NA	-	-
Borrow Area	Polonium-210	12	12	0.8267	0.44	0.8	12	TRUE	2	NA	NA	NA
Background	Polonium-212	104	64	0.6479	0.2158	-	104	-	-	NA	-	-
Borrow Area	Polonium-212	12	12	0.6475	0.157	0.8	12	TRUE	1	NA	NA	NA
Background	Polonium-214	104	104	0.9615	0.2127	-	104	-	-	15	-	-
Borrow Area	Polonium-214	12	12	1.26	0.1887	0.8	12	FALSE	1.19	7	7	0.001513
Background	Polonium-216	104	104	1.535	0.2535	-	104	-	-	12	-	-
Borrow Area	Polonium-216	12	12	2.113	0.282	0.8	12	FALSE	1.82	10	10	4.207E-07
Background	Polonium-218	104	96	1.112	0.3472	-	104	-	-	NA	-	-
Borrow Area	Polonium-218	12	12	2.223	0.4139	0.8	12	TRUE	1.72	NA	NA	NA
Background	Potassium-40	120	120	25.19	3.256	-	120	-	-	22	-	-
Borrow Area	Potassium-40	49	49	24.55	5.079	0.8	49	FALSE	28.04	12	12	0.241
Background	Protactinium-234	104	0	-0.07841	0.09437	-	104	-	-	NA	-	-
Borrow Area	Protactinium-234	12	12	1.479	0.1427	0.8	12	TRUE	0.06	NA	NA	NA
Background	Radium-224	104	104	1.535	0.2535	-	104	-	-	11	-	-
Borrow Area	Radium-224	12	12	4.367	1.46	0.8	12	FALSE	1.86	12	12	1.966E-10
Background	Radium-226	104	96	1.112	0.3472	-	104	-	-	NA	-	-
Borrow Area	Radium-226	49	49	2.012	0.7012	0.8	49	TRUE	1.91	NA	NA	NA
Background	Radium-228	84	68	1.916	0.4046	-	84	-	-	NA	-	-
Borrow Area	Radium-228	49	45	2.144	0.5851	0.8	49	TRUE	2.672	NA	NA	NA
Background	Thallium-208	120	120	0.5405	0.09088	-	120	-	-	21	-	-
Borrow Area	Thallium-208	49	49	0.5559	0.1216	0.8	49	FALSE	0.62	11	11	0.294
Background	Thorium-228	120	120	1.687	0.2775	-	120	-	-	21	-	-
Borrow Area	Thorium-228	49	49	1.708	0.4298	0.8	49	FALSE	1.96	12	12	0.2027
Background	Thorium-230	120	120	1.246	0.3828	-	120	-	-	14	-	-
Borrow Area	Thorium-230	49	49	1.674	0.5599	0.8	49	FALSE	1.664	20	20	0.0000427

TABLE E2-2
GISdT OUTPUT FROM THE QUANTILE TEST
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Sample Identification	Data Subset	Sample Size	Number of Detects	Mean	Standard Deviation	Test Quantile	Sample Size for Test	NDs Greater Than Test Quantile?	Test Quantile Value	N Above the Test Quantile	Test Statistic	p-value
Background	Thorium-232	120	120	1.614	0.2657	-	120	-	-	25	-	-
Borrow Area	Thorium-232	49	49	1.521	0.3691	0.8	49	FALSE	1.854	9	9	0.7126
Background	Thorium-234	120	65	1.165	0.6305	-	120	-	-	NA	-	-
Borrow Area	Thorium-234	49	13	2.143	0.8345	0.8	49	TRUE	2.608	NA	NA	NA
Background	Uranium-234	120	61	1.109	0.4571	-	120	-	-	NA	-	-
Borrow Area	Uranium-234	49	49	1.598	0.6099	0.8	49	TRUE	2.008	NA	NA	NA
Background	Uranium-235	120	54	0.06591	0.03818	-	120	-	-	NA	-	-
Borrow Area	Uranium-235	49	33	0.1177	0.1685	0.8	49	TRUE	0.1288	NA	NA	NA
Background	Uranium-238	120	120	1.084	0.3732	-	120	-	-	15	-	-
Borrow Area	Uranium-238	49	49	1.394	0.4664	0.8	49	FALSE	1.482	19	19	0.0002086

All column headings and values are standard output from the Guided Interactive Statistical Decision Tools website for the test presented. http://www.gisdt.org/

TABLE E2-3
GISdT OUTPUT FROM THE SLIPPAGE TEST
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 3)

Sample Identification	Data Subset	Sample Size	Number of Detects	Maximum ND	Maximum Detect	NDs Greater than the Sample 1 Max Detect	Sample Size for Test	Test Statistic	p-value
Background	Aluminum	120	120	-	15300	0	120	-	-
Borrow Area	Aluminum	80	80	-	17600	0	80	3	0.06256
Background	Antimony	120	49	1	0.5	16	104	-	-
Borrow Area	Antimony	80	44	8.3	0.34	18	62	0	1
Background	Arsenic	120	120	-	7.2	0	120	-	-
Borrow Area	Arsenic	80	80	-	25.4	0	80	23	7.84E-11
Background	Barium	120	120	-	836	0	120	-	-
Borrow Area	Barium	80	80	-	927	0	80	1	0.4
Background	Beryllium	120	120	-	0.89	0	120	-	-
Borrow Area	Beryllium	80	65	0.53	1.1	0	80	4	0.02445
Background	Boron	104	34	5.1	11.6	0	104	-	-
Borrow Area	Boron	48	19	82.5	31.5	3	45	11	7.36E-07
Background	Cadmium	120	16	0.1291	0.16	0	120	-	-
Borrow Area	Cadmium	80	48	0.53	0.32	32	48	2	0.08041
Background	Calcium	104	104	-	82800	0	104	-	-
Borrow Area	Calcium	48	48	-	692000	0	48	6	0.000792
Background	Chromium (Total)	120	120	-	16.7	0	120	-	-
Borrow Area	Chromium (Total)	80	79	6.4	110	0	80	13	3.57E-06
Background	Cobalt	120	120	-	16.3	0	120	-	-
Borrow Area	Cobalt	80	80	-	10.9	0	80	0	1
Background	Copper	120	120	-	30.5	0	120	-	-
Borrow Area	Copper	80	80	-	24.9	0	80	0	1
Background	Iron	120	120	-	19700	0	120	-	-
Borrow Area	Iron	80	80	-	23300	0	80	2	0.1588
Background	Lead	120	120	-	35.1	0	120	-	-
Borrow Area	Lead	80	80	-	18.5	0	80	0	1
Background	Lithium	104	104	-	26.5	0	104	-	-
Borrow Area	Lithium	48	46	82.5	61.8	1	47	13	7.02E-08
Background	Magnesium	120	120	-	17500	0	120	-	-
Borrow Area	Magnesium	80	80	-	36500	0	80	7	0.001391
Background	Manganese	120	120	-	1090	0	120	-	-
Borrow Area	Manganese	80	80	-	763	0	80	0	1
Background	Mercury	120	93	0.0072	0.11	0	120	-	-
Borrow Area	Mercury	80	24	0.27	0.04	1	79	0	1
Background	Molybdenum	120	120	-	2	0	120	-	-
Borrow Area	Molybdenum	80	76	8.3	5.9	1	79	3	0.06113
Background	Nickel	120	120	-	30	0	120	-	-
Borrow Area	Nickel	80	80	-	72	0	80	31	6.37E-15
Background	Niobium	104	0	2.8	-	104	0	-	-
Borrow Area	Niobium	48	14	41.2	2	34	14	NA	NA
Background	Palladium	104	104	-	1.5	0	104	-	-
Borrow Area	Palladium	48	48	-	1.6	0	48	1	0.3158
Background	Platinum	104	5	0.0435	0.099	0	104	-	-
Borrow Area	Platinum	48	2	1.7	0.02	46	2	0	1

TABLE E2-3
GISdT OUTPUT FROM THE SLIPPAGE TEST
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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Sample Identification	Data Subset	Sample Size	Number of Detects	Maximum ND	Maximum Detect	NDs Greater than the Sample 1 Max Detect	Sample Size for Test	Test Statistic	p-value
Background	Potassium	104	104	-	3890	0	104	-	-
Borrow Area	Potassium	48	48	-	7300	0	48	7	0.000228
Background	Selenium	120	52	0.51	0.6	0	120	-	-
Borrow Area	Selenium	80	4	8.3	0.64	23	57	1	0.322
Background	Silicon	104	104	-	4150	0	104	-	-
Borrow Area	Silicon	48	39	103	278	0	48	0	1
Background	Silver	120	16	0.2609	0.083	104	16	-	-
Borrow Area	Silver	80	44	82.5	0.7	36	44	23	8.61E-05
Background	Sodium	104	104	-	1320	0	104	-	-
Borrow Area	Sodium	48	48	-	3770	0	48	18	7.11E-11
Background	Strontium	104	104	-	808	0	104	-	-
Borrow Area	Strontium	48	48	-	678	0	48	0	1
Background	Thallium	120	42	1.1	1.8	0	120	-	-
Borrow Area	Thallium	80	1	3.3	1.6	3	77	0	1
Background	Tin	104	103	0.187	0.8	0	104	-	-
Borrow Area	Tin	48	48	-	1.1	0	48	5	0.002706
Background	Titanium	120	120	-	1010	0	120	-	-
Borrow Area	Titanium	80	80	-	1200	0	80	4	0.02445
Background	Tungsten	104	0	2.5	-	104	0	-	-
Borrow Area	Tungsten	76	19	8.3	2.6	57	19	NA	NA
Background	Uranium	103	103	-	2.7	0	103	-	-
Borrow Area	Uranium	48	48	-	4.6	0	48	5	0.002799
Background	Vanadium	120	120	-	59.1	0	120	-	-
Borrow Area	Vanadium	80	80	-	78.1	0	80	5	0.009481
Background	Zinc	120	120	-	121	0	120	-	-
Borrow Area	Zinc	80	79	0.5	58.7	0	80	0	1
Background	Zirconium	104	104	-	179	0	104	-	-
Borrow Area	Zirconium	48	48	-	497	0	48	25	1.10E-15
Background	Actinium-228	120	120	-	3.4	0	120	-	-
Borrow Area	Actinium-228	49	43	1.81	2.95	0	49	0	1
Background	Bismuth-210	104	1	4	2.2	16	88	-	-
Borrow Area	Bismuth-210	12	12	-	1.5	0	12	0	1
Background	Bismuth-212	120	68	2.6	1.82	15	105	-	-
Borrow Area	Bismuth-212	49	5	4.5	1.42	39	10	0	1
Background	Bismuth-214	120	120	-	1.62	0	120	-	-
Borrow Area	Bismuth-214	49	22	1.35	1.75	0	49	1	0.2899
Background	Lead-210	120	2	4.4	2.2	27	93	-	-
Borrow Area	Lead-210	49	3	80.4	2.31	37	12	1	0.1143
Background	Lead-212	120	120	-	2.11	0	120	-	-
Borrow Area	Lead-212	49	49	-	2.85	0	49	6	0.000473
Background	Lead-214	120	120	-	1.72	0	120	-	-
Borrow Area	Lead-214	49	49	-	2.6	0	49	3	0.02331
Background	Polonium-210	104	1	4	2.2	16	88	-	-
Borrow Area	Polonium-210	12	12	-	1.5	0	12	0	1

TABLE E2-3
GISdT OUTPUT FROM THE SLIPPAGE TEST
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 3 of 3)

Sample Identification	Data Subset	Sample Size	Number of Detects	Maximum ND	Maximum Detect	NDs Greater than the Sample 1 Max Detect	Sample Size for Test	Test Statistic	p-value
Background	Polonium-212	104	64	1.56	1.17	9	95	-	-
Borrow Area	Polonium-212	12	12	-	0.91	0	12	0	1
Background	Polonium-214	104	104	-	1.62	0	104	-	-
Borrow Area	Polonium-214	12	12	-	1.58	0	12	0	1
Background	Polonium-216	104	104	-	2.11	0	104	-	-
Borrow Area	Polonium-216	12	12	-	2.64	0	12	4	6.91E-05
Background	Polonium-218	104	96	1.998	2.36	0	104	-	-
Borrow Area	Polonium-218	12	12	-	2.99	0	12	4	6.91E-05
Background	Potassium-40	120	120	-	35	0	120	-	-
Borrow Area	Potassium-40	49	49	-	30.8	0	49	0	1
Background	Protactinium-234	104	0	0.26	-	104	0	-	-
Borrow Area	Protactinium-234	12	12	-	1.7	0	12	NA	NA
Background	Radium-224	104	104	-	2.11	0	104	-	-
Borrow Area	Radium-224	12	12	-	8.7	0	12	12	1.45E-16
Background	Radium-226	104	96	1.998	2.36	0	104	-	-
Borrow Area	Radium-226	49	49	-	4.52	0	49	12	7.1E-09
Background	Radium-228	84	68	4	2.94	10	74	-	-
Borrow Area	Radium-228	49	45	8.46	3.25	4	45	3	0.05182
Background	Thallium-208	120	120	-	0.72	0	120	-	-
Borrow Area	Thallium-208	49	49	-	1.02	0	49	1	0.2899
Background	Thorium-228	120	120	-	2.28	0	120	-	-
Borrow Area	Thorium-228	49	49	-	2.64	0	49	4	0.006461
Background	Thorium-230	120	120	-	3.01	0	120	-	-
Borrow Area	Thorium-230	49	49	-	3.35	0	49	2	0.08284
Background	Thorium-232	120	120	-	2.23	0	120	-	-
Borrow Area	Thorium-232	49	49	-	2.64	0	49	1	0.2899
Background	Thorium-234	120	65	2.78	2.5	1	119	-	-
Borrow Area	Thorium-234	49	13	9.14	2.3	34	15	0	1
Background	Uranium-234	120	61	2.34	2.84	0	120	-	-
Borrow Area	Uranium-234	49	49	-	3.69	0	49	2	0.08284
Background	Uranium-235	120	54	0.22	0.21	1	119	-	-
Borrow Area	Uranium-235	49	33	1.2	0.24	7	42	1	0.2609
Background	Uranium-238	120	120	-	2.37	0	120	-	-
Borrow Area	Uranium-238	49	49	-	2.73	0	49	2	0.08284

All column headings and values are standard output from the Guided Interactive Statistical Decision Tools website for the test presented. http://www.gisdt.org/

TABLE E2-4
GISdT OUTPUT FROM THE WILCOXON RANK SUM TEST
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 3)

Sample Identification	Data Subset	Sample Size	Number of Detects	Mean	Standard Deviation	Shapiro-Wilk p-value	Hypothesized Difference	Test Statistic	Null Standard Deviation	p-value
Background	Aluminum	120	120	8899	2653	0.0009834	-	-	-	-
Borrow Area	Aluminum	80	80	7519	3111	8.168E-08	less than 0	3358	802	1
Background	Antimony	120	49	0.24	0.1252	3.459E-14	-	-	-	-
Borrow Area	Antimony	80	44	0.2152	0.2985	5.83E-17	less than 0	1377	371.7	0.9999
Background	Arsenic	120	120	4.132	1.135	0.001554	-	-	-	-
Borrow Area	Arsenic	80	80	6.967	5.271	9.523E-10	less than 0	-2998	801.7	9.221E-05
Background	Barium	120	120	222.5	125.6	5.446E-12	-	-	-	-
Borrow Area	Barium	80	80	162.1	104.3	2.558E-14	less than 0	4009	801.9	1
Background	Beryllium	120	120	0.5566	0.1634	0.02202	-	-	-	-
Borrow Area	Beryllium	80	65	0.4597	0.2433	0.001171	less than 0	2797	801.6	0.9998
Background	Boron	104	34	3.601	2.623	5.658E-12	-	-	-	-
Borrow Area	Boron	48	19	7.335	7.55	1.069E-06	less than 0	-992	418.9	0.008943
Background	Cadmium	120	16	0.07008	0.01736	3.74E-20	-	-	-	-
Borrow Area	Cadmium	80	48	0.1021	0.0416	2.283E-08	less than 0	-526	300	0.03977
Background	Calcium	104	104	28130	14860	2.558E-07	-	-	-	-
Borrow Area	Calcium	48	48	71440	117600	4.694E-12	less than 0	-2138	504.6	1.131E-05
Background	Chromium (Total)	120	120	8.937	2.886	0.6271	-	-	-	-
Borrow Area	Chromium (Total)	80	79	12.42	13.32	1.51E-15	less than 0	-1209	801.9	0.06582
Background	Cobalt	120	120	8.225	2.479	0.05115	-	-	-	-
Borrow Area	Cobalt	80	80	5.688	1.677	0.000486	less than 0	5779	801.9	1
Background	Copper	120	120	17.07	4.235	0.4795	-	-	-	-
Borrow Area	Copper	80	80	13.74	3.732	0.001572	less than 0	4492	801.9	1
Background	Iron	120	120	12810	3263	0.3891	-	-	-	-
Borrow Area	Iron	80	80	11480	4050	0.0001873	less than 0	2520	802	0.9992
Background	Lead	120	120	9.447	5.059	3.718E-12	-	-	-	-
Borrow Area	Lead	80	80	7.704	2.923	6.603E-05	less than 0	2017	801.9	0.9941
Background	Lithium	104	104	13.85	4.32	2.435E-06	-	-	-	-
Borrow Area	Lithium	48	46	20.72	12.7	3.679E-05	less than 0	-1475	499.8	0.001583
Background	Magnesium	120	120	9505	3046	0.009969	-	-	-	-
Borrow Area	Magnesium	80	80	9217	6458	2.573E-12	less than 0	2686	802	0.9996
Background	Manganese	120	120	424.9	135.3	1.278E-05	-	-	-	-
Borrow Area	Manganese	80	80	216.6	119.5	1.039E-08	less than 0	7757	802	1
Background	Mercury	120	93	0.01762	0.01539	2.097E-13	-	-	-	-
Borrow Area	Mercury	80	24	0.01102	0.01016	9.699E-13	less than 0	3504	695.5	1
Background	Molybdenum	120	120	0.5467	0.2792	4.608E-12	-	-	-	-
Borrow Area	Molybdenum	80	76	0.8247	0.6851	7.19E-15	less than 0	-4511	795.9	7.231E-09
Background	Nickel	120	120	15.12	4.238	0.002739	-	-	-	-
Borrow Area	Nickel	80	80	27.53	19.66	1.953E-07	less than 0	-1703	802	0.01685
Background	Niobium	104	0	0.7102	0.2299	1.816E-09	-	-	-	-
Borrow Area	Niobium	48	14	1.461	1.871	1.201E-11	less than 0	-293	90.16	0.0005778
Background	Palladium	104	104	0.4615	0.2423	1.284E-07	-	-	-	-
Borrow Area	Palladium	48	48	0.566	0.3142	0.000401	less than 0	-1025	504.5	0.02109
Background	Platinum	104	5	0.02411	0.01129	4.66E-21	-	-	-	-
Borrow Area	Platinum	48	2	0.05615	0.07701	6.496E-12	less than 0	120	131.5	0.8192
Background	Potassium	104	104	1730	732.8	4.521E-06	-	-	-	-
Borrow Area	Potassium	48	48	2789	1190	0.0006341	less than 0	-2985	504.5	1.647E-09
Background	Selenium	120	52	0.1779	0.1279	1.716E-12	-	-	-	-
Borrow Area	Selenium	80	4	0.2325	0.3051	1.85E-16	less than 0	1890	492.4	0.9999
Background	Silicon	104	104	981	780.1	9.35E-15	-	-	-	-
Borrow Area	Silicon	48	39	117.7	68.98	0.0677	less than 0	4992	504.5	1

TABLE E2-4
GISdT OUTPUT FROM THE WILCOXON RANK SUM TEST
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 2 of 3)

Sample Identification	Data Subset	Sample Size	Number of Detects	Mean	Standard Deviation	Shapiro-Wilk p-value	Hypothesized Difference	Test Statistic	Null Standard Deviation	p-value
Background	Silver	120	16	0.1197	0.02846	1.03E-19	-	-	-	-
Borrow Area	Silver	80	44	0.8942	3.27	4.57E-18	less than 0	-672	159.9	1.315E-05
Background	Sodium	104	104	485.7	285.9	0.0001267	-	-	-	-
Borrow Area	Sodium	48	48	1238	845.6	0.001384	less than 0	-3063	504.6	6.372E-10
Background	Strontium	104	104	222.9	132.1	1.856E-09	-	-	-	-
Borrow Area	Strontium	48	48	265.2	143.5	0.0001444	less than 0	-1062	504.6	0.01765
Background	Thallium	120	42	0.5048	0.4806	9.176E-14	-	-	-	-
Borrow Area	Thallium	80	1	0.137	0.2022	5.77E-17	less than 0	2458	483.6	1
Background	Tin	104	103	0.4759	0.1317	0.6634	-	-	-	-
Borrow Area	Tin	48	48	0.549	0.1966	0.02394	less than 0	-814	504.4	0.05328
Background	Titanium	120	120	510.3	170.8	0.05495	-	-	-	-
Borrow Area	Titanium	80	80	622.1	219.4	0.01868	less than 0	-2777	802	0.0002674
Background	Tungsten	104	0	0.5888	0.213	5.051E-05	-	-	-	-
Borrow Area	Tungsten	76	19	0.4402	0.5115	1.712E-11	less than 0	-643	221.1	0.001821
Background	Uranium	103	103	1.001	0.3143	1.598E-10	-	-	-	-
Borrow Area	Uranium	48	48	1.499	0.8864	1.879E-05	less than 0	-1533	499.8	0.001081
Background	Vanadium	120	120	35.41	10.54	0.1697	-	-	-	-
Borrow Area	Vanadium	80	80	35.82	13.81	2.605E-05	less than 0	527	802	0.7445
Background	Zinc	120	120	37.23	12.62	4.206E-10	-	-	-	-
Borrow Area	Zinc	80	79	28.53	9.977	0.3811	less than 0	4201	802	1
Background	Zirconium	104	104	126.3	26.69	0.2634	-	-	-	-
Borrow Area	Zirconium	48	48	227.2	88.97	0.001974	less than 0	-4048	504.5	5.15E-16
Background	Actinium-228	120	120	1.804	0.3775	0.003107	-	-	-	-
Borrow Area	Actinium-228	49	43	1.72	0.6088	2.227E-05	less than 0	-254	577.1	0.3299
Background	Bismuth-210	104	1	0.3132	0.3342	1.508E-07	-	-	-	-
Borrow Area	Bismuth-210	12	12	0.8267	0.44	0.8255	less than 0	-752	86.69	2.07E-18
Background	Bismuth-212	120	68	0.8445	0.4624	1.263E-05	-	-	-	-
Borrow Area	Bismuth-212	49	5	0.7938	0.2376	0.388	less than 0	489	388.2	0.8961
Background	Bismuth-214	120	120	0.9495	0.2106	0.01866	-	-	-	-
Borrow Area	Bismuth-214	49	22	0.6591	0.5471	3.763E-07	less than 0	1383	575.9	0.9918
Background	Lead-210	120	2	0.3791	0.3777	2.353E-07	-	-	-	-
Borrow Area	Lead-210	49	3	4.043	5.112	6.314E-09	less than 0	-300	132.7	0.0119
Background	Lead-212	120	120	1.497	0.262	0.04815	-	-	-	-
Borrow Area	Lead-212	49	49	1.788	0.3668	0.008919	less than 0	-3176	577.2	1.869E-08
Background	Lead-214	120	120	0.9672	0.2189	2.674E-07	-	-	-	-
Borrow Area	Lead-214	49	49	1.35	0.3124	0.0009611	less than 0	-4386	577.1	1.486E-14
Background	Polonium-210	104	1	0.3132	0.3342	1.508E-07	-	-	-	-
Borrow Area	Polonium-210	12	12	0.8267	0.44	0.8255	less than 0	-752	86.69	2.07E-18
Background	Polonium-212	104	64	0.5556	0.2941	0.0001163	-	-	-	-
Borrow Area	Polonium-212	12	12	0.6475	0.157	0.9888	less than 0	-150	206.9	0.2343
Background	Polonium-214	104	104	0.9615	0.2127	0.02745	-	-	-	-
Borrow Area	Polonium-214	12	12	1.26	0.1887	0.996	less than 0	-887	220.6	2.893E-05
Background	Polonium-216	104	104	1.535	0.2535	0.0196	-	-	-	-
Borrow Area	Polonium-216	12	12	2.113	0.282	0.04082	less than 0	-1169	220.6	5.797E-08
Background	Polonium-218	104	96	1.08	0.3868	0.01808	-	-	-	-
Borrow Area	Polonium-218	12	12	2.223	0.4139	0.4678	less than 0	-1186	219.2	3.151E-08
Background	Potassium-40	120	120	25.19	3.256	0.009732	-	-	-	-
Borrow Area	Potassium-40	49	49	24.55	5.079	1.991E-06	less than 0	-594	577.2	0.1517
Background	Protactinium-234	104	0	-0.0392	0.04719	0.697	-	-	-	-
Borrow Area	Protactinium-234	12	12	1.479	0.1427	0.8505	less than 0	-1248	116.6	4.93E-27

TABLE E2-4
GISdT OUTPUT FROM THE WILCOXON RANK SUM TEST
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 3 of 3)

Sample Identification	Data Subset	Sample Size	Number of Detects	Mean	Standard Deviation	Shapiro-Wilk p-value	Hypothesized Difference	Test Statistic	Null Standard Deviation	p-value
Background	Radium-224	104	104	1.535	0.2535	0.0196	-	-	-	-
Borrow Area	Radium-224	12	12	4.367	1.46	0.0003588	less than 0	-1248	220.6	7.661E-09
Background	Radium-226	104	96	1.08	0.3868	0.01808	-	-	-	-
Borrow Area	Radium-226	49	49	2.012	0.7012	0.01235	less than 0	-4075	509.9	6.66E-16
Background	Radium-228	84	68	1.765	0.5924	0.001443	-	-	-	-
Borrow Area	Radium-228	49	45	2.039	0.5666	0.8941	less than 0	-827	414.8	0.02308
Background	Thallium-208	120	120	0.5405	0.09088	0.2159	-	-	-	-
Borrow Area	Thallium-208	49	49	0.5559	0.1216	0.0004371	less than 0	-644	576.8	0.1321
Background	Thorium-228	120	120	1.687	0.2775	0.03116	-	-	-	-
Borrow Area	Thorium-228	49	49	1.708	0.4298	0.2377	less than 0	-305	577.2	0.2986
Background	Thorium-230	120	120	1.246	0.3828	4.313E-08	-	-	-	-
Borrow Area	Thorium-230	49	49	1.674	0.5599	0.008631	less than 0	-2976	577.2	1.261E-07
Background	Thorium-232	120	120	1.614	0.2657	0.03175	-	-	-	-
Borrow Area	Thorium-232	49	49	1.521	0.3691	0.09261	less than 0	817	577.2	0.9215
Background	Thorium-234	120	65	1.025	0.7186	3.197E-06	-	-	-	-
Borrow Area	Thorium-234	49	13	1.28	0.4347	0.1589	less than 0	-42	425.2	0.4607
Background	Uranium-234	120	61	0.8869	0.5863	1.943E-10	-	-	-	-
Borrow Area	Uranium-234	49	49	1.598	0.6099	0.003195	less than 0	-3458	540.4	7.829E-11
Background	Uranium-235	120	54	0.05322	0.04253	1.838E-07	-	-	-	-
Borrow Area	Uranium-235	49	33	0.07867	0.08343	1.176E-09	less than 0	95	457.4	0.5823
Background	Uranium-238	120	120	1.084	0.3732	2.155E-07	-	-	-	-
Borrow Area	Uranium-238	49	49	1.394	0.4664	0.06155	less than 0	-2414	577.2	1.442E-05

All column headings and values are standard output from the Guided Interactive Statistical Decision Tools website for the test presented. http://www.gisdt.org/

TABLE E2-5
GISdT OUTPUT FROM THE T TEST
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 3)

Sample Identification	Data Subset	Sample Size	Number of Detects	Mean	Standard Deviation	Shapiro-Wilk p-value	Hypothesized Difference	Test Statistic	DF	p-value
Background	Aluminum	120	120	8899	2653	0.0009834	-	-	-	-
Borrow Area	Aluminum	80	80	7519	3111	8.168E-08	less than 0	3.257	150.7	0.9993
Background	Antimony	120	49	0.24	0.1252	3.459E-14	-	-	-	-
Borrow Area	Antimony	80	44	0.3361	0.6107	1.40E-17	less than 0	-1.389	83.4	0.08433
Background	Arsenic	120	120	4.132	1.135	0.001554	-	-	-	-
Borrow Area	Arsenic	80	80	6.967	5.271	9.523E-10	less than 0	-4.739	83.9	4.333E-06
Background	Barium	120	120	222.5	125.6	5.446E-12	-	-	-	-
Borrow Area	Barium	80	80	162.1	104.3	2.558E-14	less than 0	3.696	188.6	0.9999
Background	Beryllium	120	120	0.5566	0.1634	0.02202	-	-	-	-
Borrow Area	Beryllium	80	65	0.4834	0.2135	9.423E-06	less than 0	2.601	138.7	0.9948
Background	Boron	104	34	3.601	2.623	5.658E-12	-	-	-	-
Borrow Area	Boron	48	19	9.168	8.743	1.603E-07	less than 0	-4.322	50.9	3.591E-05
Background	Cadmium	120	16	0.07008	0.01736	3.74E-20	-	-	-	-
Borrow Area	Cadmium	80	48	0.1526	0.08854	5.291E-08	less than 0	-8.234	83.1	1.105E-12
Background	Calcium	104	104	28130	14860	2.558E-07	-	-	-	-
Borrow Area	Calcium	48	48	71440	117600	4.694E-12	less than 0	-2.542	47.7	0.007172
Background	Chromium (Total)	120	120	8.937	2.886	0.6271	-	-	-	-
Borrow Area	Chromium (Total)	80	79	12.43	13.31	1.32E-15	less than 0	-2.315	84	0.01153
Background	Cobalt	120	120	8.225	2.479	0.05115	-	-	-	-
Borrow Area	Cobalt	80	80	5.688	1.677	0.000486	less than 0	8.634	197.9	1
Background	Copper	120	120	17.07	4.235	0.4795	-	-	-	-
Borrow Area	Copper	80	80	13.74	3.732	0.001572	less than 0	5.845	183.2	1
Background	Iron	120	120	12810	3263	0.3891	-	-	-	-
Borrow Area	Iron	80	80	11480	4050	0.0001873	less than 0	2.444	144.2	0.9921
Background	Lead	120	120	9.447	5.059	3.718E-12	-	-	-	-
Borrow Area	Lead	80	80	7.704	2.923	6.603E-05	less than 0	3.081	194.5	0.9988
Background	Lithium	104	104	13.85	4.32	2.435E-06	-	-	-	-
Borrow Area	Lithium	48	46	21.21	12.96	2.767E-05	less than 0	-3.84	51.9	0.0001684
Background	Magnesium	120	120	9505	3046	0.009969	-	-	-	-
Borrow Area	Magnesium	80	80	9217	6458	2.573E-12	less than 0	0.3719	102.7	0.6446
Background	Manganese	120	120	424.9	135.3	1.278E-05	-	-	-	-
Borrow Area	Manganese	80	80	216.6	119.5	1.039E-08	less than 0	11.44	183	1
Background	Mercury	120	93	0.01762	0.01539	2.097E-13	-	-	-	-
Borrow Area	Mercury	80	24	0.01914	0.01543	3.37E-15	less than 0	-0.685	169.2	0.2472
Background	Molybdenum	120	120	0.5467	0.2792	4.608E-12	-	-	-	-
Borrow Area	Molybdenum	80	76	0.8553	0.7633	3.37E-15	less than 0	-3.465	93.2	0.000402
Background	Nickel	120	120	15.12	4.238	0.002739	-	-	-	-
Borrow Area	Nickel	80	80	27.53	19.66	1.953E-07	less than 0	-5.556	83.9	1.59E-07
Background	Niobium	104	0	0.7102	0.2299	1.816E-09	-	-	-	-
Borrow Area	Niobium	48	14	2.63	3.821	9.678E-12	less than 0	-3.477	47.2	0.0005502
Background	Palladium	104	104	0.4615	0.2423	1.284E-07	-	-	-	-
Borrow Area	Palladium	48	48	0.566	0.3142	0.000401	less than 0	-2.041	73.8	0.0224
Background	Platinum	104	5	0.02411	0.01129	4.66E-21	-	-	-	-
Borrow Area	Platinum	48	2	0.114	0.1539	1.068E-11	less than 0	-4.039	47.2	9.813E-05
Background	Potassium	104	104	1730	732.8	4.521E-06	-	-	-	-
Borrow Area	Potassium	48	48	2789	1190	0.0006341	less than 0	-5.683	64	1.752E-07
Background	Selenium	120	52	0.1779	0.1279	1.716E-12	-	-	-	-
Borrow Area	Selenium	80	4	0.4522	0.6043	1.32E-16	less than 0	-4	83.7	6.807E-05
Background	Silicon	104	104	981	780.1	9.35E-15	-	-	-	-
Borrow Area	Silicon	48	39	121.7	63.61	0.0259	less than 0	11.15	105.9	1

TABLE E2-5
GISdT OUTPUT FROM THE T TEST
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Sample Identification	Data Subset	Sample Size	Number of Detects	Mean	Standard Deviation	Shapiro-Wilk p-value	Hypothesized Difference	Test Statistic	DF	p-value
Background	Silver	120	16	0.1197	0.02846	1.03E-19	-	-	-	-
Borrow Area	Silver	80	44	1.724	6.554	4.47E-18	less than 0	-2.189	79	0.01576
Background	Sodium	104	104	485.7	285.9	0.0001267	-	-	-	-
Borrow Area	Sodium	48	48	1238	845.6	0.001384	less than 0	-6.005	52	9.437E-08
Background	Strontium	104	104	222.9	132.1	1.856E-09	-	-	-	-
Borrow Area	Strontium	48	48	265.2	143.5	0.0001444	less than 0	-1.729	85	0.04376
Background	Thallium	120	42	0.5048	0.4806	9.176E-14	-	-	-	-
Borrow Area	Thallium	80	1	0.2563	0.2771	1.68E-15	less than 0	4.626	194.4	1
Background	Tin	104	103	0.4759	0.1317	0.6634	-	-	-	-
Borrow Area	Tin	48	48	0.549	0.1966	0.02394	less than 0	-2.343	67.2	0.01104
Background	Titanium	120	120	510.3	170.8	0.05495	-	-	-	-
Borrow Area	Titanium	80	80	622.1	219.4	0.01868	less than 0	-3.847	140.5	9.029E-05
Background	Tungsten	104	0	0.5888	0.213	5.051E-05	-	-	-	-
Borrow Area	Tungsten	76	19	0.6314	0.692	5.334E-13	less than 0	-0.5188	85.4	0.3026
Background	Uranium	103	103	1.001	0.3143	1.598E-10	-	-	-	-
Borrow Area	Uranium	48	48	1.499	0.8864	1.879E-05	less than 0	-3.787	52.6	0.0001966
Background	Vanadium	120	120	35.41	10.54	0.1697	-	-	-	-
Borrow Area	Vanadium	80	80	35.82	13.81	2.605E-05	less than 0	-0.2224	138.4	0.4122
Background	Zinc	120	120	37.23	12.62	4.206E-10	-	-	-	-
Borrow Area	Zinc	80	79	28.54	9.973	0.3841	less than 0	5.423	192.3	1
Background	Zirconium	104	104	126.3	26.69	0.2634	-	-	-	-
Borrow Area	Zirconium	48	48	227.2	88.97	0.001974	less than 0	-7.692	50.9	2.219E-10
Background	Actinium-228	120	120	1.804	0.3775	0.003107	-	-	-	-
Borrow Area	Actinium-228	49	43	1.762	0.5172	0.002325	less than 0	0.521	69.8	0.698
Background	Bismuth-210	104	1	0.6053	0.5762	0.06965	-	-	-	-
Borrow Area	Bismuth-210	12	12	0.8267	0.44	0.8255	less than 0	-1.593	15.7	0.06558
Background	Bismuth-212	120	68	1.014	0.3367	0.04643	-	-	-	-
Borrow Area	Bismuth-212	49	5	1.463	0.3759	0.4828	less than 0	-7.256	81.1	1.072E-10
Background	Bismuth-214	120	120	0.9495	0.2106	0.01866	-	-	-	-
Borrow Area	Bismuth-214	49	22	0.7636	0.458	5.153E-06	less than 0	2.727	56.5	0.9957
Background	Lead-210	120	2	0.7241	0.6393	0.02305	-	-	-	-
Borrow Area	Lead-210	49	3	7.968	10.28	5.971E-09	less than 0	-4.928	48.2	5.125E-06
Background	Lead-212	120	120	1.497	0.262	0.04815	-	-	-	-
Borrow Area	Lead-212	49	49	1.788	0.3668	0.008919	less than 0	-5.046	68.9	1.754E-06
Background	Lead-214	120	120	0.9672	0.2189	2.674E-07	-	-	-	-
Borrow Area	Lead-214	49	49	1.35	0.3124	0.0009611	less than 0	-7.822	68.1	2.294E-11
Background	Polonium-210	104	1	0.6053	0.5762	0.06965	-	-	-	-
Borrow Area	Polonium-210	12	12	0.8267	0.44	0.8255	less than 0	-1.593	15.7	0.06558
Background	Polonium-212	104	64	0.6479	0.2158	0.03194	-	-	-	-
Borrow Area	Polonium-212	12	12	0.6475	0.157	0.9888	less than 0	0.00769	16.2	0.503
Background	Polonium-214	104	104	0.9615	0.2127	0.02745	-	-	-	-
Borrow Area	Polonium-214	12	12	1.26	0.1887	0.996	less than 0	-5.117	14.4	7.125E-05
Background	Polonium-216	104	104	1.535	0.2535	0.0196	-	-	-	-
Borrow Area	Polonium-216	12	12	2.113	0.282	0.04082	less than 0	-6.798	13.1	6.003E-06
Background	Polonium-218	104	96	1.112	0.3472	0.0001894	-	-	-	-
Borrow Area	Polonium-218	12	12	2.223	0.4139	0.4678	less than 0	-8.936	12.9	3.563E-07
Background	Potassium-40	120	120	25.19	3.256	0.009732	-	-	-	-
Borrow Area	Potassium-40	49	49	24.55	5.079	1.991E-06	less than 0	0.8197	64.7	0.7923
Background	Protactinium-234	104	0	-0.0784	0.09437	0.697	-	-	-	-
Borrow Area	Protactinium-234	12	12	1.479	0.1427	0.8505	less than 0	-36.9	12.1	3.885E-14

TABLE E2-5
GISdT OUTPUT FROM THE T TEST
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Sample Identification	Data Subset	Sample Size	Number of Detects	Mean	Standard Deviation	Shapiro-Wilk p-value	Hypothesized Difference	Test Statistic	DF	p-value
Background	Radium-224	104	104	1.535	0.2535	0.0196	-	-	-	-
Borrow Area	Radium-224	12	12	4.367	1.46	0.0003588	less than 0	-6.708	11.1	1.615E-05
Background	Radium-226	104	96	1.112	0.3472	0.0001894	-	-	-	-
Borrow Area	Radium-226	49	49	2.012	0.7012	0.01235	less than 0	-8.503	59.4	3.703E-12
Background	Radium-228	84	68	1.916	0.4046	0.7347	-	-	-	-
Borrow Area	Radium-228	49	45	2.144	0.5851	0.03008	less than 0	-2.414	75.1	0.0091
Background	Thallium-208	120	120	0.5405	0.09088	0.2159	-	-	-	-
Borrow Area	Thallium-208	49	49	0.5559	0.1216	0.0004371	less than 0	-0.8008	70.9	0.213
Background	Thorium-228	120	120	1.687	0.2775	0.03116	-	-	-	-
Borrow Area	Thorium-228	49	49	1.708	0.4298	0.2377	less than 0	-0.3144	65	0.3771
Background	Thorium-230	120	120	1.246	0.3828	4.313E-08	-	-	-	-
Borrow Area	Thorium-230	49	49	1.674	0.5599	0.008631	less than 0	-4.904	67.1	3.14E-06
Background	Thorium-232	120	120	1.614	0.2657	0.03175	-	-	-	-
Borrow Area	Thorium-232	49	49	1.521	0.3691	0.09261	less than 0	1.61	69.2	0.944
Background	Thorium-234	120	65	1.165	0.6305	0.114	-	-	-	-
Borrow Area	Thorium-234	49	13	2.143	0.8345	0.0002024	less than 0	-7.392	71.4	1.085E-10
Background	Uranium-234	120	61	1.109	0.4571	1.04E-10	-	-	-	-
Borrow Area	Uranium-234	49	49	1.598	0.6099	0.003195	less than 0	-5.058	71	1.591E-06
Background	Uranium-235	120	54	0.06591	0.03818	0.0008369	-	-	-	-
Borrow Area	Uranium-235	49	33	0.1177	0.1685	2.288E-11	less than 0	-2.127	50	0.01919
Background	Uranium-238	120	120	1.084	0.3732	2.155E-07	-	-	-	-
Borrow Area	Uranium-238	49	49	1.394	0.4664	0.06155	less than 0	-4.134	74.3	4.633E-05

All column headings and values are standard output from the Guided Interactive Statistical Decision Tools website for the test presented. http://www.gisdt.org/

ATTACHMENT E-3

SUMMARY STATISTICS

TABLE E3-1
SUMMARY STATISTICS FOR RADIONUCLIDES - ALL DATA
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	Dataset	N	Number of Detects	Frequency of Detects	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	5th Percentile	25th Percentile	Median	Mean	75th Percentile	95th Percentile	Maximum Detect	Standard Deviation	Shapiro-Wilk p-value	log Shapiro-Wilk p-value
Actinium-228	Background	120	120	100%	NA	NA	1.11	1.24	1.54	1.775	1.804	2.04	2.354	3.4	0.3775	3.1 E-3	4.0 E-1
Actinium-228	Borrow Area	49	43	88%	0.42	0.9	1.1	0.732	1.66	1.85	1.762	2.07	2.33	2.95	0.5178	2.2 E-3	4.8 E-7
Bismuth-210	Background	104	1	1.0%	-0.6	2	2.2	-0.2955	0.2	0.6	0.6053	0.9	1.685	2.2	0.5762	7.0 E-2	4.8 E-6
Bismuth-210	Borrow Area	12	12	100%	NA	NA	0.1	0.21	0.58	0.8	0.8267	1.125	1.5	1.5	0.44	8.3 E-1	5.4 E-2
Bismuth-212	Background	120	68	57%	0.29	1.3	0.71	0.5395	0.7725	0.97	1.014	1.248	1.622	1.82	0.3367	4.6 E-2	2.4 E-2
Bismuth-212	Borrow Area	49	5	10%	0.59	2.25	1.07	0.808	1.14	1.52	1.463	1.68	2.066	1.42	0.3759	4.8 E-1	7.5 E-3
Bismuth-214	Background	120	120	100%	NA	NA	0.52	0.64	0.8	0.925	0.9495	1.08	1.263	1.62	0.2106	1.9 E-2	9.2 E-1
Bismuth-214	Borrow Area	49	22	45%	0.24	0.67	0.94	0.314	0.37	0.44	0.7616	1.19	1.474	1.75	0.4596	5.0 E-6	7.4 E-6
Lead-210	Background	120	2	1.7%	-0.6	2.2	1.9	-0.2715	0.3	0.665	0.7241	1.1	1.9	2.2	0.6393	2.3 E-2	7.6 E-7
Lead-210	Borrow Area	49	3	6.1%	0.1	40.2	1.5	0.552	1.48	4.65	7.968	7.33	37.4	2.31	10.28	6.0 E-9	3.6 E-1
Lead-212	Background	120	120	100%	NA	NA	0.94	1.08	1.285	1.465	1.497	1.72	1.93	2.11	0.262	4.8 E-2	2.2 E-2
Lead-212	Borrow Area	49	49	100%	NA	NA	0.72	1.038	1.63	1.82	1.788	1.98	2.216	2.85	0.3668	8.9 E-3	1.6 E-5
Lead-214	Background	120	120	100%	NA	NA	0.61	0.6895	0.83	0.93	0.9672	1.07	1.48	1.72	0.2189	2.7 E-7	7.2 E-3
Lead-214	Borrow Area	49	49	100%	NA	NA	0.7	0.978	1.17	1.3	1.35	1.5	1.756	2.6	0.3124	9.6 E-4	2.3 E-1
Polonium-210	Background	104	1	1.0%	-0.6	2	2.2	-0.2955	0.2	0.6	0.6053	0.9	1.685	2.2	0.5762	7.0 E-2	4.8 E-6
Polonium-210	Borrow Area	12	12	100%	NA	NA	0.1	0.21	0.58	0.8	0.8267	1.125	1.5	1.5	0.44	8.3 E-1	5.4 E-2
Polonium-212	Background	104	64	62%	0.19	0.78	0.46	0.3515	0.495	0.605	0.6479	0.78	1.037	1.17	0.2158	3.2 E-2	1.6 E-1
Polonium-212	Borrow Area	12	12	100%	NA	NA	0.38	0.435	0.5425	0.66	0.6475	0.735	0.877	0.91	0.157	9.9 E-1	8.9 E-1
Polonium-214	Background	104	104	100%	NA	NA	0.52	0.6615	0.8075	0.93	0.9615	1.09	1.311	1.62	0.2127	2.7 E-2	9.3 E-1
Polonium-214	Borrow Area	12	12	100%	NA	NA	0.94	0.995	1.163	1.24	1.26	1.383	1.53	1.58	0.1887	1.0 E+0	9.9 E-1
Polonium-216	Background	104	104	100%	NA	NA	1.08	1.113	1.337	1.57	1.535	1.73	1.93	2.11	0.2535	2.0 E-2	4.2 E-3
Polonium-216	Borrow Area	12	12	100%	NA	NA	1.79	1.806	1.955	2.01	2.113	2.265	2.568	2.64	0.282	4.1 E-2	7.5 E-2
Polonium-218	Background	104	96	92%	0.592	0.999	0.494	0.6002	0.8922	1.065	1.112	1.245	1.815	2.36	0.3472	1.9 E-4	4.0 E-1
Polonium-218	Borrow Area	12	12	100%	NA	NA	1.72	1.726	1.827	2.255	2.223	2.47	2.82	2.99	0.4139	4.7 E-1	4.1 E-1
Potassium-40	Background	120	120	100%	NA	NA	17.8	20.9	22.88	24.5	25.19	27.05	31	35	3.256	9.7 E-3	3.3 E-1
Potassium-40	Borrow Area	49	49	100%	NA	NA	9.44	13.48	23.9	25.9	24.55	27.8	29.6	30.8	5.079	2.0 E-6	1.6 E-8
Protactinium-234	Background	104	0	0%	-0.34	0.13	NA	-0.2385	-0.14	-0.08	-0.07841	-0.0175	0.0685	NA	0.09437	7.0 E-1	5.8 E-2
Protactinium-234	Borrow Area	12	12	100%	NA	NA	1.19	1.25	1.405	1.515	1.479	1.542	1.661	1.7	0.1427	8.5 E-1	6.2 E-1
Radium-224	Background	104	104	100%	NA	NA	1.08	1.113	1.337	1.57	1.535	1.73	1.93	2.11	0.2535	2.0 E-2	4.2 E-3
Radium-224	Borrow Area	12	12	100%	NA	NA	3.3	3.355	3.55	4.05	4.367	4.525	6.61	8.7	1.46	3.6 E-4	6.4 E-3
Radium-226	Background	104	96	92%	0.592	0.999	0.494	0.6002	0.8922	1.065	1.112	1.245	1.815	2.36	0.3472	1.9 E-4	4.0 E-1
Radium-226	Borrow Area	49	49	100%	NA	NA	0.92	1.106	1.52	1.91	2.012	2.35	3.062	4.52	0.7012	1.2 E-2	9.8 E-1
Radium-228	Background	84	68	81%	0.946	2	1.15	1.3	1.667	1.96	1.916	2.17	2.561	2.94	0.4046	7.3 E-1	5.7 E-2
Radium-228	Borrow Area	49	45	92%	2	4.23	0.78	1.418	1.76	2.04	2.144	2.42	3.124	3.25	0.5851	3.0 E-2	1.1 E-1
Thallium-208	Background	120	120	100%	NA	NA	0.33	0.39	0.48	0.54	0.5405	0.6025	0.69	0.72	0.09088	2.2 E-1	1.9 E-2
Thallium-208	Borrow Area	49	49	100%	NA	NA	0.23	0.35	0.5	0.56	0.5559	0.62	0.676	1.02	0.1216	4.4 E-4	2.7 E-5
Thorium-228	Background	120	120	100%	NA	NA	1.07	1.24	1.478	1.705	1.687	1.903	2.091	2.28	0.2775	3.1 E-2	3.8 E-3
Thorium-228	Borrow Area	49	49	100%	NA	NA	0.55	0.934	1.49	1.75	1.708	1.96	2.502	2.64	0.4298	2.4 E-1	1.9 E-4
Thorium-230	Background	120	120	100%	NA	NA	0.66	0.78	0.98	1.19	1.246	1.395	1.931	3.01	0.3828	4.3 E-8	6.8 E-2
Thorium-230	Borrow Area	49	49	100%	NA	NA	0.84	0.902	1.24	1.59	1.674	1.95	2.596	3.35	0.5599	8.6 E-3	8.6 E-1

TABLE E3-1
SUMMARY STATISTICS FOR RADIONUCLIDES - ALL DATA
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	Dataset	N	Number of Detects	Frequency of Detects	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	5th Percentile	25th Percentile	Median	Mean	75th Percentile	95th Percentile	Maximum Detect	Standard Deviation	Shapiro-Wilk p-value	log Shapiro-Wilk p-value
Thorium-232	Background	120	120	100%	NA	NA	1.05	1.24	1.407	1.57	1.614	1.802	2.06	2.23	0.2657	3.2 E-2	6.7 E-2
Thorium-232	Borrow Area	49	49	100%	NA	NA	0.54	0.84	1.41	1.51	1.521	1.76	1.956	2.64	0.3691	9.3 E-2	3.0 E-4
Thorium-234	Background	120	65	54%	-0.53	1.39	1.11	-0.0074	0.745	1.255	1.165	1.625	2.071	2.5	0.6305	1.1 E-1	2.3 E-9
Thorium-234	Borrow Area	49	13	27%	1.21	4.57	1.19	1.244	1.51	1.81	2.143	2.63	3.82	2.3	0.8345	2.0 E-4	3.2 E-2
Uranium-234	Background	120	61	51%	0.47	1.17	0.53	0.649	0.83	0.99	1.109	1.212	1.994	2.84	0.4571	1.0 E-10	5.1 E-4
Uranium-234	Borrow Area	49	49	100%	NA	NA	0.55	0.81	1.13	1.54	1.598	1.96	2.506	3.69	0.6099	3.2 E-3	3.4 E-1
Uranium-235	Background	120	54	45%	0	0.11	0.037	0.0105	0.04275	0.059	0.06591	0.08925	0.13	0.21	0.03818	8.4 E-4	NA
Uranium-235	Borrow Area	49	33	67%	0.02	0.6	0.01	0.02	0.04	0.06	0.1171	0.09	0.6	0.24	0.1688	2.3 E-11	2.7 E-4
Uranium-238	Background	120	120	100%	NA	NA	0.45	0.628	0.86	1.015	1.084	1.208	1.95	2.37	0.3732	2.2 E-7	9.5 E-2
Uranium-238	Borrow Area	49	49	100%	NA	NA	0.57	0.748	1.01	1.42	1.394	1.61	2.142	2.73	0.4664	6.2 E-2	1.0 E-1

Note: All units in pCi/g.
Summary statistics prepared using GISdT® (Neptune and Company 2007).

TABLE E3-2
SUMMARY STATISTICS FOR RADIONUCLIDES - DETECTS ONLY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 2)

Chemical	Dataset	N	Number of Detects	Frequency of Detects	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	5th Percentile	25th Percentile	Median	Mean	75th Percentile	95th Percentile	Maximum Detect	Standard Deviation	Shapiro-Wilk p-value	log Shapiro-Wilk p-value
Actinium-228	Background	120	120	100%	NA	NA	1.11	1.24	1.54	1.775	1.804	2.04	2.354	3.4	0.3775	3.8 E-1	3.1 E-3
Actinium-228	Borrow Area	49	43	88%	0.42	0.9	1.1	1.473	1.73	1.92	1.912	2.085	2.33	2.95	0.3375	3.4 E-1	2.1 E-1
Bismuth-210	Background	104	1	1.0%	-0.6	2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	NA	NA	NA
Bismuth-210	Borrow Area	12	12	100%	NA	NA	0.1	0.21	0.58	0.8	0.8267	1.125	1.5	1.5	0.44	4.4 E-1	8.3 E-1
Bismuth-212	Background	120	68	57%	0.29	1.3	0.71	0.797	0.925	1.16	1.192	1.413	1.696	1.82	0.2962	3.0 E-1	3.0 E-2
Bismuth-212	Borrow Area	49	5	10%	0.59	2.25	1.07	1.082	1.13	1.17	1.224	1.33	1.402	1.42	0.1459	1.5 E-1	5.8 E-1
Bismuth-214	Background	120	120	100%	NA	NA	0.52	0.64	0.8	0.925	0.9495	1.08	1.263	1.62	0.2106	2.1 E-1	1.9 E-2
Bismuth-214	Borrow Area	49	22	45%	0.24	0.67	0.94	0.9805	1.095	1.21	1.24	1.345	1.575	1.75	0.2045	2.0 E-1	4.1 E-1
Cobalt-57	Background	104	0	0%	-0.045	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt-57	Borrow Area	34	0	0%	0.317	0.614	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt-60	Background	104	0	0%	-0.073	0.082	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt-60	Borrow Area	36	0	0%	0.0541	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead-210	Background	120	2	1.7%	-0.6	2.2	1.9	1.915	1.975	2.05	2.05	2.125	2.185	2.2	0.2121	2.1 E-1	NA
Lead-210	Borrow Area	49	3	6.1%	0.1	40.2	1.5	1.55	1.75	2	1.937	2.155	2.279	2.31	0.4087	4.1 E-1	7.4 E-1
Lead-212	Background	120	120	100%	NA	NA	0.94	1.08	1.285	1.465	1.497	1.72	1.93	2.11	0.262	2.6 E-1	4.8 E-2
Lead-212	Borrow Area	49	49	100%	NA	NA	0.72	1.038	1.63	1.82	1.788	1.98	2.216	2.85	0.3668	3.7 E-1	8.9 E-3
Lead-214	Background	120	120	100%	NA	NA	0.61	0.6895	0.83	0.93	0.9672	1.07	1.48	1.72	0.2189	2.2 E-1	2.7 E-7
Lead-214	Borrow Area	49	49	100%	NA	NA	0.7	0.978	1.17	1.3	1.35	1.5	1.756	2.6	0.3124	3.1 E-1	9.6 E-4
Polonium-210	Background	104	1	1.0%	-0.6	2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	NA	NA	NA
Polonium-210	Borrow Area	12	12	100%	NA	NA	0.1	0.21	0.58	0.8	0.8267	1.125	1.5	1.5	0.44	4.4 E-1	8.3 E-1
Polonium-212	Background	104	64	62%	0.19	0.78	0.46	0.5115	0.58	0.72	0.753	0.8925	1.077	1.17	0.1889	1.9 E-1	2.1 E-2
Polonium-212	Borrow Area	12	12	100%	NA	NA	0.38	0.435	0.5425	0.66	0.6475	0.735	0.877	0.91	0.157	1.6 E-1	9.9 E-1
Polonium-214	Background	104	104	100%	NA	NA	0.52	0.6615	0.8075	0.93	0.9615	1.09	1.311	1.62	0.2127	2.1 E-1	2.7 E-2
Polonium-214	Borrow Area	12	12	100%	NA	NA	0.94	0.995	1.163	1.24	1.26	1.383	1.53	1.58	0.1887	1.9 E-1	1.0 E+0
Polonium-216	Background	104	104	100%	NA	NA	1.08	1.113	1.337	1.57	1.535	1.73	1.93	2.11	0.2535	2.5 E-1	2.0 E-2
Polonium-216	Borrow Area	12	12	100%	NA	NA	1.79	1.806	1.955	2.01	2.113	2.265	2.568	2.64	0.282	2.8 E-1	4.1 E-2
Polonium-218	Background	104	96	92%	0.592	0.999	0.494	0.625	0.9257	1.09	1.135	1.27	1.833	2.36	0.3495	3.5 E-1	6.5 E-4
Polonium-218	Borrow Area	12	12	100%	NA	NA	1.72	1.726	1.827	2.255	2.223	2.47	2.82	2.99	0.4139	4.1 E-1	4.7 E-1
Potassium-40	Background	120	120	100%	NA	NA	17.8	20.9	22.88	24.5	25.19	27.05	31	35	3.256	3.3 E+0	9.7 E-3
Potassium-40	Borrow Area	49	49	100%	NA	NA	9.44	13.48	23.9	25.9	24.55	27.8	29.6	30.8	5.079	5.1 E+0	2.0 E-6
Protactinium-234	Background	104	0	0%	-0.34	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Protactinium-234	Borrow Area	12	12	100%	NA	NA	1.19	1.25	1.405	1.515	1.479	1.542	1.661	1.7	0.1427	1.4 E-1	8.5 E-1
Radium-224	Background	104	104	100%	NA	NA	1.08	1.113	1.337	1.57	1.535	1.73	1.93	2.11	0.2535	2.5 E-1	2.0 E-2
Radium-224	Borrow Area	12	12	100%	NA	NA	3.3	3.355	3.55	4.05	4.367	4.525	6.61	8.7	1.46	1.5 E+0	3.6 E-4
Radium-226	Background	104	96	92%	0.592	0.999	0.494	0.625	0.9257	1.09	1.135	1.27	1.833	2.36	0.3495	3.5 E-1	6.5 E-4
Radium-226	Borrow Area	49	49	100%	NA	NA	0.92	1.106	1.52	1.91	2.012	2.35	3.062	4.52	0.7012	7.0 E-1	1.2 E-2
Radium-228	Background	84	68	81%	0.946	2	1.15	1.314	1.738	2.035	1.994	2.21	2.622	2.94	0.3866	3.9 E-1	3.8 E-1
Radium-228	Borrow Area	49	45	92%	2	4.23	0.78	1.414	1.74	2.05	2.107	2.42	2.926	3.25	0.5213	5.2 E-1	8.2 E-1
Thallium-208	Background	120	120	100%	NA	NA	0.33	0.39	0.48	0.54	0.5405	0.6025	0.69	0.72	0.09088	9.1 E-2	2.2 E-1
Thallium-208	Borrow Area	49	49	100%	NA	NA	0.23	0.35	0.5	0.56	0.5559	0.62	0.676	1.02	0.1216	1.2 E-1	4.4 E-4

TABLE E3-2
SUMMARY STATISTICS FOR RADIONUCLIDES - DETECTS ONLY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 2 of 2)

Chemical	Dataset	N	Number of Detects	Frequency of Detects	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	5th Percentile	25th Percentile	Median	Mean	75th Percentile	95th Percentile	Maximum Detect	Standard Deviation	Shapiro-Wilk p-value	log Shapiro-Wilk p-value
Thorium-227	Background	104	0	0%	-0.57	0.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-227	Borrow Area	35	0	0%	0.353	0.702	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-228	Background	120	120	100%	NA	NA	1.07	1.24	1.478	1.705	1.687	1.903	2.091	2.28	0.2775	2.8 E-1	3.1 E-2
Thorium-228	Borrow Area	49	49	100%	NA	NA	0.55	0.934	1.49	1.75	1.708	1.96	2.502	2.64	0.4298	4.3 E-1	2.4 E-1
Thorium-230	Background	120	120	100%	NA	NA	0.66	0.78	0.98	1.19	1.246	1.395	1.931	3.01	0.3828	3.8 E-1	4.3 E-8
Thorium-230	Borrow Area	49	49	100%	NA	NA	0.84	0.902	1.24	1.59	1.674	1.95	2.596	3.35	0.5599	5.6 E-1	8.6 E-3
Thorium-232	Background	120	120	100%	NA	NA	1.05	1.24	1.407	1.57	1.614	1.802	2.06	2.23	0.2657	2.7 E-1	3.2 E-2
Thorium-232	Borrow Area	49	49	100%	NA	NA	0.54	0.84	1.41	1.51	1.521	1.76	1.956	2.64	0.3691	3.7 E-1	9.3 E-2
Thorium-234	Background	120	65	54%	-0.53	1.39	1.11	1.2	1.4	1.6	1.635	1.84	2.176	2.5	0.313	3.1 E-1	1.3 E-1
Thorium-234	Borrow Area	49	13	27%	1.21	4.57	1.19	1.256	1.41	1.52	1.568	1.63	2.036	2.3	0.2795	2.8 E-1	8.7 E-2
Uranium-234	Background	120	61	51%	0.47	1.17	0.53	0.65	0.91	1.21	1.308	1.59	2.44	2.84	0.5564	5.6 E-1	4.7 E-4
Uranium-234	Borrow Area	49	49	100%	NA	NA	0.55	0.81	1.13	1.54	1.598	1.96	2.506	3.69	0.6099	6.1 E-1	3.2 E-3
Uranium-235	Background	120	54	45%	0	0.11	0.037	0.043	0.05925	0.088	0.09006	0.106	0.1505	0.21	0.0365	3.7 E-2	3.4 E-3
Uranium-235	Borrow Area	49	33	67%	0.02	0.6	0.01	0.026	0.04	0.05	0.0597	0.07	0.108	0.24	0.0405	4.1 E-2	2.1 E-6
Uranium-238	Background	120	120	100%	NA	NA	0.45	0.628	0.86	1.015	1.084	1.208	1.95	2.37	0.3732	3.7 E-1	2.2 E-7
Uranium-238	Borrow Area	49	49	100%	NA	NA	0.57	0.748	1.01	1.42	1.394	1.61	2.142	2.73	0.4664	4.7 E-1	6.2 E-2

Note: All units in pCi/g.

Summary statistics prepared using GISdT® (Neptune and Company 2007).

TABLE E3-3
SUMMARY STATISTICS FOR METALS - ALL DATA - RANDOM DETECTION LIMIT
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 2)

Chemical	Dataset	N	Number of Detects	Frequency of Detects	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	5th Percentile	25th Percentile	Median	Mean	75th Percentile	95th Percentile	Maximum Detect	Standard Deviation	Shapiro-Wilk p-value	log Shapiro-Wilk p-value
Aluminum	Background	120	120	100%	NA	NA	3740	5230	6708	8420	8899	11200	13300	15300	2653	9.8 E-4	6.2 E-3
Aluminum	Borrow Area	80	80	100%	NA	NA	3580	4119	5500	6550	7519	8525	15020	17600	3111	8.2 E-8	7.4 E-3
Antimony	Background	120	49	41%	0.001071	0.3273	0.12	0.01225	0.07847	0.1629	0.1761	0.2592	0.3805	0.5	0.1158	2.6 E-3	1.8 E-9
Antimony	Borrow Area	80	44	55%	0.008772	4.796	0.07	0.04371	0.12	0.19	0.3216	0.31	0.5039	0.34	0.6304	3.9 E-17	2.2 E-4
Arsenic	Background	120	120	100%	NA	NA	2.1	2.6	3.3	3.9	4.132	4.925	6.11	7.2	1.135	1.6 E-3	2.2 E-1
Arsenic	Borrow Area	80	80	100%	NA	NA	1.9	2.595	3.5	5.2	6.967	7.725	19.09	25.4	5.271	9.5 E-10	2.7 E-3
Barium	Background	120	120	100%	NA	NA	73	101.7	144.5	190	222.5	233.3	446	836	125.6	5.4 E-12	4.7 E-3
Barium	Borrow Area	80	80	100%	NA	NA	40	76.56	118	140	162.1	171.8	299.4	927	104.3	2.6 E-14	1.3 E-4
Beryllium	Background	120	120	100%	NA	NA	0.16	0.309	0.44	0.54	0.5566	0.69	0.84	0.89	0.1634	2.2 E-2	3.5 E-3
Beryllium	Borrow Area	80	65	81%	0.00793	0.4999	0.27	0.2095	0.352	0.45	0.4876	0.58	0.8825	1.1	0.2198	1.5 E-3	5.7 E-13
Boron	Background	104	34	33%	0.04946	4.145	5.2	0.2722	1.046	2.327	3.43	5.8	8.585	11.6	2.867	3.9 E-7	1.7 E-4
Boron	Borrow Area	48	19	40%	0.2325	52.69	6.7	0.5785	2.549	5.65	8.842	12.03	25.74	31.5	9.599	1.2 E-7	1.1 E-1
Cadmium	Background	120	16	13%	0.0008475	0.1288	0.052	0.007757	0.03735	0.06425	0.06835	0.1023	0.1263	0.16	0.0396	1.7 E-3	1.9 E-10
Cadmium	Borrow Area	80	48	60%	0.003433	0.4857	0.03	0.03672	0.06	0.11	0.1525	0.2031	0.4242	0.32	0.1266	2.8 E-8	2.8 E-3
Calcium	Background	104	104	100%	NA	NA	8160	11230	17530	23650	28130	35230	51710	82800	14860	2.6 E-7	3.9 E-1
Calcium	Borrow Area	48	48	100%	NA	NA	3170	16700	26230	38700	71440	50100	288200	692000	117600	4.7 E-12	1.2 E-4
Chromium (Total)	Background	120	120	100%	NA	NA	2.6	4.495	7	8.8	8.937	10.8	14.12	16.7	2.886	6.3 E-1	3.5 E-3
Chromium (Total)	Borrow Area	80	79	99%	4.704	4.704	2.8	4.99	6.9	9.05	12.45	13	24.57	110	13.3	1.2 E-15	8.4 E-5
Cobalt	Background	120	120	100%	NA	NA	3.7	4.195	6.375	8.25	8.225	9.725	12.2	16.3	2.479	5.1 E-2	1.4 E-2
Cobalt	Borrow Area	80	80	100%	NA	NA	2.3	3.595	4.475	5.4	5.688	6.525	9.115	10.9	1.677	4.9 E-4	4.2 E-1
Copper	Background	120	120	100%	NA	NA	7.8	9.85	14.38	17.2	17.07	19.73	23.7	30.5	4.235	4.8 E-1	7.7 E-4
Copper	Borrow Area	80	80	100%	NA	NA	7.4	9.04	11.07	13	13.74	15.47	21.52	24.9	3.732	1.6 E-3	5.7 E-1
Hexavalent Chromium	Background	104	0	0%	0.002051	0.2508	NA	0.01222	0.06044	0.1395	0.1294	0.1951	0.2394	NA	0.0744	2.5 E-4	1.7 E-9
Hexavalent Chromium	Borrow Area	79	0	0%	0.01526	1.096	NA	0.02589	0.1152	0.273	0.2867	0.3678	0.7385	NA	0.2174	6.8 E-6	1.8 E-4
Iron	Background	120	120	100%	NA	NA	5410	7374	10480	13050	12810	15100	17920	19700	3263	3.9 E-1	6.5 E-4
Iron	Borrow Area	80	80	100%	NA	NA	4700	6185	8495	10250	11480	13300	19010	23300	4050	1.9 E-4	6.7 E-2
Lead	Background	120	120	100%	NA	NA	3	4.895	6.375	7.75	9.447	10.6	20.34	35.1	5.059	3.7 E-12	5.7 E-4
Lead	Borrow Area	80	80	100%	NA	NA	3.4	4.19	5.675	7.35	7.704	8.7	13.63	18.5	2.923	6.6 E-5	6.2 E-1
Lithium	Background	104	104	100%	NA	NA	7.5	8.8	10.8	12.75	13.85	16.13	22.29	26.5	4.32	2.4 E-6	1.4 E-2
Lithium	Borrow Area	48	46	96%	9.194	64.39	7.9	9.441	11.68	15.55	21.76	28.65	50.88	61.8	14.03	3.2 E-6	6.9 E-3
Magnesium	Background	120	120	100%	NA	NA	4580	4959	6970	9425	9505	11700	14010	17500	3046	1.0 E-2	1.1 E-3
Magnesium	Borrow Area	80	80	100%	NA	NA	4110	4700	5723	7200	9217	9315	27400	36500	6458	2.6 E-12	5.5 E-7
Manganese	Background	120	120	100%	NA	NA	151	221.8	343.8	419	424.9	495.8	619.1	1090	135.3	1.3 E-5	2.9 E-3
Manganese	Borrow Area	80	80	100%	NA	NA	68	94.95	130	185.5	216.6	277.3	402.2	763	119.5	1.0 E-8	3.8 E-1
Mercury	Background	120	93	78%	0.0001844	0.007186	0.0084	0.001855	0.009175	0.015	0.01769	0.022	0.0342	0.11	0.01536	6.0 E-13	4.4 E-7
Mercury	Borrow Area	80	24	30%	0.0002439	0.2303	0.0071	0.001821	0.007752	0.01579	0.02016	0.02624	0.04663	0.04	0.02691	2.0 E-15	4.0 E-4
Molybdenum	Background	120	120	100%	NA	NA	0.17	0.2695	0.38	0.475	0.5467	0.6225	0.9715	2	0.2792	4.6 E-12	5.3 E-2
Molybdenum	Borrow Area	80	76	95%	0.05514	0.5303	0.33	0.3965	0.5475	0.65	0.807	0.9125	1.405	5.9	0.6699	2.7 E-15	6.7 E-8
Nickel	Background	120	120	100%	NA	NA	7.8	9.185	11.4	15.35	15.12	17.65	22.1	30	4.238	2.7 E-3	7.5 E-2
Nickel	Borrow Area	80	80	100%	NA	NA	5	8.085	10.43	17.8	27.53	45	59.25	72	19.66	2.0 E-7	7.2 E-6

TABLE E3-3
SUMMARY STATISTICS FOR METALS - ALL DATA - RANDOM DETECTION LIMIT
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Chemical	Dataset	N	Number of Detects	Frequency of Detects	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	5th Percentile	25th Percentile	Median	Mean	75th Percentile	95th Percentile	Maximum Detect	Standard Deviation	Shapiro-Wilk p-value	log Shapiro-Wilk p-value
Niobium	Background	104	0	0%	0.001676	2.382	NA	0.03281	0.2842	0.5358	0.6793	0.9415	1.691	NA	0.5255	5.4 E-6	5.6 E-9
Niobium	Borrow Area	48	14	29%	0.3548	11.46	0.4	0.427	0.915	1.3	2.185	2.365	7.2	2	2.444	2.3 E-9	1.8 E-1
Palladium	Background	104	104	100%	NA	NA	0.14	0.1915	0.2875	0.4	0.4615	0.55	0.88	1.5	0.2423	1.3 E-7	5.4 E-1
Palladium	Borrow Area	48	48	100%	NA	NA	0.14	0.194	0.34	0.465	0.566	0.7875	1.165	1.6	0.3142	4.0 E-4	7.3 E-1
Platinum	Background	104	5	4.8%	0.000723	0.04263	0.045	0.003045	0.009276	0.02046	0.02239	0.03261	0.04252	0.099	0.01659	7.3 E-8	2.6 E-4
Platinum	Borrow Area	48	2	4.2%	0.02585	0.9556	0.01	0.02733	0.04436	0.07066	0.1213	0.1036	0.4603	0.02	0.1793	1.4 E-11	7.2 E-3
Potassium	Background	104	104	100%	NA	NA	625	872.8	1233	1535	1730	2058	3259	3890	732.8	4.5 E-6	4.2 E-1
Potassium	Borrow Area	48	48	100%	NA	NA	1260	1395	1843	2625	2789	3470	4724	7300	1190	6.3 E-4	4.8 E-1
Selenium	Background	120	52	43%	0.002137	0.1578	0.1	0.006813	0.06363	0.144	0.1718	0.2725	0.39	0.6	0.1348	2.5 E-6	4.2 E-8
Selenium	Borrow Area	80	4	5.0%	0.005855	4.037	0.12	0.04746	0.1228	0.2502	0.4051	0.4392	1.199	0.64	0.5867	1.6 E-14	8.0 E-2
Silicon	Background	104	104	100%	NA	NA	335	413.6	562.8	720	981	1068	2789	4150	780.1	9.3 E-15	6.1 E-7
Silicon	Borrow Area	48	39	81%	4.754	85.52	56.1	19.07	74.38	105	120.7	164.8	225.3	278	65.82	3.9 E-1	1.0 E-5
Silver	Background	120	16	13%	0.0027	0.2553	0.019	0.02598	0.06391	0.1411	0.1299	0.1908	0.2446	0.083	0.07209	1.2 E-4	1.2 E-8
Silver	Borrow Area	80	44	55%	0.005366	56.7	0.05	0.03921	0.0775	0.13	2.222	0.2639	8.212	0.7	9.492	2.0 E-18	1.7 E-9
Sodium	Background	104	104	100%	NA	NA	111	138.3	209.8	452	485.7	684.8	973.7	1320	285.9	1.3 E-4	9.4 E-5
Sodium	Borrow Area	48	48	100%	NA	NA	167	269.9	515.8	1015	1238	1575	2823	3770	845.6	1.4 E-3	2.6 E-1
Strontium	Background	104	104	100%	NA	NA	69	88.42	134.5	186	222.9	258	483.9	808	132.1	1.9 E-9	1.7 E-1
Strontium	Borrow Area	48	48	100%	NA	NA	68.9	113.2	165.3	213.5	265.2	347.3	542	678	143.5	1.4 E-4	5.8 E-1
Thallium	Background	120	42	35%	0.0161	0.9121	0.1	0.04313	0.1284	0.298	0.5032	0.7429	1.505	1.8	0.5074	5.7 E-11	6.0 E-3
Thallium	Borrow Area	80	1	1.3%	0.006864	2.24	1.6	0.02704	0.08444	0.1773	0.2598	0.3411	0.5544	1.6	0.334	1.0 E-13	1.1 E-1
Tin	Background	104	103	99%	0.167	0.167	0.2	0.2415	0.4	0.485	0.4766	0.5525	0.6685	0.8	0.1298	5.8 E-1	8.9 E-5
Tin	Borrow Area	48	48	100%	NA	NA	0.22	0.31	0.39	0.51	0.549	0.6825	0.8465	1.1	0.1966	2.4 E-2	4.6 E-1
Titanium	Background	120	120	100%	NA	NA	200	243.6	392.8	503.5	510.3	618	840	1010	170.8	5.5 E-2	3.8 E-2
Titanium	Borrow Area	80	80	100%	NA	NA	271	319.6	416.3	640.5	622.1	775.5	1002	1200	219.4	1.9 E-2	1.4 E-2
Tungsten	Background	104	0	0%	0.0005052	1.891	NA	0.1277	0.3616	0.5747	0.6365	0.8319	1.565	NA	0.3981	4.8 E-5	2.0 E-13
Tungsten	Borrow Area	76	19	25%	0.001393	5.574	0.56	0.02006	0.1994	0.3995	0.6219	0.7007	1.978	2.6	0.8224	6.5 E-13	3.7 E-5
Uranium	Background	103	103	100%	NA	NA	0.43	0.671	0.82	0.94	1.001	1.1	1.39	2.7	0.3143	1.6 E-10	5.8 E-4
Uranium	Borrow Area	48	48	100%	NA	NA	0.54	0.645	0.8625	1.2	1.499	1.925	3.03	4.6	0.8864	1.9 E-5	1.0 E-1
Vanadium	Background	120	120	100%	NA	NA	14.6	17.69	25.88	35.55	35.41	43.45	51.92	59.1	10.54	1.7 E-1	9.3 E-4
Vanadium	Borrow Area	80	80	100%	NA	NA	13.7	20.29	25.57	30.5	35.82	42.83	64.11	78.1	13.81	2.6 E-5	1.4 E-1
Zinc	Background	120	120	100%	NA	NA	15.4	21.36	28.5	37.15	37.23	43.13	52.12	121	12.62	4.2 E-10	9.4 E-3
Zinc	Borrow Area	80	79	99%	0.4173	0.4173	10.3	15.57	20.07	28.05	28.54	35.1	44.15	58.7	9.967	3.9 E-1	6.9 E-13
Zirconium	Background	104	104	100%	NA	NA	60.1	79.91	111.8	125	126.3	145	170.6	179	26.69	2.6 E-1	3.2 E-4
Zirconium	Borrow Area	48	48	100%	NA	NA	64.7	140.4	157.5	191.5	227.2	299.8	369.4	497	88.97	2.0 E-3	2.1 E-2

Note: All units in mg/kg.

Summary statistics prepared using GISdT® (Neptune and Company 2007).

TABLE E3-4
SUMMARY STATISTICS FOR METALS - ALL DATA - DETECTION LIMIT
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 2)

Chemical	Dataset	N	Number of Detects	Frequency of Detects	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	5th Percentile	25th Percentile	Median	Mean	75th Percentile	95th Percentile	Maximum Detect	Standard Deviation	Shapiro-Wilk p-value	log Shapiro-Wilk p-value
Aluminum	Background	120	120	100%	NA	NA	3740	5230	6708	8420	8899	11200	13300	15300	2653	9.8 E-4	6.2 E-3
Aluminum	Borrow Area	80	80	100%	NA	NA	3580	4119	5500	6550	7519	8525	15020	17600	3111	8.2 E-8	7.4 E-3
Antimony	Background	120	49	41%	0.0394	0.3298	0.12	0.0394	0.1675	0.3298	0.2542	0.3298	0.3805	0.5	0.1137	7.8 E-10	5.7 E-14
Antimony	Borrow Area	80	44	55%	0.46	8.3	0.07	0.09	0.15	0.285	0.5767	0.5	0.6635	0.34	1.247	2.6 E-17	7.6 E-8
Arsenic	Background	120	120	100%	NA	NA	2.1	2.6	3.3	3.9	4.132	4.925	6.11	7.2	1.135	1.6 E-3	2.2 E-1
Arsenic	Borrow Area	80	80	100%	NA	NA	1.9	2.595	3.5	5.2	6.967	7.725	19.09	25.4	5.271	9.5 E-10	2.7 E-3
Barium	Background	120	120	100%	NA	NA	73	101.7	144.5	190	222.5	233.3	446	836	125.6	5.4 E-12	4.7 E-3
Barium	Borrow Area	80	80	100%	NA	NA	40	76.56	118	140	162.1	171.8	299.4	927	104.3	2.6 E-14	1.3 E-4
Beryllium	Background	120	120	100%	NA	NA	0.16	0.309	0.44	0.54	0.5566	0.69	0.84	0.89	0.1634	2.2 E-2	3.5 E-3
Beryllium	Borrow Area	80	65	81%	0.47	0.53	0.27	0.31	0.42	0.5	0.5304	0.58	0.8825	1.1	0.1821	2.0 E-6	5.8 E-2
Boron	Background	104	34	33%	3.2	5.1	5.2	3.2	3.35	4.25	4.878	5.8	8.585	11.6	1.863	3.1 E-9	7.1 E-7
Boron	Borrow Area	48	19	40%	5.1	82.5	6.7	5.135	5.7	8.4	12.83	12.93	31.95	31.5	13.98	5.5 E-11	3.7 E-5
Cadmium	Background	120	16	13%	0.1291	0.1291	0.052	0.0989	0.1291	0.1291	0.126	0.1291	0.1291	0.16	0.01278	5.9 E-20	1.3 E-20
Cadmium	Borrow Area	80	48	60%	0.46	0.53	0.03	0.04	0.07	0.125	0.2526	0.5	0.5105	0.32	0.207	1.2 E-10	4.1 E-8
Calcium	Background	104	104	100%	NA	NA	8160	11230	17530	23650	28130	35230	51710	82800	14860	2.6 E-7	3.9 E-1
Calcium	Borrow Area	48	48	100%	NA	NA	3170	16700	26230	38700	71440	50100	288200	692000	117600	4.7 E-12	1.2 E-4
Chromium (Total)	Background	120	120	100%	NA	NA	2.6	4.495	7	8.8	8.937	10.8	14.12	16.7	2.886	6.3 E-1	3.5 E-3
Chromium (Total)	Borrow Area	80	79	99%	6.4	6.4	2.8	5.095	6.9	9.05	12.47	13	24.57	110	13.29	1.1 E-15	5.1 E-5
Cobalt	Background	120	120	100%	NA	NA	3.7	4.195	6.375	8.25	8.225	9.725	12.2	16.3	2.479	5.1 E-2	1.4 E-2
Cobalt	Borrow Area	80	80	100%	NA	NA	2.3	3.595	4.475	5.4	5.688	6.525	9.115	10.9	1.677	4.9 E-4	4.2 E-1
Copper	Background	120	120	100%	NA	NA	7.8	9.85	14.38	17.2	17.07	19.73	23.7	30.5	4.235	4.8 E-1	7.7 E-4
Copper	Borrow Area	80	80	100%	NA	NA	7.4	9.04	11.07	13	13.74	15.47	21.52	24.9	3.732	1.6 E-3	5.7 E-1
Hexavalent Chromium	Background	104	0	0%	0.251	0.251	NA	0.251	0.251	0.251	0.251	0.251	0.251	NA	0	NA	NA
Hexavalent Chromium	Borrow Area	79	0	0%	0.4	1.3	NA	0.409	0.42	0.5	0.5595	0.56	0.931	NA	0.1858	2.5 E-10	1.4 E-8
Iron	Background	120	120	100%	NA	NA	5410	7374	10480	13050	12810	15100	17920	19700	3263	3.9 E-1	6.5 E-4
Iron	Borrow Area	80	80	100%	NA	NA	4700	6185	8495	10250	11480	13300	19010	23300	4050	1.9 E-4	6.7 E-2
Lead	Background	120	120	100%	NA	NA	3	4.895	6.375	7.75	9.447	10.6	20.34	35.1	5.059	3.7 E-12	5.7 E-4
Lead	Borrow Area	80	80	100%	NA	NA	3.4	4.19	5.675	7.35	7.704	8.7	13.63	18.5	2.923	6.6 E-5	6.2 E-1
Lithium	Background	104	104	100%	NA	NA	7.5	8.8	10.8	12.75	13.85	16.13	22.29	26.5	4.32	2.4 E-6	1.4 E-2
Lithium	Borrow Area	48	46	96%	11.7	82.5	7.9	10.01	11.7	15.55	22.19	28.65	50.88	61.8	15.34	4.9 E-7	5.3 E-3
Magnesium	Background	120	120	100%	NA	NA	4580	4959	6970	9425	9505	11700	14010	17500	3046	1.0 E-2	1.1 E-3
Magnesium	Borrow Area	80	80	100%	NA	NA	4110	4700	5723	7200	9217	9315	27400	36500	6458	2.6 E-12	5.5 E-7
Manganese	Background	120	120	100%	NA	NA	151	221.8	343.8	419	424.9	495.8	619.1	1090	135.3	1.3 E-5	2.9 E-3
Manganese	Borrow Area	80	80	100%	NA	NA	68	94.95	130	185.5	216.6	277.3	402.2	763	119.5	1.0 E-8	3.8 E-1
Mercury	Background	120	93	78%	0.0072	0.0072	0.0084	0.0072	0.009175	0.015	0.01843	0.022	0.0342	0.11	0.01471	7.6 E-15	1.2 E-5
Mercury	Borrow Area	80	24	30%	0.02	0.27	0.0071	0.01	0.02	0.03	0.03295	0.03	0.0605	0.04	0.03091	2.0 E-15	1.7 E-6
Molybdenum	Background	120	120	100%	NA	NA	0.17	0.2695	0.38	0.475	0.5467	0.6225	0.9715	2	0.2792	4.6 E-12	5.3 E-2
Molybdenum	Borrow Area	80	76	95%	0.47	8.3	0.33	0.47	0.5575	0.655	0.9163	0.9525	1.53	5.9	1.065	6.5 E-17	2.8 E-9
Nickel	Background	120	120	100%	NA	NA	7.8	9.185	11.4	15.35	15.12	17.65	22.1	30	4.238	2.7 E-3	7.5 E-2
Nickel	Borrow Area	80	80	100%	NA	NA	5	8.085	10.43	17.8	27.53	45	59.25	72	19.66	2.0 E-7	7.2 E-6

TABLE E3-4
SUMMARY STATISTICS FOR METALS - ALL DATA - DETECTION LIMIT
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 2 of 2)

Chemical	Dataset	N	Number of Detects	Frequency of Detects	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	5th Percentile	25th Percentile	Median	Mean	75th Percentile	95th Percentile	Maximum Detect	Standard Deviation	Shapiro-Wilk p-value	log Shapiro-Wilk p-value
Niobium	Background	104	0	0%	1.015	2.8	NA	1.015	1.015	1.3	1.42	1.625	2.385	NA	0.4599	1.8 E-9	6.8 E-8
Niobium	Borrow Area	48	14	29%	2.5	41.2	0.4	0.6015	1.5	2.6	4.967	4.625	22.08	2	7.772	2.2 E-11	8.2 E-3
Palladium	Background	104	104	100%	NA	NA	0.14	0.1915	0.2875	0.4	0.4615	0.55	0.88	1.5	0.2423	1.3 E-7	5.4 E-1
Palladium	Borrow Area	48	48	100%	NA	NA	0.14	0.194	0.34	0.465	0.566	0.7875	1.165	1.6	0.3142	4.0 E-4	7.3 E-1
Platinum	Background	104	5	4.8%	0.0435	0.0435	0.045	0.0435	0.0435	0.0435	0.04481	0.0435	0.0435	0.099	0.007123	2.0 E-21	2.5 E-21
Platinum	Borrow Area	48	2	4.2%	0.1	1.7	0.01	0.1	0.1	0.11	0.2273	0.2	0.8775	0.02	0.3083	1.2 E-11	2.6 E-6
Potassium	Background	104	104	100%	NA	NA	625	872.8	1233	1535	1730	2058	3259	3890	732.8	4.5 E-6	4.2 E-1
Potassium	Borrow Area	48	48	100%	NA	NA	1260	1395	1843	2625	2789	3470	4724	7300	1190	6.3 E-4	4.8 E-1
Selenium	Background	120	52	43%	0.0467	0.1579	0.1	0.1095	0.1579	0.1579	0.2131	0.2725	0.39	0.6	0.1022	1.5 E-11	4.8 E-10
Selenium	Borrow Area	80	4	5.0%	0.46	8.3	0.12	0.4695	0.5	0.52	0.8892	0.8725	2.63	0.64	1.212	1.4 E-16	4.7 E-11
Silicon	Background	104	104	100%	NA	NA	335	413.6	562.8	720	981	1068	2789	4150	780.1	9.3 E-15	6.1 E-7
Silicon	Borrow Area	48	39	81%	69.4	103	56.1	68.36	82.22	105	129.7	164.8	225.3	278	55.29	1.9 E-3	4.6 E-2
Silver	Background	120	16	13%	0.2609	0.2609	0.019	0.0428	0.2609	0.2609	0.2327	0.2609	0.2609	0.083	0.07248	8.3 E-20	1.2 E-19
Silver	Borrow Area	80	44	55%	0.46	82.5	0.05	0.0595	0.08	0.17	3.383	0.5025	26.31	0.7	13.12	4.5 E-18	1.7 E-10
Sodium	Background	104	104	100%	NA	NA	111	138.3	209.8	452	485.7	684.8	973.7	1320	285.9	1.3 E-4	9.4 E-5
Sodium	Borrow Area	48	48	100%	NA	NA	167	269.9	515.8	1015	1238	1575	2823	3770	845.6	1.4 E-3	2.6 E-1
Strontium	Background	104	104	100%	NA	NA	69	88.42	134.5	186	222.9	258	483.9	808	132.1	1.9 E-9	1.7 E-1
Strontium	Borrow Area	48	48	100%	NA	NA	68.9	113.2	165.3	213.5	265.2	347.3	542	678	143.5	1.4 E-4	5.8 E-1
Thallium	Background	120	42	35%	0.2	1.1	0.1	0.149	0.3975	0.5428	0.6884	0.985	1.505	1.8	0.4342	8.0 E-7	7.9 E-4
Thallium	Borrow Area	80	1	1.3%	0.2	3.3	1.6	0.2	0.2175	0.45	0.4926	0.5	1.315	1.6	0.4799	5.5 E-15	2.2 E-8
Tin	Background	104	103	99%	0.187	0.187	0.2	0.2415	0.4	0.485	0.4768	0.5525	0.6685	0.8	0.1293	4.8 E-1	1.2 E-4
Tin	Borrow Area	48	48	100%	NA	NA	0.22	0.31	0.39	0.51	0.549	0.6825	0.8465	1.1	0.1966	2.4 E-2	4.6 E-1
Titanium	Background	120	120	100%	NA	NA	200	243.6	392.8	503.5	510.3	618	840	1010	170.8	5.5 E-2	3.8 E-2
Titanium	Borrow Area	80	80	100%	NA	NA	271	319.6	416.3	640.5	622.1	775.5	1002	1200	219.4	1.9 E-2	1.4 E-2
Tungsten	Background	104	0	0%	0.49	2.5	NA	0.6615	0.8875	1.05	1.178	1.5	2	NA	0.426	5.1 E-5	1.7 E-1
Tungsten	Borrow Area	76	19	25%	0.46	8.3	0.56	0.4875	0.51	0.555	1.012	0.97	2.75	2.6	1.242	1.8 E-15	1.6 E-10
Uranium	Background	103	103	100%	NA	NA	0.43	0.671	0.82	0.94	1.001	1.1	1.39	2.7	0.3143	1.6 E-10	5.8 E-4
Uranium	Borrow Area	48	48	100%	NA	NA	0.54	0.645	0.8625	1.2	1.499	1.925	3.03	4.6	0.8864	1.9 E-5	1.0 E-1
Vanadium	Background	120	120	100%	NA	NA	14.6	17.69	25.88	35.55	35.41	43.45	51.92	59.1	10.54	1.7 E-1	9.3 E-4
Vanadium	Borrow Area	80	80	100%	NA	NA	13.7	20.29	25.57	30.5	35.82	42.83	64.11	78.1	13.81	2.6 E-5	1.4 E-1
Zinc	Background	120	120	100%	NA	NA	15.4	21.36	28.5	37.15	37.23	43.13	52.12	121	12.62	4.2 E-10	9.4 E-3
Zinc	Borrow Area	80	79	99%	0.5	0.5	10.3	15.57	20.07	28.05	28.54	35.1	44.15	58.7	9.964	3.9 E-1	1.6 E-12
Zirconium	Background	104	104	100%	NA	NA	60.1	79.91	111.8	125	126.3	145	170.6	179	26.69	2.6 E-1	3.2 E-4
Zirconium	Borrow Area	48	48	100%	NA	NA	64.7	140.4	157.5	191.5	227.2	299.8	369.4	497	88.97	2.0 E-3	2.1 E-2

Note: All units in mg/kg.

Summary statistics prepared using GISdT® (Neptune and Company 2007).

TABLE E3-5
SUMMARY STATISTICS FOR METALS - ALL DATA - ONE-HALF DETECTION LIMIT
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 2)

Chemical	Dataset	N	Number of Detects	Frequency of Detects	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	5th Percentile	25th Percentile	Median	Mean	75th Percentile	95th Percentile	Maximum Detect	Standard Deviation	Shapiro-Wilk p-value	log Shapiro-Wilk p-value
Aluminum	Background	120	120	100%	NA	NA	3740	5230	6708	8420	8899	11200	13300	15300	2653	9.8 E-4	6.2 E-3
Aluminum	Borrow Area	80	80	100%	NA	NA	3580	4119	5500	6550	7519	8525	15020	17600	3111	8.2 E-8	7.4 E-3
Antimony	Background	120	49	41%	0.0197	0.1649	0.12	0.0197	0.1637	0.1649	0.176	0.2	0.3805	0.5	0.09475	5.6 E-10	2.3 E-14
Antimony	Borrow Area	80	44	55%	0.23	4.15	0.07	0.09	0.15	0.235	0.335	0.25	0.403	0.34	0.6109	1.3 E-17	2.8 E-11
Arsenic	Background	120	120	100%	NA	NA	2.1	2.6	3.3	3.9	4.132	4.925	6.11	7.2	1.135	1.6 E-3	2.2 E-1
Arsenic	Borrow Area	80	80	100%	NA	NA	1.9	2.595	3.5	5.2	6.967	7.725	19.09	25.4	5.271	9.5 E-10	2.7 E-3
Barium	Background	120	120	100%	NA	NA	73	101.7	144.5	190	222.5	233.3	446	836	125.6	5.4 E-12	4.7 E-3
Barium	Borrow Area	80	80	100%	NA	NA	40	76.56	118	140	162.1	171.8	299.4	927	104.3	2.6 E-14	1.3 E-4
Beryllium	Background	120	120	100%	NA	NA	0.16	0.309	0.44	0.54	0.5566	0.69	0.84	0.89	0.1634	2.2 E-2	3.5 E-3
Beryllium	Borrow Area	80	65	81%	0.23	0.26	0.27	0.24	0.325	0.44	0.483	0.58	0.8825	1.1	0.2139	1.1 E-5	1.7 E-2
Boron	Background	104	34	33%	1.6	2.55	5.2	1.6	1.675	2.125	3.601	5.8	8.585	11.6	2.623	5.7 E-12	1.0 E-10
Boron	Borrow Area	48	19	40%	2.55	41.25	6.7	2.567	2.85	5.275	9.168	12.93	29.05	31.5	8.743	1.6 E-7	8.2 E-4
Cadmium	Background	120	16	13%	0.06455	0.06455	0.052	0.06455	0.06455	0.06455	0.07008	0.06455	0.11	0.16	0.01736	3.7 E-20	7.5 E-20
Cadmium	Borrow Area	80	48	60%	0.23	0.26	0.03	0.04	0.07	0.125	0.1515	0.25	0.26	0.32	0.08728	5.4 E-8	1.5 E-6
Calcium	Background	104	104	100%	NA	NA	8160	11230	17530	23650	28130	35230	51710	82800	14860	2.6 E-7	3.9 E-1
Calcium	Borrow Area	48	48	100%	NA	NA	3170	16700	26230	38700	71440	50100	288200	692000	117600	4.7 E-12	1.2 E-4
Chromium (Total)	Background	120	120	100%	NA	NA	2.6	4.495	7	8.8	8.937	10.8	14.12	16.7	2.886	6.3 E-1	3.5 E-3
Chromium (Total)	Borrow Area	80	79	99%	3.2	3.2	2.8	4.99	6.9	9.05	12.43	13	24.57	110	13.31	1.3 E-15	1.9 E-4
Cobalt	Background	120	120	100%	NA	NA	3.7	4.195	6.375	8.25	8.225	9.725	12.2	16.3	2.479	5.1 E-2	1.4 E-2
Cobalt	Borrow Area	80	80	100%	NA	NA	2.3	3.595	4.475	5.4	5.688	6.525	9.115	10.9	1.677	4.9 E-4	4.2 E-1
Copper	Background	120	120	100%	NA	NA	7.8	9.85	14.38	17.2	17.07	19.73	23.7	30.5	4.235	4.8 E-1	7.7 E-4
Copper	Borrow Area	80	80	100%	NA	NA	7.4	9.04	11.07	13	13.74	15.47	21.52	24.9	3.732	1.6 E-3	5.7 E-1
Iron	Background	120	120	100%	NA	NA	5410	7374	10480	13050	12810	15100	17920	19700	3263	3.9 E-1	6.5 E-4
Iron	Borrow Area	80	80	100%	NA	NA	4700	6185	8495	10250	11480	13300	19010	23300	4050	1.9 E-4	6.7 E-2
Lead	Background	120	120	100%	NA	NA	3	4.895	6.375	7.75	9.447	10.6	20.34	35.1	5.059	3.7 E-12	5.7 E-4
Lead	Borrow Area	80	80	100%	NA	NA	3.4	4.19	5.675	7.35	7.704	8.7	13.63	18.5	2.923	6.6 E-5	6.2 E-1
Lithium	Background	104	104	100%	NA	NA	7.5	8.8	10.8	12.75	13.85	16.13	22.29	26.5	4.32	2.4 E-6	1.4 E-2
Lithium	Borrow Area	48	46	96%	5.85	41.25	7.9	8.925	11.68	15.55	21.21	28.65	46.19	61.8	12.96	2.8 E-5	5.6 E-2
Magnesium	Background	120	120	100%	NA	NA	4580	4959	6970	9425	9505	11700	14010	17500	3046	1.0 E-2	1.1 E-3
Magnesium	Borrow Area	80	80	100%	NA	NA	4110	4700	5723	7200	9217	9315	27400	36500	6458	2.6 E-12	5.5 E-7
Manganese	Background	120	120	100%	NA	NA	151	221.8	343.8	419	424.9	495.8	619.1	1090	135.3	1.3 E-5	2.9 E-3
Manganese	Borrow Area	80	80	100%	NA	NA	68	94.95	130	185.5	216.6	277.3	402.2	763	119.5	1.0 E-8	3.8 E-1
Mercury	Background	120	93	78%	0.0036	0.0036	0.0084	0.0036	0.009175	0.015	0.01762	0.022	0.0342	0.11	0.01539	2.1 E-13	1.2 E-6
Mercury	Borrow Area	80	24	30%	0.01	0.13	0.0071	0.01	0.01	0.01	0.0167	0.02	0.03	0.04	0.01551	9.4 E-16	4.6 E-12
Molybdenum	Background	120	120	100%	NA	NA	0.17	0.2695	0.38	0.475	0.5467	0.6225	0.9715	2	0.2792	4.6 E-12	5.3 E-2
Molybdenum	Borrow Area	80	76	95%	0.23	4.15	0.33	0.3965	0.5575	0.655	0.8551	0.9525	1.53	5.9	0.7634	3.4 E-15	5.6 E-6
Nickel	Background	120	120	100%	NA	NA	7.8	9.185	11.4	15.35	15.12	17.65	22.1	30	4.238	2.7 E-3	7.5 E-2
Nickel	Borrow Area	80	80	100%	NA	NA	5	8.085	10.43	17.8	27.53	45	59.25	72	19.66	2.0 E-7	7.2 E-6
Niobium	Background	104	0	0%	0.5075	1.4	NA	0.5075	0.5075	0.65	0.7102	0.8125	1.192	NA	0.2299	1.8 E-9	6.8 E-8
Niobium	Borrow Area	48	14	29%	1.25	20.6	0.4	0.6015	1.25	1.3	2.63	2.313	11.04	2	3.821	9.7 E-12	2.4 E-5

TABLE E3-5
SUMMARY STATISTICS FOR METALS - ALL DATA - ONE-HALF DETECTION LIMIT
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 2 of 2)

Chemical	Dataset	N	Number of Detects	Frequency of Detects	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	5th Percentile	25th Percentile	Median	Mean	75th Percentile	95th Percentile	Maximum Detect	Standard Deviation	Shapiro-Wilk p-value	log Shapiro-Wilk p-value
Palladium	Background	104	104	100%	NA	NA	0.14	0.1915	0.2875	0.4	0.4615	0.55	0.88	1.5	0.2423	1.3 E-7	5.4 E-1
Palladium	Borrow Area	48	48	100%	NA	NA	0.14	0.194	0.34	0.465	0.566	0.7875	1.165	1.6	0.3142	4.0 E-4	7.3 E-1
Platinum	Background	104	5	4.8%	0.02175	0.02175	0.045	0.02175	0.02175	0.02175	0.02411	0.02175	0.02175	0.099	0.01129	4.7 E-21	5.7 E-21
Platinum	Borrow Area	48	2	4.2%	0.05	0.85	0.01	0.05	0.05	0.05	0.1117	0.1	0.437	0.02	0.1544	8.5 E-12	1.2 E-6
Potassium	Background	104	104	100%	NA	NA	625	872.8	1233	1535	1730	2058	3259	3890	732.8	4.5 E-6	4.2 E-1
Potassium	Borrow Area	48	48	100%	NA	NA	1260	1395	1843	2625	2789	3470	4724	7300	1190	6.3 E-4	4.8 E-1
Selenium	Background	120	52	43%	0.02335	0.07895	0.1	0.07895	0.07895	0.07895	0.1702	0.2725	0.39	0.6	0.1301	3.2 E-12	9.4 E-11
Selenium	Borrow Area	80	4	5.0%	0.23	4.15	0.12	0.23	0.25	0.26	0.4499	0.4525	1.315	0.64	0.6049	1.3 E-16	7.5 E-12
Silicon	Background	104	104	100%	NA	NA	335	413.6	562.8	720	981	1068	2789	4150	780.1	9.3 E-15	6.1 E-7
Silicon	Borrow Area	48	39	81%	34.7	51.5	56.1	38.77	71.78	105	121.7	164.8	225.3	278	63.61	2.6 E-2	3.3 E-2
Silver	Background	120	16	13%	0.1305	0.1305	0.019	0.0428	0.1305	0.1305	0.1197	0.1305	0.1305	0.083	0.02846	1.0 E-19	8.2 E-20
Silver	Borrow Area	80	44	55%	0.23	41.25	0.05	0.0595	0.08	0.17	1.723	0.25	13.15	0.7	6.555	4.4 E-18	1.7 E-12
Sodium	Background	104	104	100%	NA	NA	111	138.3	209.8	452	485.7	684.8	973.7	1320	285.9	1.3 E-4	9.4 E-5
Sodium	Borrow Area	48	48	100%	NA	NA	167	269.9	515.8	1015	1238	1575	2823	3770	845.6	1.4 E-3	2.6 E-1
Strontium	Background	104	104	100%	NA	NA	69	88.42	134.5	186	222.9	258	483.9	808	132.1	1.9 E-9	1.7 E-1
Strontium	Borrow Area	48	48	100%	NA	NA	68.9	113.2	165.3	213.5	265.2	347.3	542	678	143.5	1.4 E-4	5.8 E-1
Thallium	Background	120	42	35%	0.1	0.55	0.1	0.12	0.2137	0.2714	0.5048	0.4925	1.505	1.8	0.4806	9.2 E-14	3.8 E-7
Thallium	Borrow Area	80	1	1.3%	0.1	1.65	1.6	0.1	0.1075	0.225	0.254	0.25	0.6675	1.6	0.2776	1.5 E-15	4.1 E-9
Tin	Background	104	103	99%	0.0935	0.0935	0.2	0.2415	0.4	0.485	0.4759	0.5525	0.6685	0.8	0.1317	6.6 E-1	7.1 E-7
Tin	Borrow Area	48	48	100%	NA	NA	0.22	0.31	0.39	0.51	0.549	0.6825	0.8465	1.1	0.1966	2.4 E-2	4.6 E-1
Titanium	Background	120	120	100%	NA	NA	200	243.6	392.8	503.5	510.3	618	840	1010	170.8	5.5 E-2	3.8 E-2
Titanium	Borrow Area	80	80	100%	NA	NA	271	319.6	416.3	640.5	622.1	775.5	1002	1200	219.4	1.9 E-2	1.4 E-2
Tungsten	Background	104	0	0%	0.245	1.25	NA	0.3307	0.4437	0.525	0.5888	0.75	1	NA	0.213	5.1 E-5	1.7 E-1
Tungsten	Borrow Area	76	19	25%	0.23	4.15	0.56	0.24	0.25	0.29	0.6296	0.6925	1.988	2.6	0.6929	5.5 E-13	3.2 E-8
Uranium	Background	103	103	100%	NA	NA	0.43	0.671	0.82	0.94	1.001	1.1	1.39	2.7	0.3143	1.6 E-10	5.8 E-4
Uranium	Borrow Area	48	48	100%	NA	NA	0.54	0.645	0.8625	1.2	1.499	1.925	3.03	4.6	0.8864	1.9 E-5	1.0 E-1
Vanadium	Background	120	120	100%	NA	NA	14.6	17.69	25.88	35.55	35.41	43.45	51.92	59.1	10.54	1.7 E-1	9.3 E-4
Vanadium	Borrow Area	80	80	100%	NA	NA	13.7	20.29	25.57	30.5	35.82	42.83	64.11	78.1	13.81	2.6 E-5	1.4 E-1
Zinc	Background	120	120	100%	NA	NA	15.4	21.36	28.5	37.15	37.23	43.13	52.12	121	12.62	4.2 E-10	9.4 E-3
Zinc	Borrow Area	80	79	99%	0.25	0.25	10.3	15.57	20.07	28.05	28.54	35.1	44.15	58.7	9.973	3.8 E-1	8.6 E-14
Zirconium	Background	104	104	100%	NA	NA	60.1	79.91	111.8	125	126.3	145	170.6	179	26.69	2.6 E-1	3.2 E-4
Zirconium	Borrow Area	48	48	100%	NA	NA	64.7	140.4	157.5	191.5	227.2	299.8	369.4	497	88.97	2.0 E-3	2.1 E-2

Note: All units in mg/kg.

Summary statistics prepared using GISdT® (Neptune and Company 2007).

TABLE E3-6
SUMMARY STATISTICS FOR METALS - DETECTS ONLY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 2)

Chemical	Dataset	N	Number of Detects	Frequency of Detects	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	5th Percentile	25th Percentile	Median	Mean	75th Percentile	95th Percentile	Maximum Detect	Standard Deviation	Shapiro-Wilk p-value	log Shapiro-Wilk p-value
Aluminum	Background	120	120	100%	NA	NA	3740	5230	6708	8420	8899	11200	13300	15300	2653	9.8 E-4	6.2 E-3
Aluminum	Borrow Area	80	80	100%	NA	NA	3580	4119	5500	6550	7519	8525	15020	17600	3111	8.2 E-8	7.4 E-3
Antimony	Background	120	49	41%	0.0394	0.3298	0.12	0.124	0.15	0.22	0.2394	0.29	0.428	0.5	0.09936	1.5 E-3	1.0 E-1
Antimony	Borrow Area	80	44	55%	0.46	8.3	0.07	0.09	0.12	0.16	0.1736	0.2025	0.307	0.34	0.06556	2.1 E-2	6.1 E-1
Arsenic	Background	120	120	100%	NA	NA	2.1	2.6	3.3	3.9	4.132	4.925	6.11	7.2	1.135	1.6 E-3	2.2 E-1
Arsenic	Borrow Area	80	80	100%	NA	NA	1.9	2.595	3.5	5.2	6.967	7.725	19.09	25.4	5.271	9.5 E-10	2.7 E-3
Barium	Background	120	120	100%	NA	NA	73	101.7	144.5	190	222.5	233.3	446	836	125.6	5.4 E-12	4.7 E-3
Barium	Borrow Area	80	80	100%	NA	NA	40	76.56	118	140	162.1	171.8	299.4	927	104.3	2.6 E-14	1.3 E-4
Beryllium	Background	120	120	100%	NA	NA	0.16	0.309	0.44	0.54	0.5566	0.69	0.84	0.89	0.1634	2.2 E-2	3.5 E-3
Beryllium	Borrow Area	80	65	81%	0.47	0.53	0.27	0.31	0.39	0.48	0.5371	0.61	0.92	1.1	0.2016	5.2 E-5	1.6 E-1
Boron	Background	104	34	33%	3.2	5.1	5.2	5.365	5.825	6.8	7.112	8.275	9.485	11.6	1.553	8.9 E-3	6.1 E-2
Boron	Borrow Area	48	19	40%	5.1	82.5	6.7	7.24	9.3	12.7	13.9	16.25	28.8	31.5	6.676	5.2 E-3	5.3 E-1
Cadmium	Background	120	16	13%	0.1291	0.1291	0.052	0.06175	0.09425	0.105	0.106	0.1225	0.145	0.16	0.02832	9.6 E-1	4.5 E-1
Cadmium	Borrow Area	80	48	60%	0.46	0.53	0.03	0.04	0.06	0.075	0.08771	0.11	0.15	0.32	0.0487	5.4 E-7	3.6 E-1
Calcium	Background	104	104	100%	NA	NA	8160	11230	17530	23650	28130	35230	51710	82800	14860	2.6 E-7	3.9 E-1
Calcium	Borrow Area	48	48	100%	NA	NA	3170	16700	26230	38700	71440	50100	288200	692000	117600	4.7 E-12	1.2 E-4
Chromium (Total)	Background	120	120	100%	NA	NA	2.6	4.495	7	8.8	8.937	10.8	14.12	16.7	2.886	6.3 E-1	3.5 E-3
Chromium (Total)	Borrow Area	80	79	99%	6.4	6.4	2.8	5.09	6.9	9.1	12.55	13	24.73	110	13.35	1.5 E-15	6.8 E-5
Cobalt	Background	120	120	100%	NA	NA	3.7	4.195	6.375	8.25	8.225	9.725	12.2	16.3	2.479	5.1 E-2	1.4 E-2
Cobalt	Borrow Area	80	80	100%	NA	NA	2.3	3.595	4.475	5.4	5.688	6.525	9.115	10.9	1.677	4.9 E-4	4.2 E-1
Copper	Background	120	120	100%	NA	NA	7.8	9.85	14.38	17.2	17.07	19.73	23.7	30.5	4.235	4.8 E-1	7.7 E-4
Copper	Borrow Area	80	80	100%	NA	NA	7.4	9.04	11.07	13	13.74	15.47	21.52	24.9	3.732	1.6 E-3	5.7 E-1
Hexavalent Chromium	Background	104	0	0%	0.251	0.251	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexavalent Chromium	Borrow Area	79	0	0%	0.4	1.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	Background	120	120	100%	NA	NA	5410	7374	10480	13050	12810	15100	17920	19700	3263	3.9 E-1	6.5 E-4
Iron	Borrow Area	80	80	100%	NA	NA	4700	6185	8495	10250	11480	13300	19010	23300	4050	1.9 E-4	6.7 E-2
Lead	Background	120	120	100%	NA	NA	3	4.895	6.375	7.75	9.447	10.6	20.34	35.1	5.059	3.7 E-12	5.7 E-4
Lead	Borrow Area	80	80	100%	NA	NA	3.4	4.19	5.675	7.35	7.704	8.7	13.63	18.5	2.923	6.6 E-5	6.2 E-1
Lithium	Background	104	104	100%	NA	NA	7.5	8.8	10.8	12.75	13.85	16.13	22.29	26.5	4.32	2.4 E-6	1.4 E-2
Lithium	Borrow Area	48	46	96%	11.7	82.5	7.9	9.975	11.8	15.55	21.11	28.2	46.88	61.8	12.69	1.3 E-5	1.2 E-2
Magnesium	Background	120	120	100%	NA	NA	4580	4959	6970	9425	9505	11700	14010	17500	3046	1.0 E-2	1.1 E-3
Magnesium	Borrow Area	80	80	100%	NA	NA	4110	4700	5723	7200	9217	9315	27400	36500	6458	2.6 E-12	5.5 E-7
Manganese	Background	120	120	100%	NA	NA	151	221.8	343.8	419	424.9	495.8	619.1	1090	135.3	1.3 E-5	2.9 E-3
Manganese	Borrow Area	80	80	100%	NA	NA	68	94.95	130	185.5	216.6	277.3	402.2	763	119.5	1.0 E-8	3.8 E-1
Mercury	Background	120	93	78%	0.0072	0.0072	0.0084	0.00954	0.013	0.019	0.02169	0.025	0.0424	0.11	0.01523	3.6 E-13	8.5 E-4
Mercury	Borrow Area	80	24	30%	0.02	0.27	0.0071	0.00939	0.01	0.01	0.01776	0.0225	0.0385	0.04	0.01035	2.4 E-4	8.4 E-4
Molybdenum	Background	120	120	100%	NA	NA	0.17	0.2695	0.38	0.475	0.5467	0.6225	0.9715	2	0.2792	4.6 E-12	5.3 E-2
Molybdenum	Borrow Area	80	76	95%	0.47	8.3	0.33	0.4775	0.56	0.66	0.8361	0.9525	1.425	5.9	0.6735	2.1 E-15	8.3 E-7
Nickel	Background	120	120	100%	NA	NA	7.8	9.185	11.4	15.35	15.12	17.65	22.1	30	4.238	2.7 E-3	7.5 E-2
Nickel	Borrow Area	80	80	100%	NA	NA	5	8.085	10.43	17.8	27.53	45	59.25	72	19.66	2.0 E-7	7.2 E-6

TABLE E3-6
SUMMARY STATISTICS FOR METALS - DETECTS ONLY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 2 of 2)

Chemical	Dataset	N	Number of Detects	Frequency of Detects	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	5th Percentile	25th Percentile	Median	Mean	75th Percentile	95th Percentile	Maximum Detect	Standard Deviation	Shapiro-Wilk p-value	log Shapiro-Wilk p-value
Niobium	Background	104	0	0%	1.015	2.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Niobium	Borrow Area	48	14	29%	2.5	41.2	0.4	0.4715	0.695	0.97	1.001	1.175	1.675	2	0.4403	5.2 E-1	9.9 E-1
Palladium	Background	104	104	100%	NA	NA	0.14	0.1915	0.2875	0.4	0.4615	0.55	0.88	1.5	0.2423	1.3 E-7	5.4 E-1
Palladium	Borrow Area	48	48	100%	NA	NA	0.14	0.194	0.34	0.465	0.566	0.7875	1.165	1.6	0.3142	4.0 E-4	7.3 E-1
Platinum	Background	104	5	4.8%	0.0435	0.0435	0.045	0.0488	0.064	0.064	0.0708	0.082	0.0956	0.099	0.02049	8.4 E-1	8.3 E-1
Platinum	Borrow Area	48	2	4.2%	0.1	1.7	0.01	0.0105	0.0125	0.015	0.015	0.0175	0.0195	0.02	0.007071	NA	NA
Potassium	Background	104	104	100%	NA	NA	625	872.8	1233	1535	1730	2058	3259	3890	732.8	4.5 E-6	4.2 E-1
Potassium	Borrow Area	48	48	100%	NA	NA	1260	1395	1843	2625	2789	3470	4724	7300	1190	6.3 E-4	4.8 E-1
Selenium	Background	120	52	43%	0.0467	0.1579	0.1	0.11	0.23	0.29	0.2938	0.3525	0.463	0.6	0.1083	1.5 E-2	2.6 E-3
Selenium	Borrow Area	80	4	5.0%	0.46	8.3	0.12	0.1245	0.1425	0.225	0.3025	0.385	0.589	0.64	0.2384	2.5 E-1	6.3 E-1
Silicon	Background	104	104	100%	NA	NA	335	413.6	562.8	720	981	1068	2789	4150	780.1	9.3 E-15	6.1 E-7
Silicon	Borrow Area	48	39	81%	69.4	103	56.1	67.39	90.3	141	139.9	170	226.9	278	56.39	8.7 E-2	1.7 E-1
Silver	Background	120	16	13%	0.2609	0.2609	0.019	0.02275	0.03675	0.0445	0.0495	0.06075	0.0785	0.083	0.01913	3.3 E-1	4.6 E-1
Silver	Borrow Area	80	44	55%	0.46	82.5	0.05	0.05	0.07	0.09	0.1189	0.14	0.1955	0.7	0.1001	8.6 E-11	1.5 E-3
Sodium	Background	104	104	100%	NA	NA	111	138.3	209.8	452	485.7	684.8	973.7	1320	285.9	1.3 E-4	9.4 E-5
Sodium	Borrow Area	48	48	100%	NA	NA	167	269.9	515.8	1015	1238	1575	2823	3770	845.6	1.4 E-3	2.6 E-1
Strontium	Background	104	104	100%	NA	NA	69	88.42	134.5	186	222.9	258	483.9	808	132.1	1.9 E-9	1.7 E-1
Strontium	Borrow Area	48	48	100%	NA	NA	68.9	113.2	165.3	213.5	265.2	347.3	542	678	143.5	1.4 E-4	5.8 E-1
Thallium	Background	120	42	35%	0.2	1.1	0.1	0.13	0.165	1.1	0.9174	1.4	1.795	1.8	0.6175	5.7 E-5	2.3 E-6
Thallium	Borrow Area	80	1	1.3%	0.2	3.3	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	NA	NA	NA
Tin	Background	104	103	99%	0.187	0.187	0.2	0.25	0.4	0.49	0.4796	0.555	0.669	0.8	0.1267	5.4 E-1	3.7 E-4
Tin	Borrow Area	48	48	100%	NA	NA	0.22	0.31	0.39	0.51	0.549	0.6825	0.8465	1.1	0.1966	2.4 E-2	4.6 E-1
Titanium	Background	120	120	100%	NA	NA	200	243.6	392.8	503.5	510.3	618	840	1010	170.8	5.5 E-2	3.8 E-2
Titanium	Borrow Area	80	80	100%	NA	NA	271	319.6	416.3	640.5	622.1	775.5	1002	1200	219.4	1.9 E-2	1.4 E-2
Tungsten	Background	104	0	0%	0.49	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tungsten	Borrow Area	76	19	25%	0.46	8.3	0.56	0.587	0.655	0.9	1.003	1.05	1.88	2.6	0.5072	5.5 E-4	8.1 E-2
Uranium	Background	103	103	100%	NA	NA	0.43	0.671	0.82	0.94	1.001	1.1	1.39	2.7	0.3143	1.6 E-10	5.8 E-4
Uranium	Borrow Area	48	48	100%	NA	NA	0.54	0.645	0.8625	1.2	1.499	1.925	3.03	4.6	0.8864	1.9 E-5	1.0 E-1
Vanadium	Background	120	120	100%	NA	NA	14.6	17.69	25.88	35.55	35.41	43.45	51.92	59.1	10.54	1.7 E-1	9.3 E-4
Vanadium	Borrow Area	80	80	100%	NA	NA	13.7	20.29	25.57	30.5	35.82	42.83	64.11	78.1	13.81	2.6 E-5	1.4 E-1
Zinc	Background	120	120	100%	NA	NA	15.4	21.36	28.5	37.15	37.23	43.13	52.12	121	12.62	4.2 E-10	9.4 E-3
Zinc	Borrow Area	80	79	99%	0.5	0.5	10.3	15.96	20.3	28.1	28.89	35.2	44.19	58.7	9.505	8.0 E-2	3.3 E-1
Zirconium	Background	104	104	100%	NA	NA	60.1	79.91	111.8	125	126.3	145	170.6	179	26.69	2.6 E-1	3.2 E-4
Zirconium	Borrow Area	48	48	100%	NA	NA	64.7	140.4	157.5	191.5	227.2	299.8	369.4	497	88.97	2.0 E-3	2.1 E-2

Note: All units in mg/kg.

Summary statistics prepared using GISdT® (Neptune and Company 2007).

APPENDIX F

FATE AND TRANSPORT MODELING CALCULATIONS

TABLE F-1
CONSTRUCTION ACTIVITIES FUGITIVE DUST MODEL PARAMETERS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
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Parameter	Abbrev.	Units	Value
Wind Erosion and Construction Activities			
Fugitive dust from wind erosion[1]	M_{wind}	g	1.9 E+5
Fraction of vegetative cover[2]	V	--	0.0 E+0
Mean annual wind speed[3]	U_m	m/s	4.00
Equivalent threshold value of wind speed[2]	U_t	m/s	1.1 E+1
Function dependent on U/U_t[2]	F(x)	--	1.9 E-1
Areal Extent of site surface contamination[4]	A_{surf}	m^2	72033.5
Exposure duration[5]	ED	year	1.0 E+0
Fugitive dust from excavation[6]	M_{excav}	g	22990.05
Wet soil bulk density[7]	ρ_{soil}	Mg/m^3	1.83
Percent moisture in soil[8]	M	%	23.1
Areal extent of site excavation[9]	A_{excav}	m^2	14406.7
Depth of site excavation[2]	d_{excav}	m	11.0
Number of times soil is dumped[2]	N_A	--	2.0
Fugitive dust from dozing[10]	M_{doz}	g	931.69
Percent weight of silt in soil[7]	s	%	9.4
Percent moisture in soil[8]	M	%	23.1
Mean vehicle speed[2]	S_{doz}	km/hr	11.4
Sum dozing kilometers traveled[11]	VKT_{doz}	km	88.57
Fugitive dust from grading[12]	M_{grade}	g	38673.62
Mean vehicle speed[2]	S_{grade}	km/hr	11.4
Sum dozing kilometers traveled[12]	VKT_{grade}	km	88.57
Fugitive dust from tilling[13]	M_{till}	g	12159
Percent weight of silt in soil[7]	s	%	9.4
Areal extent of site tilling[9]	A_{till}	acre	3.6
Number of times soil is tilled[2]	N_A	--	2.0
Total Time Averaged PM_{10} Emission[14]	J'_T	g/m2-sec	9.98E-07
Duration of construction[2]	T	sec	3744000
Subchronic Dispersion Factor for Area Source[15]	Q/C_{sa}	g/m^2-sec per kg/m^3	7.68
Constant A[2]	A	--	2.4538
Constant B[2]	B	--	17.5660
Constant C[2]	C	--	189.0426
Areal Extent of site surface contamination[4]	A_{surf}	acres	17.8
Dispersion correction factor[16]	F_D	--	0.1903
Subchronic PEF for Construction Activities[17]	**PEF_{sc}**	**m^3/kg**	**4.04E+07**

TABLE F-1
CONSTRUCTION ACTIVITIES FUGITIVE DUST MODEL PARAMETERS
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Parameter	Abbrev.	Units	Value
Unpaved Road Traffic			
Length of road segment[18]	L_R	m	268
Width of road segment[2]	W_R	m	6.1
Surface area of road segment[19]	A_R	m^2	1636
Percent weight of silt in road surface[20]	s	%	9.4
Mean vehicle weight[2]	W	tons	8
Percent moisture in dry road surface[20]	M	%	1.5
Number of days/year≥ 0.01 inches[3]	p	days	27.0
Sum vehicle kilometers traveled[21]	VKT_{road}	km	1046.72
Subchronic Dispersion Factor for road segment[22]	Q/C_{sr}	g/m^2-sec per kg/m^3	14.5
Constant A[2]	A		12.9351
Constant B[2]	B		5.7383
Constant C[2]	C		71.7711
Areal Extent of site surface contamination	A_{surf}	acres	17.8
Subchronic PEF for Unpaved Road Traffic[23]	**PEF_{sc_road}**	**m^3/kg**	**9.87E+05**
Total construction related PEF[24]	PEF_{sc_total}	m^3/kg	9.6 E+5
Total outdoor ambient air dust concentration[25]	C_{const_dust}	kg/m^3	1.0 E-6

(1) From USEPA. (2002a). Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Solid Waste and Emergency Response, Washington, DC. OSWER 9355.4-24. December.
- $M_{wind} = 0.036 \times (1\text{-}V) \times (U_m/U_{t)}^{3} \times F(x) \times A_{surf} \times ED \times 8760hr/yr$.

(2) Assumed value for the site based upon USEPA (2002a).
(3) Based on long-term weather data for the area of interest (WRCC 2006, On-line. http://www.wrcc.dri.edu/).
(4) Site area of 17.8 acres
(5) Construction worker ED, See Table 7.
(6) From USEPA 2002a - $M_{excav} = 0.35 \times 0.0016 \times [(U_m/2.2_{)}^{1.3}/(M/2)^{1.4}] \times \rho_{soil} \times A_{excav} \times d_{excav} \times N_A \times 10^{-3} g/kg$.
(7) Based on data from vicinity investigations (from data collected by GES 2006) for VLEACH modeling.
(8) Average of site data from BRC (2006) dataset.
(9) Assumed value of one fifth of the site based upon USEPA (2002).
(10) From USEPA 2002a - $M_{doz} = 0.75 \times [(0.45 \times s^{1.5})/(M)^{1.4}] \times \sum VKT_{doz}/S_{doz} \times 10^{-3} g/kg$.
(11) From USEPA 2002a - $VKT_{doz} = [(A_{surf}^{0.5}/2.44m) \times A_{surf}^{0.5} \times 3]/1{,}000$ m/km.
(12) From USEPA 2002a - $M_{grade} = 0.60 \times (0.0056 \times S^{2.0}) \times \sum VKT_{grade} \times 10^{-3} g/kg$.
(13) From USEPA 2002a - $M_{till} = 1.1 \times s^{0.6} \times A_{till} \times 4{,}047 m^2/acre \times 10^{-4} ha/m^2 \times 10^{-3} g/kg \times N_A$.
(14) From USEPA 2002a - $J'_T = (M_{wind} + M_{excav} + M_{doz} + M_{grade} + M_{till})/(A_{surf} \times T)$.
(15) From USEPA 2002a - $Q/C_{sa} = A \times \exp[(\ln(A_{surf}) - B)^2/C]$.
(16) From USEPA 2002a - $F_D = 0.1852 + (5.3537/t_c) + (-9.6318/t_c^2)$, $t_c = T/(3{,}600sec/hour)$.
(17) From USEPA 2002a - $PEF_{sc} = Q/C_{sa} \times (1/F_D) \times (1/J'_T)$.
(18) Assumed value of the square root of the site area, based upon USEPA (2002a).
(19) From USEPA 2002a - $A_R = L_R \times W_R$
(20) Average of site data in Table E-4.
(21) From USEPA 2002a - $VKT_{road} = 30$ vehicles $\times L_R \times [(52$ wks/yr)/2] $\times$ (5 days/week) / (1000 m/km).
(22) From USEPA 2002a - $Q/C_{sr} = A \times \exp[(\ln(A_{surf}) - B)^2/C]$.
(23) From USEPA 2002a - $PEF_{sc\_road} = Q/C_{sr} \times (1/F_D) \times T \times A_R /$
$\{[2.6 \times (s/12)^{0.8} \times (W/3)^{0.7}/(M/0.2)^{0.3}] \times [(365\text{-}p)/365] \times 281.9 \times \sum VKT_{road}\}$.
(24) $PEF_{sc\_total} = \{1/[(1/PEF_{sc}) + (1/PEF_{sc\_road})]\}$.
(25) $C_{const\_dust} = 1/PEF_{sc\_total}$.

TABLE F-2
OUTDOOR AIR EMISSION FACTORS
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	Emission Factors, Soil		
	Construction		Fugitive Dust
	PEF[1]	VF[2]	PEF[3]
Chemical	(kg/m^3)	(m^3/kg)	(kg/m^3)
	Inorganics		
Arsenic	1.0 E-6	NA	7.4 E-10
Beryllium	1.0 E-6	NA	7.4 E-10
Boron	1.0 E-6	NA	7.4 E-10
Calcium	1.0 E-6	NA	7.4 E-10
Cadmium	1.0 E-6	NA	7.4 E-10
Calcium	1.0 E-6	NA	7.4 E-10
Chromium (Total)	1.0 E-6	NA	7.4 E-10
Lithium	1.0 E-6	NA	7.4 E-10
Magnesium	1.0 E-6	NA	7.4 E-10
Mercury	1.0 E-6	NA	7.4 E-10
Molybdenum	1.0 E-6	NA	7.4 E-10
Nickel	1.0 E-6	NA	7.4 E-10
Niobium	1.0 E-6	NA	7.4 E-10
Palladium	1.0 E-6	NA	7.4 E-10
Phosphorus	1.0 E-6	NA	7.4 E-10
Perchlorate	1.0 E-6	NA	7.4 E-10
Potassium	1.0 E-6	NA	7.4 E-10
Silver	1.0 E-6	NA	7.4 E-10
Tin	1.0 E-6	NA	7.4 E-10
Titanium	1.0 E-6	NA	7.4 E-10
Tungsten	1.0 E-6	NA	7.4 E-10
Uranium	1.0 E-6	NA	7.4 E-10
Vanadium	1.0 E-6	NA	7.4 E-10
Zirconium	1.0 E-6	NA	7.4 E-10
	Radionuclides		
Bismuth-210	1.0 E-6	NA	7.4 E-10
Bismuth-214	1.0 E-6	NA	7.4 E-10
Lead-210	1.0 E-6	NA	7.4 E-10
Lead-214	1.0 E-6	NA	7.4 E-10
Polonium-210	1.0 E-6	NA	7.4 E-10
Polonium-214	1.0 E-6	NA	7.4 E-10
Polonium-218	1.0 E-6	NA	7.4 E-10
Protactinium-234	1.0 E-6	NA	7.4 E-10
Radium-226	1.0 E-6	NA	7.4 E-10
Radon-222	1.0 E-6	NA	7.4 E-10
Thorium-230	1.0 E-6	NA	7.4 E-10
Thorium-234	1.0 E-6	NA	7.4 E-10
Uranium-234	1.0 E-6	NA	7.4 E-10
Uranium-238	1.0 E-6	NA	7.4 E-10
	Volatile Organic Compounds		
1,2-Dichlorobenzene	NA	1.6E+04	NA
1,2,3-Trichlorobenzene	NA	4.7E+04	NA
1,2,4-Trichlorobenzene	NA	4.7E+04	NA
Ethylbenzene	NA	5.9E+03	NA
Methylene chloride	NA	2.7E+03	NA
m-Xylene & p-Xylene	NA	6.7E+03	NA
Acetone	NA	1.4E+04	NA
Benzene	NA	3.0E+03	NA
Carbon Disulfide	NA	1.3E+03	NA
Chloroethane	NA	1.4E+03	NA
Chloroform	NA	2.9E+03	NA
2-Butanone (MEK)	NA	2.7E+03	NA

TABLE F-2
OUTDOOR AIR EMISSION FACTORS
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	Emission Factors, Soil		
	Construction		Fugitive Dust
	PEF[1]	VF[2]	PEF[3]
Chemical	(kg/m^3)	(m^3/kg)	(kg/m^3)
Toluene	NA	4.3E+03	NA
Semivolatile Organic Compounds			
Benzoic Acid	1.0 E-6	NA	7.4 E-10
Cyclic octaatomic sulfur	1.0 E-6	NA	7.4 E-10
p-Chlorothiophenol	1.0 E-6	NA	7.4 E-10
O,o'-diethyl s-methyl thiophos	1.0 E-6	NA	7.4 E-10
Hexachlorobenzene	1.0 E-6	NA	7.4 E-10
Phosphorothioic acid, s-[2-[(1	1.0 E-6	NA	7.4 E-10
S-methyl methanethiosulphonate	1.0 E-6	NA	7.4 E-10
Polychlorinated Biphenyls			
Aroclor 1254	1.0 E-6	NA	7.4 E-10
Organochlorine Pesticides			
alpha-BHC	1.0 E-6	NA	7.4 E-10
beta-BHC	1.0 E-6	NA	7.4 E-10
delta-BHC	1.0 E-6	NA	7.4 E-10
Dieldrin	1.0 E-6	NA	7.4 E-10
2,4'-DDD	1.0 E-6	NA	7.4 E-10
2,4'-DDE	1.0 E-6	NA	7.4 E-10
4,4'-DDD	1.0 E-6	NA	7.4 E-10
4,4'-DDE	1.0 E-6	NA	7.4 E-10
4,4'-DDT	1.0 E-6	NA	7.4 E-10
gamma-BHC (Lindane)	1.0 E-6	NA	7.4 E-10
gamma-Chlordane	1.0 E-6	NA	7.4 E-10
Organophosphorous Pesticides			
O,O,O-Triethyl phosphorothioate	1.0 E-6	NA	7.4 E-10
Herbicides			
2,4,5-TP	1.0 E-6	NA	7.4 E-10
Dicamba	1.0 E-6	NA	7.4 E-10
Dichlorprop	1.0 E-6	NA	7.4 E-10
Organic Acids			
Diethyl phosphorodithioic acid	1.0 E-6	NA	7.4 E-10
Asbestos			
Chrysotile	1.0 E-6	NA	7.4 E-10
Amphibole	1.0 E-6	NA	7.4 E-10

(1) Construction activities dust generation particulate exposure factor (PEF) from Table F-1.
(2) Ambient air volatilization factors (VF) from USEPA 2002a.
(3) Ambient air dust generation particulate exposure factor (PEF) of 1.36 E+9 m^3/kg from USEPA 2002a.

TABLE F-3
OUTDOOR AIR EXPOSURE POINT CONCENTRATIONS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
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	Construction Worker Outdoor Air			Maintenance Worker/Trespasser Outdoor Air		
Chemical	**Soil Conc.[1] (mg/kg)**	**PEF/VF[2] (kg/m^3)**	**Air Conc.[3] mg/m^3**	**Soil Conc.[4] (mg/kg)**	**PEF/VF[2] (kg/m^3)**	**Air Conc.[3] mg/m^3**
			Dioxins / Furans			
TCDD Equivalents	6.0 E-6	1.0 E-6	6.2 E-12	6.0 E-6	7.4 E-10	4.4 E-15
			Inorganics			
Arsenic	8.2 E+0	1.0 E-6	8.5 E-6	8.2 E+0	7.4 E-10	6.1 E-9
Beryllium	5.7 E-1	1.0 E-6	5.9 E-7	5.7 E-1	7.4 E-10	4.2 E-10
Boron	1.8 E+1	1.0 E-6	1.8 E-5	1.8 E+1	7.4 E-10	1.3 E-8
Calcium	1.1 E+5	1.0 E-6	1.2 E-1	1.1 E+5	7.4 E-10	8.3 E-5
Cadmium	2.9 E-1	1.0 E-6	3.0 E-7	2.9 E-1	7.4 E-10	2.1 E-10
Calcium	1.1 E+5	1.0 E-6	1.2 E-1	1.1 E+5	7.4 E-10	8.3 E-5
Chromium (Total)	1.6 E+1	1.0 E-6	1.7 E-5	1.6 E+1	7.4 E-10	1.2 E-8
Lithium	2.6 E+1	1.0 E-6	2.7 E-5	2.6 E+1	7.4 E-10	1.9 E-8
Magnesium	1.1 E+4	1.0 E-6	1.1 E-2	1.1 E+4	7.4 E-10	7.8 E-6
Molybdenum	1.2 E+0	1.0 E-6	1.3 E-6	1.2 E+0	7.4 E-10	8.9 E-10
Nickel	3.1 E+1	1.0 E-6	3.3 E-5	3.1 E+1	7.4 E-10	2.3 E-8
Niobium	7.3 E+0	1.0 E-6	7.6 E-6	7.3 E+0	7.4 E-10	5.4 E-9
Palladium	6.5 E-1	1.0 E-6	6.8 E-7	6.5 E-1	7.4 E-10	4.8 E-10
Perchlorate	3.5 E+0	1.0 E-6	3.7 E-6	3.5 E+0	7.4 E-10	2.6 E-9
Potassium	3.1 E+3	1.0 E-6	3.2 E-3	3.1 E+3	7.4 E-10	2.3 E-6
Silver	7.1 E+0	1.0 E-6	7.4 E-6	7.1 E+0	7.4 E-10	5.2 E-9
Tin	6.0 E-1	1.0 E-6	6.2 E-7	6.0 E-1	7.4 E-10	4.4 E-10
Titanium	6.6 E+2	1.0 E-6	6.9 E-4	6.6 E+2	7.4 E-10	4.9 E-7
Tungsten	1.4 E+0	1.0 E-6	1.4 E-6	1.4 E+0	7.4 E-10	1.0 E-9
Uranium	1.7 E+0	1.0 E-6	1.8 E-6	1.7 E+0	7.4 E-10	1.3 E-9
Vanadium	3.9 E+1	1.0 E-6	4.0 E-5	3.9 E+1	7.4 E-10	2.8 E-8
Zirconium	2.5 E+2	1.0 E-6	2.6 E-4	2.5 E+2	7.4 E-10	1.8 E-7
			Organochlorine Pesticides			
alpha-BHC	9.7 E-3	1.0 E-6	1.0 E-8	9.7 E-3	7.4 E-10	7.1 E-12
beta-BHC	3.6 E-2	1.0 E-6	3.7 E-8	3.6 E-2	7.4 E-10	2.6 E-11
delta-BHC	1.1 E-2	1.0 E-6	1.2 E-8	1.1 E-2	7.4 E-10	8.2 E-12
Dieldrin	4.2 E-3	1.0 E-6	4.3 E-9	4.2 E-3	7.4 E-10	3.1 E-12
2,4'-DDD	1.3 E-2	1.0 E-6	1.3 E-8	1.3 E-2	7.4 E-10	9.4 E-12
2,4'-DDE	4.3 E-3	1.0 E-6	4.5 E-9	4.3 E-3	7.4 E-10	3.2 E-12
4,4'-DDD	4.1 E-3	1.0 E-6	4.2 E-9	4.1 E-3	7.4 E-10	3.0 E-12
4,4'-DDE	6.5 E-3	1.0 E-6	6.8 E-9	6.5 E-3	7.4 E-10	4.8 E-12
4,4'-DDT	6.3 E-3	1.0 E-6	6.5 E-9	6.3 E-3	7.4 E-10	4.6 E-12
gamma-BHC (Lindane)	5.1 E-3	1.0 E-6	5.2 E-9	5.1 E-3	7.4 E-10	3.7 E-12
gamma-Chlordane	4.2 E-3	1.0 E-6	4.4 E-9	4.2 E-3	7.4 E-10	3.1 E-12
			Organophosphorous Pesticides			
O,O,O-Triethyl phosphorothioate	1.8 E-2	1.0 E-6	1.9 E-8	1.8 E-2	7.4 E-10	1.4 E-11
			Herbicides			
2,4,5-TP	1.5 E-2	1.0 E-6	1.6 E-8	1.5 E-2	7.4 E-10	1.1 E-11
Dicamba	3.0 E-2	1.0 E-6	3.1 E-8	3.0 E-2	7.4 E-10	2.2 E-11
Dichlorprop	6.2 E-2	1.0 E-6	6.5 E-8	6.2 E-2	7.4 E-10	4.6 E-11
			Organic Acids			
Diethyl phosphorodithioic acid	7.2 E+0	1.0 E-6	7.5 E-6	7.2 E+0	7.4 E-10	5.3 E-9
			Polychlorinated Biphenyls			
Aroclor 1254	5.4 E-2	1.0 E-6	5.6 E-8	5.4 E-2	7.4 E-10	3.9 E-11
			Semi-Volatile Organic Compounds			
Benzoic Acid	2.4 E+0	1.0 E-6	2.5 E-6	2.4 E+0	7.4 E-10	1.8 E-9

TABLE F-3
OUTDOOR AIR EXPOSURE POINT CONCENTRATIONS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 2 of 2)

	Construction Worker Outdoor Air			Maintenance Worker/Trespasser Outdoor Air		
Chemical	**Soil Conc.[1] (mg/kg)**	**PEF/VF[2] (kg/m^3)**	**Air Conc.[3] mg/m^3**	**Soil Conc.[4] (mg/kg)**	**PEF/VF[2] (kg/m^3)**	**Air Conc.[3] mg/m^3**
Cyclic octaatomic sulfur	5.0 E-1	1.0 E-6	5.2 E-7	5.0 E-1	7.4 E-10	3.7 E-10
p-Chlorothiophenol	6.3 E-1	1.0 E-6	6.5 E-7	6.3 E-1	7.4 E-10	4.6 E-10
O,o'-diethyl s-methyl thiophos	6.1 E-1	1.0 E-6	6.3 E-7	6.1 E-1	7.4 E-10	4.5 E-10
Hexachlorobenzene	4.6 E-1	1.0 E-6	4.8 E-7	4.6 E-1	7.4 E-10	3.4 E-10
Phosphorothioic acid, s-[2-[(1	7.7 E+0	1.0 E-6	8.0 E-6	7.7 E+0	7.4 E-10	5.7 E-9
S-methyl methanethiosulphonate	7.4 E-1	1.0 E-6	7.7 E-7	7.4 E-1	7.4 E-10	5.4 E-10
Volatile Organic Compounds						
1,2,3-Trichlorobenzene	5.8 E-2	2.1 E-5	1.2 E-6	5.8 E-2	2.1 E-5	1.2 E-6
2-Butanone (MEK)	2.3 E-2	3.7 E-4	8.5 E-6	2.3 E-2	3.7 E-4	8.5 E-6
Acetone	6.7 E-2	7.3 E-5	4.9 E-6	6.7 E-2	7.3 E-5	4.9 E-6
Benzene	1.1 E-2	3.4 E-4	3.8 E-6	1.1 E-2	3.4 E-4	3.8 E-6
Carbon disulfide	1.1 E-2	7.7 E-4	8.9 E-6	1.1 E-2	7.7 E-4	8.9 E-6
Chloroethane	1.4 E-2	7.0 E-4	9.6 E-6	1.4 E-2	7.0 E-4	9.6 E-6
Chloroform	1.2 E-2	3.5 E-4	4.3 E-6	1.2 E-2	3.5 E-4	4.3 E-6
Ethylbenzene	1.3 E-2	1.7 E-4	2.2 E-6	1.3 E-2	1.7 E-4	2.2 E-6
Methylene chloride	2.2 E-2	3.7 E-4	8.2 E-6	2.2 E-2	3.7 E-4	8.2 E-6
m-Xylene & p-Xylene	2.2 E-2	1.5 E-4	3.4 E-6	2.2 E-2	1.5 E-4	3.4 E-6
Toluene	1.1 E-2	2.3 E-4	2.7 E-6	1.1 E-2	2.3 E-4	2.7 E-6
Radionuclides						
	(pCi/g)		**(pCi/m^3)**	**(pCi/g)**		**(pCi/m^3)**
Bismuth-210	1.1 E+0	1.0 E-6	1.1 E-9	1.1 E+0	7.4 E-10	7.8 E-13
Bismuth-214	8.7 E-1	1.0 E-6	9.1 E-10	8.7 E-1	7.4 E-10	6.4 E-13
Lead-210	1.1 E+1	1.0 E-6	1.2 E-8	1.1 E+1	7.4 E-10	8.3 E-12
Lead-214	1.4 E+0	1.0 E-6	1.5 E-9	1.4 E+0	7.4 E-10	1.1 E-12
Polonium-210	1.1 E+0	1.0 E-6	1.1 E-9	1.1 E+0	7.4 E-10	7.8 E-13
Polonium-214	1.4 E+0	1.0 E-6	1.4 E-9	1.4 E+0	7.4 E-10	1.0 E-12
Polonium-218	2.4 E+0	1.0 E-6	2.5 E-9	2.4 E+0	7.4 E-10	1.8 E-12
Protactinium-234	1.6 E+0	1.0 E-6	1.6 E-9	1.6 E+0	7.4 E-10	1.1 E-12
Radium-226	2.2 E+0	1.0 E-6	2.3 E-9	2.2 E+0	7.4 E-10	1.6 E-12
Radon-222	2.5 E+0	1.0 E-6	2.6 E-9	2.5 E+0	7.4 E-10	1.8 E-12
Thorium-230	1.8 E+0	1.0 E-6	1.9 E-9	1.8 E+0	7.4 E-10	1.3 E-12
Thorium-234	2.3 E+0	1.0 E-6	2.4 E-9	2.3 E+0	7.4 E-10	1.7 E-12
Uranium-234	1.8 E+0	1.0 E-6	1.8 E-9	1.8 E+0	7.4 E-10	1.3 E-12
Uranium-238	1.5 E+0	1.0 E-6	1.6 E-9	1.5 E+0	7.4 E-10	1.1 E-12
Asbestos						
Chysotile	**(10^6 s/gPM_{10})**		**(s/cm^3)**	**(10^6 s/gPM_{10})**		**(s/cm^3)**
Best Estimate	2.7 E-1	1.0 E-6	2.8 E-4	2.7 E-1	7.4 E-10	2.0 E-7
Upper Bound	6.9 E-1	1.0 E-6	7.1 E-4	6.9 E-1	7.4 E-10	5.1 E-7
Amphibole						
Best Estimate	0.0 E+0	1.0 E-6	0.0 E+0	0.0 E+0	7.4 E-10	0.0 E+0
Upper Bound	2.7 E-1	1.0 E-6	2.8 E-4	2.7 E-1	7.4 E-10	2.0 E-7

(1) Table 5 - Exposure Point Concentrations.

(2) Table F-2.

(3) For non-rads, soil concentration × PEF (or VF). For rads, soil concentration (pCi/g)/1000 mg/g × PEF
For asbestos, soil concentration × PEF × 1000 ug/cm^3.

(4) Table 5 - Exposure Point Concentrations.

TABLE F-4
SUPPLEMENTAL SOIL PROPERTY DATA
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

Sample Location	Depth	Silt %	Moisture %
BP-01-0A	0	15.5	3.3
BP-02-0A	0	8.9	0.8
BP-03-0A	0	11.2	1.5
BP-04-0A	0	8.8	1.5
BP-05-0A	0	14.6	1.5
BP-06-0A	0	10.5	1.2
BP-07-0A	0	9.9	1.1
BP-08-0A	0	8.9	1
BP-09-0A	0	4.9	0.8
BP-09-1A	0	4.6	1.3
BP-10-0A	0	5.5	2.1

APPENDIX G

ASBESTOS RISK CALCULATIONS

TABLE G-1
RESULTS OF SOIL ASBESTOS ANALYSES
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

Sample	Number and Dimensions of Protocol Structures 5-10 µm	>10µm	Mineral Type	Analytical Sensitivity (10^6 s/gPM$_{10}$)	Concentration Protocol Structures Total (10^6 s/gPM$_{10}$)	Long[(1)] (10^6 s/gPM$_{10}$)
BEC-01-Sa(Dup)	ND	0.4 x 25.5	Chrysotile	1.96	1.96	1.96
BEC-01-Sb	ND	ND		1.95	ND	ND
BEC-02-Sa	0.32 x 5.9	ND	Chrysotile	1.95	1.95	ND
BEC-03-Sa	ND	ND		1.98	ND	ND
BEC-04-Sa	ND	ND		1.95	ND	ND
BEC-05-Sa	ND	ND		1.89	ND	ND
BEC-01-Da	ND	ND		1.99	ND	ND
BEC-02-Da	ND	ND		1.89	ND	ND
BEC-03-Da	ND	ND		1.99	ND	ND
BEC-04-Da	ND	ND		1.94	ND	ND
BEC-05-Da	ND	ND		1.96	ND	ND
BP-01-0A	ND	ND		1.96	ND	ND
BP-02-0A	ND	0.11 x 28.26	Chrysotile	1.93	1.93	1.93
BP-03-0A	ND	ND		1.97	ND	ND
BP-04-0A	ND	ND		1.92	ND	ND
BP-05-0A	ND	ND		1.95	ND	ND
BP-06-0A	ND	ND		1.98	ND	ND
BP-07-0A	ND	ND		1.97	ND	ND
BP-08-0A	ND	0.11 x 20.11	Chrysotile	1.98	1.98	1.98
BP-09-0A	ND	ND		1.88	ND	ND
BP-09-1A	ND	ND		1.94	ND	ND
BP-10-0A	ND	ND		1.96	ND	ND
BP-08-0A Run 2	0.22 x 6.52	ND	Amphibole	2.00	2.00	ND
BP-02-0A Run 2	ND	ND		1.85	ND	ND

Pooled Analytical Sensitivity 0.088593457

$$Pooled\ \ Analytical\ \ Sensitivi\ ty = 1/\left[\sum_{i}(1/analyti\ cal\ sensitivi\ ty\ \ for\ trial\ \ i)\right]$$

[(1)]Only long structures present a potential risk and are used for estimating asbestos risks. Total fiber concentrations are presented for informational purposes only.

TABLE G-2
ESTIMATED ASBESTOS CONCENTRATIONS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

Mineral Type	Number of Samples	Number of Long Structures	Analytical Sensitivity (10^6 s/gPM$_{10}$)	Best Estimate Concentrations Long (10^6 s/gPM$_{10}$)	Upper Bound Concentrations Long (10^6 s/gPM$_{10}$)
Chrysotile	22	3	0.0886	0.266	0.687
Amphibole	22	0	0.0886	0	0.265

Estimated Concentration = Analytical Sensitivity x Number of Structures
Upper Bound Concentration = 95% UCL of the Poisson Distribution where the mean equals the number of structures.

TABLE G-3
ESTIMATED AIRBORNE ASBESTOS CONCENTRATIONS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

Scenario	Estimated Bulk Chrysotile Concentrations (10^6 s/gPM_{10})	Estimated Bulk Amphibole Concentrations (10^6 s/gPM_{10})	Estimated Dust Levels[1] (kg/m^3)	Estimated Dust Levels ($\mu g/cm^3$)	Estimated Airborne Chrysotile Concentrations[2] (s/cm^3)	Estimated Airborne Amphibole Concentrations[2] (s/cm^3)
LONG FIBERS						
Future On-Site/Off-Site Construction Worker-Best Estimate	2.66 E-1	0.00 E+0	1.04 E-6	1.04 E-3	2.76 E-4	0.00 E+0
Future On-Site/Off-Site Construction Worker-Upper Bound	6.87 E-1	2.65 E-1	1.04 E-6	1.04 E-3	7.13 E-4	2.75 E-4
Future Off-Site Maintenance Worker-Best Estimate	2.66 E-1	0.00 E+0	7.35 E-10	7.35 E-7	1.95 E-7	0.00 E+0
Future Off-Site Maintenance Worker-Upper Bound	6.87 E-1	2.65 E-1	7.35 E-10	7.35 E-7	5.05 E-7	1.95 E-7
Current/Future On-Site Trespasser-Best Estimate	2.66 E-1	0.00 E+0	7.35 E-10	7.35 E-7	1.95 E-7	0.00 E+0
Current/Future On-Site Trespasser-Upper Bound	6.87 E-1	2.65 E-1	7.35 E-10	7.35 E-7	5.05 E-7	1.95 E-7

(1) The estimated dust levels are equal to the PEFs used in the chemical risk assessment (Appendix F, Table F-2).
(2) Estimated bulk concentration (10^b s/g) × Estimated dust levels (ug/cm^3) × $g/10^b ug$.
Notes:
Best Estimate - Based on the pooled analytical sensitivity multiplied by the number of asbestos fibers found.
Upper Bound - Based on the 95% UCL of the Poisson distribution.

TABLE G-4
CANDIDATE UNIT RISK FACTORS (URFS) FOR ASBESTOS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

Scenario	Time of Exposure[1] (sec)	Lifetime Exposure (sec)	URF Adjustment Factor	Unadjusted Chrysotile URF[2] $(s/cm^3)^{-1}$	Adjusted Chrysotile URF[2] $(s/cm^3)^{-1}$	Unadjusted Amphibole URF[2] $(s/cm^3)^{-1}$	Adjusted Amphibole URF[2] $(s/cm^3)^{-1}$
LONG FIBERS							
Future On-Site/Off-Site Construction Worker-Best Estimate	7.20 E+6	2.21 E+9	3.26 E-3	5.69 E-2	1.86 E-4	6.32 E+0	2.06 E-2
Future On-Site/Off-Site Construction Worker-Upper Bound	7.20 E+6	2.21 E+9	3.26 E-3	5.69 E-2	1.86 E-4	6.32 E+0	2.06 E-2
Future Off-Site Maintenance Worker-Best Estimate	1.62 E+8	2.21 E+9	7.34 E-2	5.69 E-2	4.18 E-3	6.32 E+0	4.64 E-1
Future Off-Site Maintenance Worker-Upper Bound	1.62 E+8	2.21 E+9	7.34 E-2	5.69 E-2	4.18 E-3	6.32 E+0	4.64 E-1
Current/Future On-Site Trespasser-Best Estimate	4.32 E+6	2.21 E+9	1.96 E-3	5.69 E-2	1.11 E-4	6.32 E+0	1.24 E-2
Current/Future On-Site Trespasser-Upper Bound	4.32 E+6	2.21 E+9	1.96 E-3	5.69 E-2	1.11 E-4	6.32 E+0	1.24 E-2

Notes:

(1) Calculated using the exposure parameters presented in Tables 7, 8, and 9. Because the unadjusted URF is based on continuous exposure over a lifetime, it requires adjustment for use in these less than lifetime exposure scenarios.

(2) This value is the URF from the table below times a multiplier of 0.00001/0.00010, and applies only to long asbestos structures (chrysotile and amphibole).

Best Estimate - Based on the pooled analytical sensitivity multiplied by the number of asbestos fibers found.

Upper Bound - Based on the 95% UCL of the Poisson distribution.

Using Equation information from Table 8-2 of 2003 Methodology (Berman and Crump 2003)

	Expected Chrysotile	Expected Amphibole
Non-Smoking Males (NSM)	2.69E-01	62.9
Non-Smoking Females (NSF)	0.303	72.5
Smoking Males (SM)	1.65	38.3
Smoking Females (SF)	1.57	55.1
Unit Risk Factor (URF)		
URF=0.5((0.786*(NSM+NSF))+((0.214*(SM+SF))	0.569	63.2

TABLE G-5
ASBESTOS RISK SUMMARY
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

Scenario	Estimated Airborne Chrysotile Concentrations[1] (s/cm^3)	Estimated Airborne Amphibole Concentrations[1] (s/cm^3)	Adjusted Chrysotile URF[2] $(s/cm^3)^{-1}$	Adjusted Amphibole URF[2] $(s/cm^3)^{-1}$	Estimated Chrysotile[3] Risk	Estimated Amphibole[3] Risk
LONG FIBERS						
Future On-Site/Off-Site Construction Worker-Best Estimate	2.8 E-4	0.0 E+0	1.9 E-4	2.1 E-2	5 E-8	0 E+0
Future On-Site/Off-Site Construction Worker-Upper Bound	7.1 E-4	2.8 E-4	1.9 E-4	2.1 E-2	1 E-7	6 E-6
Future Off-Site Maintenance Worker-Best Estimate	2.0 E-7	0.0 E+0	4.2 E-3	4.6 E-1	8 E-10	0 E+0
Future Off-Site Maintenance Worker-Upper Bound	5.1 E-7	2.0 E-7	4.2 E-3	4.6 E-1	2 E-9	9 E-8
Current/Future On-Site Trespasser-Best Estimate	2.0 E-7	0.0 E+0	1.1 E-4	1.2 E-2	2 E-11	0 E+0
Current/Future On-Site Trespasser-Upper Bound	5.1 E-7	2.0 E-7	1.1 E-4	1.2 E-2	6 E-11	2 E-9

Notes:

[1] From Table G-3.

[2] From Table G-4.

[2] Estimated airborne concentrations × URF.

Best Estimate - Based on the pooled analytical sensitivity multiplied by the number of asbestos fibers found.

Upper Bound - Based on the 95% UCL of the Poisson distribution.

APPENDIX H

BACKGROUND RISK CALCULATIONS

TABLE H-1
DATA EVALAUTION FOR METALS IN BACKGROUND SOILS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

Chemical	Number of Samples	Number of Detections	Percent Detected	Minimum Detection	Maximum Detection	Average	Standard Deviation	Distribution	95% UCL	EPC (mg/kg)	EPC Basis
Arsenic	120	120	100%	2.1	7.2	4.1	1.1	Non-Normal	4.3	4.3	Bootstrap using DL
Beryllium	120	120	100%	0.16	0.89	0.56	0.16	Non-Normal	0.58	0.58	Bootstrap using DL
Boron	104	34	33%	5.2	12	7.4	1.4	Non-Normal	7.7	7.7	Bootstrap using DL
Cadmium	120	16	13%	0.052	0.16	0.24	0.053	Non-Normal	0.25	0.25	Bootstrap using DL
Calcium	104	104	100%	8160	82800	28130	14860	Non-Normal	31130	31130	Bootstrap using 1/2 DL
Chromium (Total)	120	120	100%	2.6	16.7	8.9	2.9	Normal	9.4	9.4	Normal 95% UCL
Lithium	104	104	100%	7.5	26.5	14	4.3	Non-Normal	15	15	Bootstrap using 1/2 DL
Magnesium	120	120	100%	4580	17500	9505	3046	Non-Normal	9996	9996	Bootstrap using Random DL
Molybdenum	120	120	100%	0.17	2.0	0.55	0.28	Non-Normal	0.60	0.60	Bootstrap using 1/2 DL
Nickel	120	120	100%	7.8	30	15	4.2	Non-Normal	16	16	Bootstrap using DL
Niobium	104	0	0%	--	--	2.8	0.92	Non-Normal	3.0	3.0	Bootstrap using DL
Palladium	104	104	100%	0.14	1.5	0.46	0.24	Non-Normal	0.51	0.51	Bootstrap using 1/2 DL
Potassium	104	104	100%	625	3890	1730	733	Non-Normal	1859	1859	Bootstrap using Random DL
Silver	120	16	13%	0.019	0.083	0.46	0.16	Non-Normal	0.49	0.49	Bootstrap using DL
Sodium	104	104	100%	111	1320	486	286	Non-Normal	536	536	Bootstrap using 1/2 DL
Tin	104	103	99%	0.20	0.80	0.48	0.13	Normal	0.50	0.50	Normal 95% UCL
Titanium	120	120	100%	200	1010	510	171	Normal	536	536	Normal 95% UCL
Tungsten	104	0	0%	--	--	2.4	0.85	Non-Normal	2.5	2.5	Bootstrap using DL
Uranium	103	103	100%	0.43	2.7	1.0	0.31	Non-Normal	1.1	1.1	Bootstrap using Random DL
Vanadium	120	120	100%	15	59	35	11	Normal	37	37	Normal 95% UCL
Zirconium	104	104	100%	60	179	126	27	Normal	131	131	Normal 95% UCL

EPC = Exposure point concentration.

TABLE H-2
DATA EVALUATION FOR RADIONUCLIDES IN BACKGROUND SOILS
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA

Radionuclide	Number of Samples	Number of Detections	Percent Detected	Minimum Detection (pCi/g)	Maximum Detection (pCi/g)	Average	Standard Deviation	Distribution	95% UCL	EPC (pCi/g)	EPC Basis
Bismuth-210	104	1	1%	2.2	2.2	0.61	0.58	Normal	0.70	0.70	Normal 95% UCL
Bismuth-214	120	120	100%	0.52	1.6	0.95	0.21	Non-Normal	0.98	0.98	Bootstrap using DL and 1/2 DL
Lead-210	120	2	2%	1.9	2.2	0.72	0.64	Non-Normal	0.82	0.82	Bootstrap using Random DL
Lead-214	120	120	100%	0.61	1.7	0.97	0.22	Non-Normal	1.00	1.00	Bootstrap using DL and 1/2 DL
Polonium-210	104	1	1%	2.2	2.2	0.61	0.58	Normal	0.70	0.70	Normal 95% UCL
Polonium-214	104	104	100%	0.52	1.6	0.96	0.21	Non-Normal	1.0	1.0	Bootstrap using Random DL
Polonium-218	104	96	92%	0.49	2.4	1.1	0.35	Non-Normal	1.2	1.2	Bootstrap using 1/2 DL
Protactinium-234	104	0	0%	NA	NA	-0.08	0.09	Normal	-0.06	NA	
Radium-226	104	96	92%	0.49	2.4	1.1	0.35	Non-Normal	1.2	1.2	Bootstrap using DL
Thorium-230	120	120	100%	0.66	3.0	1.2	0.38	Non-Normal	1.3	1.3	Bootstrap using 1/2 DL
Thorium-234	120	65	54%	1.1	2.5	1.2	0.63	Normal	1.3	1.3	Normal 95% UCL
Uranium-234	120	61	51%	0.53	2.8	1.1	0.46	Non-Normal	1.2	1.2	Bootstrap using DL
Uranium-238	120	120	100%	0.45	2.4	1.1	0.37	Non-Normal	1.1	1.1	Bootstrap using 1/2 DL

EPC = Exposure point concentration.

TABLE H-3
CHEMICAL RISK SUMMARY FOR THE FUTURE ON-SITE/OFF-SITE CONSTRUCTION WORKER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Inhal HQ	Total HI	Oral Cancer Risk	Dermal Cancer Risk	Inhal Cancer Risk	Total Cancer Risk
Arsenic	4.3 E+0	1 E-2	4 E-3	3 E-3	0.021	9 E-8	3 E-8	2 E-7	3 E-7
Beryllium	5.8 E-1	4 E-4	0 E+0	2 E-2	0.021	NA	NA	1 E-8	1 E-8
Boron	7.7 E+0	1 E-4	0 E+0	NA	0.00012	NA	NA	NA	NA
Cadmium	2.5 E-1	8 E-4	1 E-4	5 E-5	0.00094	NA	NA	5 E-9	5 E-9
Calcium	3.1 E+4	NA	NA	NA	NA	NA	NA	NA	NA
Chromium (Total)	9.4 E+0	2 E-5	0 E+0	1 E-6	0.000021	NA	NA	NA	NA
Lithium	1.5 E+1	2 E-3	0 E+0	1 E-4	0.0025	NA	NA	NA	NA
Magnesium	1.0 E+4	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	6.0 E-1	4 E-4	0 E+0	2 E-5	0.00041	NA	NA	NA	NA
Nickel	1.6 E+1	3 E-3	0 E+0	6 E-2	0.059	NA	NA	NA	NA
Niobium	3.0 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Palladium	5.1 E-1	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	1.9 E+3	NA	NA	NA	NA	NA	NA	NA	NA
Silver	4.9 E-1	3 E-4	0 E+0	2 E-5	0.00033	NA	NA	NA	NA
Sodium	5.4 E+2	NA	NA	NA	NA	NA	NA	NA	NA
Tin	5.0 E-1	3 E-6	0 E+0	2 E-7	0.000003	NA	NA	NA	NA
Titanium	5.4 E+2	4 E-4	0 E+0	1 E-2	0.013	NA	NA	NA	NA
Tungsten	2.5 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Uranium	1.1 E+0	2 E-3	0 E+0	2 E-3	0.0036	NA	NA	NA	NA
Vanadium	3.7 E+1	2 E-2	0 E+0	NA	0.017	NA	NA	NA	NA
Zirconium	1.3 E+2	NA	NA	NA	NA	NA	NA	NA	NA
Total		0.040	0.0043	0.095	0.14	9 E-8	3 E-8	2 E-7	3 E-7

HQ = hazard quotient
HI - hazard index

TABLE H-4
CHEMICAL RISK SUMMARY FOR THE FUTURE OFF-SITE MAINTENANCE WORKER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Inhal HQ	Total HI	Oral Cancer Risk	Dermal Cancer Risk	Inhal Cancer Risk	Total Cancer Risk
Arsenic	4.3 E+0	4 E-3	3 E-3	2 E-6	0.0063	6 E-7	4 E-7	3 E-9	1 E-6
Beryllium	5.8 E-1	1 E-4	0 E+0	1 E-5	0.00012	NA	NA	2 E-10	2 E-10
Boron	7.7 E+0	3 E-5	NA	2 E-7	0.000034	NA	NA	NA	NA
Cadmium	2.5 E-1	2 E-4	5.7 E-5	3 E-8	0.00027	NA	NA	7 E-11	7 E-11
Calcium	3.1 E+4	NA	NA	NA	NA	NA	NA	NA	NA
Chromium (Total)	9.4 E+0	6 E-6	0 E+0	8 E-10	0.0000055	NA	NA	NA	NA
Lithium	1.5 E+1	6 E-4	0 E+0	9 E-8	0.00064	NA	NA	NA	NA
Magnesium	1.0 E+4	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	6.0 E-1	1 E-4	0 E+0	2 E-8	0.00011	NA	NA	NA	NA
Nickel	1.6 E+1	7 E-4	0 E+0	8 E-5	0.00078	NA	NA	NA	NA
Niobium	3.0 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Palladium	5.1 E-1	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	1.9 E+3	NA	NA	NA	NA	NA	NA	NA	NA
Silver	4.9 E-1	9 E-5	0 E+0	1 E-8	0.000086	NA	NA	NA	NA
Sodium	5.4 E+2	NA	NA	NA	NA	NA	NA	NA	NA
Tin	5.0 E-1	7 E-7	0 E+0	1 E-10	0.00000073	NA	NA	NA	NA
Titanium	5.4 E+2	1 E-4	0 E+0	8 E-6	0.00013	NA	NA	NA	NA
Tungsten	2.5 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Uranium	1.1 E+0	5 E-4	0 E+0	2 E-6	0.00047	NA	NA	NA	NA
Vanadium	3.7 E+1	5 E-3	0 E+0	NA	0.0047	NA	NA	NA	NA
Zirconium	1.3 E+2	NA	NA	NA	NA	NA	NA	NA	NA
Total		0.011	0.0026	0.00010	0.014	6 E-7	4 E-7	3 E-9	1 E-6

HQ = hazard quotient
HI - hazard index

TABLE H-5
CHEMICAL RISK SUMMARY FOR THE CURRENT/FUTURE ON-SITE TRESPASSER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Inhal HQ	Total HI	Oral Cancer Risk	Dermal Cancer Risk	Inhal Cancer Risk	Total Cancer Risk
Arsenic	4.3 E+0	1 E-3	9 E-4	1 E-7	0.0018	4 E-8	3 E-8	4 E-11	7 E-8
Beryllium	5.8 E-1	7 E-5	0 E+0	8 E-7	0.000067	NA	NA	3 E-12	3 E-12
Boron	7.7 E+0	9 E-6	NA	1 E-8	0.0000087	NA	NA	NA	NA
Cadmium	2.5 E-1	6 E-5	2 E-5	2 E-9	0.000076	NA	NA	1 E-12	1 E-12
Calcium	3.1 E+4	NA	NA	NA	NA	NA	NA	NA	NA
Chromium (Total)	9.4 E+0	1 E-6	0 E+0	5 E-11	0.0000014	NA	NA	NA	NA
Lithium	1.5 E+1	2 E-4	0 E+0	6 E-9	0.00017	NA	NA	NA	NA
Magnesium	1.0 E+4	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	6.0 E-1	3 E-5	0 E+0	1 E-9	0.000027	NA	NA	NA	NA
Nickel	1.6 E+1	2 E-4	0 E+0	5 E-6	0.00018	NA	NA	NA	NA
Niobium	3.0 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Palladium	5.1 E-1	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	1.9 E+3	NA	NA	NA	NA	NA	NA	NA	NA
Silver	4.9 E-1	2 E-5	0 E+0	8 E-10	0.000022	NA	NA	NA	NA
Sodium	5.4 E+2	NA	NA	NA	NA	NA	NA	NA	NA
Tin	5.0 E-1	2 E-7	0 E+0	7 E-12	0.00000019	NA	NA	NA	NA
Titanium	5.4 E+2	3 E-5	0 E+0	5 E-7	0.000031	NA	NA	NA	NA
Tungsten	2.5 E+0	NA	NA	NA	NA	NA	NA	NA	NA
Uranium	1.1 E+0	1 E-3	0 E+0	1 E-7	0.0012	NA	NA	NA	NA
Vanadium	3.7 E+1	8 E-3	0 E+0	NA	0.0084	NA	NA	NA	NA
Zirconium	1.3 E+2	NA	NA	NA	NA	NA	NA	NA	NA
Total		0.011	0.00088	0.0000065	0.012	4 E-8	3 E-8	5 E-11	7 E-8

HQ = hazard quotient
HI - hazard index

TABLE H-6
RADIONUCLIDE RISK SUMMARY FOR THE
FUTURE ON-SITE/OFF-SITE CONSTRUCTION WORKER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

Radionuclide	Soil Concentration (pCi/g)	Ingestion Cancer Risk	Inhalation Cancer Risk	External Cancer Risk	Total Cancer Risk
Bismuth-210	7.0 E-1	4 E-12	8 E-12	8 E-12	2 E-11
Bismuth-214	9.8 E-1	7 E-16	3 E-15	8 E-11	8 E-11
Lead-210	8.2 E-1	1 E-7	2 E-8	7 E-10	2 E-7
Lead-214	1.0 E+0	1 E-15	5 E-15	1 E-11	1 E-11
Polonium-210	7.0 E-1	8 E-9	6 E-9	3 E-12	1 E-8
Polonium-214	1.0 E+0	NA	NA	4 E-18	4 E-18
Polonium-218	1.2 E+0	NA	NA	1 E-18	1 E-18
Radium-226	1.2 E+0	3 E-8	2 E-8	2 E-6	2 E-6
Thorium-230	1.3 E+0	8 E-9	6 E-8	2 E-10	7 E-8
Thorium-234	1.3 E+0	9 E-11	6 E-12	4 E-10	5 E-10
Uranium-234	1.2 E+0	5 E-9	2 E-8	2 E-10	3 E-8
Uranium-238	1.1 E+0	5 E-9	2 E-8	3 E-8	5 E-8
Total		2 E-7	2 E-7	2 E-6	2 E-6

TABLE H-7
RADIONUCLIDE RISK SUMMARY FOR THE
FUTURE OFF-SITE MAINTENANCE WORKER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

Radionuclide	Soil Concentration (pCi/g)	Ingestion Cancer Risk	Inhalation Cancer Risk	External Cancer Risk	Total Cancer Risk
Bismuth-210	7.0 E-1	1 E-12	5 E-15	7 E-12	8 E-12
Bismuth-214	9.8 E-1	2 E-16	2 E-18	7 E-11	7 E-11
Lead-210	8.2 E-1	7 E-7	2 E-10	1 E-8	7 E-7
Lead-214	1.0 E+0	4 E-16	3 E-18	1 E-11	1 E-11
Polonium-210	7.0 E-1	3 E-9	5 E-12	3 E-12	3 E-9
Polonium-214	1.0 E+0	NA	NA	3 E-18	3 E-18
Polonium-218	1.2 E+0	NA	NA	1 E-18	1 E-18
Radium-226	1.2 E+0	2 E-7	4 E-10	5 E-5	5 E-5
Thorium-230	1.3 E+0	6 E-8	1 E-9	5 E-9	6 E-8
Thorium-234	1.3 E+0	3 E-11	4 E-15	4 E-10	4 E-10
Uranium-234	1.2 E+0	3 E-8	4 E-10	5 E-9	4 E-8
Uranium-238	1.1 E+0	4 E-8	3 E-10	6 E-7	6 E-7
Total		1 E-6	2 E-9	5 E-5	5 E-5

TABLE H-8
RADIONUCLIDE RISK SUMMARY FOR THE
CURRENT/FUTURE ON-SITE TRESPASSER
BRC HUMAN HEALTH RISK ASSESSMENT REPORT
BORROW AREA, CLARK COUNTY, NEVADA
(Page 1 of 1)

Radionuclide	Soil Concentration (pCi/g)	Ingestion Cancer Risk	Inhalation Cancer Risk	External Cancer Risk	Total Cancer Risk
Bismuth-210	7.0 E-1	3 E-13	1 E-16	8 E-13	1 E-12
Bismuth-214	9.8 E-1	4 E-17	5 E-20	8 E-12	8 E-12
Lead-210	8.2 E-1	5 E-8	2 E-12	4 E-10	5 E-8
Lead-214	1.0 E+0	8 E-17	8 E-20	2 E-12	2 E-12
Polonium-210	7.0 E-1	6 E-10	1 E-13	3 E-13	6 E-10
Polonium-214	1.0 E+0	NA	NA	4 E-19	4 E-19
Polonium-218	1.2 E+0	NA	NA	1 E-19	1 E-19
Radium-226	1.2 E+0	1 E-8	2 E-12	1 E-6	1 E-6
Thorium-230	1.3 E+0	3 E-9	7 E-12	1 E-10	3 E-9
Thorium-234	1.3 E+0	6 E-12	1 E-16	4 E-11	5 E-11
Uranium-234	1.2 E+0	2 E-9	2 E-12	1 E-10	2 E-9
Uranium-238	1.1 E+0	2 E-9	2 E-12	2 E-8	2 E-8
Total		6 E-8	2 E-11	1 E-6	1 E-6

APPENDIX I

VLEACH MODELING

TABLE I-1
VLEACH CASE SETTINGS AND INITIAL CONDITIONS INPUT PARAMETERS
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA
(Page 1 of 1)

Parameter	Units	Top Layer 1 (Borrow Materials)	Bottom Layer 2 (Native Soils)
Simulation Timestep	days	365	365
Simulation Length	years	30	30
Simulation Length[a]	days	10,958	10,958
Number of Cells	--	1	10
Recharge Rate[b]	cm/day	0.0139 - 0.0417	0.0139 - 0.0417
Output Timestep[a]	days	365	365
Depth below grade to water table[c]	feet	0	25
Fill depth[d]	feet	20	NA

[a]The mass balance has been checked to confirm that the simulation length, timestep and number of cells provide a stable solution.

[b]A sensitivity analysis has been performed using a range of values for this parameter. The range shown is from 2 to 6 inches per year. Four inches per year is equivalent to 100 percent of rainfall. It should be noted that this recharge rate is much higher than the highest recharge rate for Las Vegas, Nevada from USEPA's Composite Model for Leachate Migration with Transformation Products (EPACMTP) Parameters/Data: Background Document (2003a). In addition, the assumption of 100 percent recharge from precipitation is much higher than that calculated in a recent study by UNLV which indicated a recharge rate of approximately 3 percent (James *et al* . 2006). This also assumes no additional water application to the site/location.

[c]Based on measured depth to groundwater from monitoring wells within the northernmost most placement location (where groundwater is shallowest). Not necessary for the first (top) Borrow material layer since it is assumed that this material will be placed immediately on top of the native material, and that the concentration at the bottom of this layer will be used as input into next lower native soil layer.

[d]Assumed maximum potential depth of fill material.

TABLE I-2
VLEACH CHEMICAL PROPERTY INPUT PARAMETERS
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA
(Page 1 of 1)

Chemical	Water Solubility (mg/L)[a]	Soil Pore Water Partition Coefficient (ml/g)[a]	Organic Carbon Partition Coefficient (ml/g)[a]	Henry's Law Constant (unitless)[a]	Free Air Dispersion Coefficient (cm^2/sec)[a]
Arsenic	1.0 E+4	3.1 E+1	Site-Specific[b]	1.0 E-6	1.0 E-3
Beryllium	1.0 E+4	1.0 E+5	Site-Specific[b]	1.0 E-6	1.0 E-3
Cadmium	1.0 E+4	4.3 E+3	Site-Specific[b]	1.0 E-6	1.0 E-3
Hexavalent Chromium	1.0 E+4	1.4 E+1	Site-Specific[b]	1.0 E-6	1.0 E-3
Chromium (Total)	1.0 E+4	4.3 E+6	Site-Specific[b]	1.0 E-6	1.0 E-3
Iron	1.0 E+4	4.0 E+0	Site-Specific[b]	1.0 E-6	1.0 E-3
Mercury	1.0 E+4	2.0 E+2	Site-Specific[b]	1.0 E-6	1.0 E-3
Nickel	1.0 E+4	1.9 E+3	Site-Specific[b]	1.0 E-6	1.0 E-3
Selenium	1.0 E+4	2.2 E+0	Site-Specific[b]	1.0 E-6	1.0 E-3
Silver	1.0 E+4	1.1 E+2	Site-Specific[b]	1.0 E-6	1.0 E-3
Thallium	1.0 E+4	9.6 E+1	Site-Specific[b]	1.0 E-6	1.0 E-3
Vanadium	1.0 E+4	1.0 E+3	Site-Specific[b]	1.0 E-6	1.0 E-3
4,4'-DDD	9.0 E-2	Site-Specific[b]	1.0 E+6	1.6 E-4	1.7 E-2
4,4'-DDE	1.2 E-1	Site-Specific[b]	4.5 E+6	8.6 E-4	1.4 E-2
4,4'-DDT	2.5 E-2	Site-Specific[b]	2.6 E+6	3.3 E-4	1.4 E-2
alpha-BHC	2.0 E+0	Site-Specific[b]	1.2 E+3	4.4 E-4	1.4 E-2
beta-BHC	2.4 E-1	Site-Specific[b]	1.3 E+3	3.1 E-5	1.4 E-2
delta-BHC	2.0 E+0	Site-Specific[b]	1.2 E+3	4.4 E-4	1.4 E-2
Dieldrin	2.0 E-1	Site-Specific[b]	2.1 E+4	6.2 E-4	1.3 E-2
gamma-BHC (Lindane)	6.8 E+0	Site-Specific[b]	1.1 E+3	5.7 E-4	1.4 E-2
gamma-Chlordane	5.6 E-2	Site-Specific[b]	1.2 E+5	2.0 E-3	1.2 E-2
Benzoic Acid	3.5 E+3	Site-Specific[b]	6.0 E-1	6.3 E-5	5.4 E-2
Hexachlorobenzene	6.2 E+0	Site-Specific[b]	5.5 E+4	5.4 E-2	5.4 E-2
1,2,3-Trichlorobenzene	3.0 E+2	Site-Specific[b]	1.8 E+3	5.8 E-2	3.0 E-2
2-Butanone (MEK)	2.2 E+5	Site-Specific[b]	2.3 E+0	2.3 E-3	8.1 E-2
Acetone	1.0 E+6	Site-Specific[b]	5.8 E-1	1.6 E-3	1.2 E-1
Benzene	1.8 E+3	Site-Specific[b]	5.9 E+1	2.3 E-1	8.8 E-2
Carbon disulfide	1.2 E+3	Site-Specific[b]	4.6 E+1	1.2 E+0	1.0 E-1
Chloroethane	5.7 E+3	Site-Specific[b]	4.4 E+0	3.6 E-1	2.7 E-1
Chloroform	7.9 E+3	Site-Specific[b]	4.0 E+1	1.5 E-1	1.0 E-1
Ethylbenzene	1.7 E+2	Site-Specific[b]	3.6 E+2	3.2 E-1	7.5 E-2
Methylene chloride	1.3 E+4	Site-Specific[b]	1.2 E+1	9.0 E-2	1.0 E-1
m-Xylene & p-Xylene	1.9 E+2	Site-Specific[b]	3.9 E+2	3.1 E-1	7.7 E-2
Toluene	5.3 E+2	Site-Specific[b]	1.8 E+2	2.7 E-1	8.7 E-2

[a] USEPA 2002 Soil Screening Guidance default chemical properties. Soil pore water paritition coefficient for metals were selected as the defualt for soil with a pH of 8 (the average pH of site soils is 8.2). Values for water solubility, Henry's Law Constant and free air dispersion coefficients are not readily available for metals. As such default values were selected, 10,000, 0.000001, and 0.001 respectivley, such that the metals would be subject to neglible volatilization and would be readily soluble in water subject to the chemical specific soil pore water coefficients.

[b] Soil pore water coefficient is calculated by the VLEACH model using chemical specific orgnanic carbon partition coefficient and the site-specific soil fraction organic carbon. For metals a rgnanic carbon partition coefficient was input into the model such that teh VLEACH calculation of the soil pore water coefficient using the input soil fraction organic carbon would result in the appropriate chemical-specific soil pore water coefficient (See Table I-3).

TABLE I-3
VLEACH SOIL INPUT PARAMETERS
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA
(Page 1 of 1)

Parameter	Units	Borrow Material		Placement Site Soil[b]						
		Type II[d]	Reject Sand[e]	Site 1	Site 2	Site 4	Site 5	Site 6	Site 7	Site 8
Bulk density[a]	g/cm^3	1.96	1.96	2.05	1.83	1.73	1.68	1.67	1.79	1.77
Effective porosity[a]	cm^3/cm^3	0.26	0.26	0.24	0.33	0.37	0.37	0.26	0.27	0.33
Volumetric air content in vadose zone soils[c]	cm^3/cm^3									
Volumetric water content in vadose zone soils[a]	cm^3/cm^3	0.053	0.087	0.105	0.058	0.060	0.047	0.052	0.065	0.040
Fraction organic carbon[a]	--	0.0079	0.0075	0.0088	0.0057	0.0014	0.0072	0.0027	0.0023	0.0037

[a]Based on measured data.

[b] From data shown in Table I-4 (color-coded).

[c]Calculated from total porosity minus volumetric water content in vadose zone soils.

[d] From data shown in Table I-5 (color-coded). Bulk density and porosity based on measurements of 95% compaction of borrow material.

[e] Fraction organic carbon and water content inputs are from data shown in Table I-6 (color-coded). Bulk density and porosity based on measurements of 95% compaction of borrow material shown in Table I-5 (color-coded) for Type II Borrow Material.

TABLE I-4
PLACEMENT SITE SOIL DATA USED FOR VLEACH SOIL INPUT PARAMETERS
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA

Native Soil Placement Sites	Sample ID	Bulk Density (pcf)	Bulk Density (g/cm^3)	Particle Density (g/cm^3)	Effective Porosity (%)	STL Results			AS Results	Volumetric Water Content[a]		
						Moisture Content (weight %)	Total Organic Carbon (mg/kg)	Fraction Organic Carbon (unitless)	Moisture Content (weight %)	STL	AS	Average
Site 1	SS-1	128.0	2.05	2.71	24.3	4.0	8800	0.0088	6.3	0.082	0.128	0.105
Site 2	SS-2	114.2	1.83	2.72	32.7	2.6	5700	0.0057	3.7	0.048	0.068	0.058
Site 3	SS-3	--	--	--	--	--	--	--	--	--	--	--
Site 4	SS-4	108.3	1.73	2.75	36.9	3.4	1400	0.0014	3.5	0.059	0.061	0.060
Site 5	SS-5	105.0	1.68	2.68	37.2	2.2	7200	0.0072	3.3	0.037	0.056	0.047
Site 6	SS-6	104.2	1.67	2.27	26.4	2.2	2700	0.0027	4.1	0.037	0.068	0.052
Site 7	SS-7	112.0	1.79	2.45	26.7	3.6	2300	0.0023	3.7	0.065	0.066	0.065
Site 8	SS-8	110.7	1.77	2.64	32.8	2.3	3700	0.0037	2.3	0.041	0.040	0.040

[a]From the equation: percent moisture × (bulk density / density of water); where the density of water is assumed to be 1.0 g/cm^3.

Color-coded highlighted cells represent values used as inputs for VLEACH modeling on Table I-3.

TABLE I-5
TYPE II BORROW SOIL DATA USED FOR VLEACH SOIL INPUT PARAMETERS
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA
(Page 1 of 1)

Borrow Material	Sample ID	Bulk Density (pcf)	Bulk Density (g/cm^3)	Particle Density (g/cm^3)	Effective Porosity (%)			Bulk Density (g/cm^3)[b]			STL Results			AS Results	Volumetric Water Content[a]		
					Percentage of Compaction			Percentage of Compaction			Moisture Content (%)	Total Organic Carbon (mg/kg)	Fraction Organic Carbon (unitless)	Moisture Content (%)	STL	AS	Average
					85%	90%	95%	85%	90%	95%							
Type II	SP-7	128.5	2.06	2.65	34.0	30.0	26.2	1.75	1.86	1.96	2.1	9300	0.0093	2.3	0.043	0.047	0.045
	SP-9	127.0	2.03	2.66	34.9	31.1	27.3	1.73	1.83	1.93	2.0	7100	0.0071	3.1	0.041	0.063	0.052
	SP-11	130.0	2.08	2.62	32.4	28.4	24.5	1.77	1.88	1.98	3.6	7400	0.0074	2.2	0.075	0.046	0.060
	Average						26			1.96			0.0079				0.053

[a]From the equation: percent moisture × (bulk density / density of water); where the density of water is assumed to be 1.0 g/cm^3.

[b]From the equation: (1- (Effective Porosity % / 100)) × Particle density.

Color-coded highlighted cells represent values used as inputs for VLEACH modeling on Table I-3.

TABLE I-6
REJECT BORROW SOIL DATA USED FOR VLEACH SOIL INPUT PARAMETERS
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA

Borrow Material	Sample ID	Bulk Density (pcf)	Bulk Density (g/cm^3)	Particle Density (g/cm^3)	Effective Porosity (%) Percentage of Compaction 85%	90%	95%	Bulk Density (g/cm^3)[b] Percentage of Compaction 85%	90%	95%	STL Results Moisture Content (%)	Total Organic Carbon (mg/kg)	Fraction Organic Carbon (unitless)	AS Results Moisture Content (%)	Volumetric Water Content[a] STL	AS	Average
Reject	SP-1	116.5	1.87	2.73	41.8	-	-	1.59	-	-	2.1	7300	0.0073	4.5	0.039	0.084	0.062
	SP-3	118.5	1.90	2.74	41.1	-	-	1.61	-	-	4.6	7900	0.0079	6.2	0.087	0.118	0.102
	SP-5	118.0	1.89	2.73	41.1	-	-	1.61	-	-	4.7	7200	0.0072	5.4	0.089	0.102	0.095
	Average												0.0075				0.087

[a]From the equation: percent moisture × (bulk density / density of water); where the density of water is assumed to be 1.0 g/cm^3.

[b]From the equation: (1- (Effective Porosity % / 100)) × Particle density.

Color-coded highlighted cells represent values used as inputs for VLEACH modeling on Table I-3.

TABLE I-7
VLEACH SITE VARIABILITY TEST SUMMARY
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA
(Page 1 of 1)

Parameter	Ratio of Scenario Pore Concentration to Max Pore Water Concentration [a]						
	Site 1	Site 2	Site 4	Site 5	Site 6	Site 7	Site 8
Metals							
Arsenic	0.54	0.88	0.92	1.00	0.99	0.84	0.95
Hexavalent Chromium	0.55	0.89	0.93	1.00	0.99	0.87	0.95
Organochlorine Pesticides							
alpha-BHC	0.03	0.08	1.00	0.05	0.31	0.45	0.13
beta-BHC	0.07	0.17	1.00	0.15	0.45	0.53	0.29
DDT	0.02	0.06	1.00	0.03	0.26	0.37	0.10
gamma-BHC	0.04	0.08	1.00	0.05	0.32	0.46	0.14
Semim-Volatile Organic Compounds							
123-Trichlorobenzene	0.06	0.17	1.00	0.14	0.46	0.53	0.29
Hexachlorobenzene	0.05	0.15	1.00	0.13	0.41	0.47	0.26
Volatile Organic Compounds							
Benzene	1.00	0.72	0.66	0.61	0.85	0.89	0.65

[a]Based VLEACH output using five feet of native soil thickness and 30-year duration. A value of one indicates that for that chemical that site scenario was the most conservative. Based on model evaluations for scenarios 1, 4, and 5 represent the worst case scenarios accross the chemical classes and potential placement sites.

Highlight indicates worst case scenario for each chemical.

TABLE I-8
VLEACH INFILTRATION RATE SENSITIVITY RESULTS SUMMARY
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA

Parameter	Scenario			Decrease[a]	Increase[b]
	4 Inch Rainfall	2 Inch Rainfall	6 Inch Rainfall		
1,2,3-Trichlorobenzene	1.2 E-6	1.4 E-7	3.1 E-6	88%	165%
alpha-BHC	7.8 E-6	6.0 E-7	2.0 E-5	92%	153%
Arsenic	9.3 E-5	3.4 E-6	3.9 E-4	96%	314%
Benzene	4.0 E-4	2.6 E-5	1.1 E-3	94%	164%
beta-BHC	1.0 E-4	4.8 E-6	3.6 E-4	95%	254%
4,4'-DDT	2.6 E-13	1.1 E-14	9.5 E-13	96%	270%
gamma-BHC (Lindane)	4.0 E-6	3.3 E-7	9.8 E-6	92%	142%
Hexachlorobenzene	8.1 E-9	7.3 E-10	2.8 E-8	91%	252%
Hexavalent Chromium	1.6 E-5	6.1 E-7	6.3 E-5	96%	299%

[a]Percent reduction in leachate concentration associated with the reduction in an infiltration rate from 4 inches (100% of rainfall) to 2 inches (50% of rainfall). Typical reduction of leachate concentration is on an order of magnitude. Indicates that the results of the model conducted using the infiltration rate of 100% of rainfall could overestimate results by several orders of magnitude given recent study by UNLV which indicated a recharge rate of approximately 3 percent (James, D.E., Piechota, T.C., Paul, S., Sistla, K., Barber, K. and Kiser, A. 2006. Rapid Methods for Evaluation of Effectiveness of Water Applied on Construction Sites. Presented at the 2006 American Water Works Association Conference on Water Sources.).

[b]Percent increase in leachate concentration associated with the increase in an infiltration rate from 4 inches (100% of rainfall) to 6 inches (150% of rainfall). Typical increase of leachate concentration ranges from a factor of 1.5 to 3.

TABLE I-9
ANALYSES OF BORROW SOIL CELL NUMBER SENSITIVITY RESULTS SUMMARY
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA

Analyte	Arsenic		Benzene		Benzoic Acid		Chlordane	
Simulation Length (years)	30	30	30	30	30	30	30	30
Borrow Soil Thickness (feet)	20	20	20	20	20	20	20	20
Cells	1	20	1	20	1	20	1	20
Min	0.285	0.287	0.0024	0.0025	0.004	6.15E-13	2.30E-05	2.31E-05
Max (Value used as recharge concentration for Site scenarios)	**0.287**	**0.287**	**0.0050**	**0.0050**	**4.964**	**4.964**	**2.31E-05**	**2.31E-05**
Max Year	1	1	1	1	1	1	1	1
Average	0.286	0.287	0.0036	0.0038	**0.748**	0.751	2.31E-05	2.31E-05
Standard Deviaiton	0.00061	0.000019	**0.00079**	**0.000777**	**1.25**	1.63	1.73E-08	2.16E-09
95%UCL	0.287	0.287	0.0038	0.0040	**1.30**	1.47	2.31E-05	2.31E-05
Distribution	NORMAL	NORMAL	NORMAL	NORMAL	Bootstrap-t	Bootstrap-t	NORMAL	NORMAL

TABLE I-10
SCENARIO SPECIFIC SOIL PORE WATER COEFFICIENT VLEACH INPUT PARAMETERS FOR METALS
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA
(Page 1 of 2)

	Borrow Material					
	Type II			Reject Sand		
Parameter	Soil Pore Water Partition Coefficient (ml/g)	Fraction organic carbon	Organic Carbon Partition Coefficient (ml/g)	Soil Pore Water Partition Coefficient (ml/g)	Fraction organic carbon	Organic Carbon Partition Coefficient (ml/g)
Arsenic	3.1E+01	7.9E-03	3.9E+03	3.1E+01	7.5E-03	4.2E+03
Beryllium	1.0E+05	7.9E-03	1.3E+07	1.0E+05	7.5E-03	1.3E+07
Cadmium	4.3E+03	7.9E-03	5.4E+05	4.3E+03	7.5E-03	5.8E+05
Hexavalent Chromium	1.4E+01	7.9E-03	1.8E+03	1.4E+01	7.5E-03	1.9E+03
Chromium (Total)	4.3E+06	7.9E-03	5.4E+08	4.3E+06	7.5E-03	5.8E+08
Iron	4.0E+00	7.9E-03	5.0E+02	4.0E+00	7.5E-03	5.4E+02
Mercury	2.0E+02	7.9E-03	2.5E+04	2.0E+02	7.5E-03	2.7E+04
Nickel	1.9E+03	7.9E-03	2.4E+05	1.9E+03	7.5E-03	2.5E+05
Selenium	2.2E+00	7.9E-03	2.8E+02	2.2E+00	7.5E-03	2.9E+02
Silver	1.1E+02	7.9E-03	1.4E+04	1.1E+02	7.5E-03	1.5E+04
Thallium	9.6E+01	7.9E-03	1.2E+04	9.6E+01	7.5E-03	1.3E+04
Vanadium	1.0E+03	7.9E-03	1.3E+05	1.0E+03	7.5E-03	1.3E+05

TABLE I-10
SCENARIO SPECIFIC SOIL PORE WATER COEFFICIENT VLEACH INPUT PARAMETERS FOR METALS
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA
(Page 2 of 2)

	Native Soil								
	Site 1			Site 4			Site 5		
Parameter	Soil Pore Water Partition Coefficient (ml/g)	Fraction organic carbon	Organic Carbon Partition Coefficient (ml/g)	Soil Pore Water Partition Coefficient (ml/g)	Fraction organic carbon	Organic Carbon Partition Coefficient (ml/g)	Soil Pore Water Partition Coefficient (ml/g)	Fraction organic carbon	Organic Carbon Partition Coefficient (ml/g)
Arsenic	3.1E+01	8.8E-03	3.5E+03	3.1E+01	1.4E-03	2.2E+04	3.1E+01	1.4E-03	2.2E+04
Beryllium	1.0E+05	8.8E-03	1.1E+07	1.0E+05	5.7E-03	1.8E+07	1.0E+05	5.7E-03	1.8E+07
Cadmium	4.3E+03	8.8E-03	4.9E+05	4.3E+03	5.7E-03	7.5E+05	4.3E+03	5.7E-03	7.5E+05
Hexavalent Chromium	1.4E+01	8.8E-03	1.6E+03	1.4E+01	1.4E-03	1.0E+04	1.4E+01	1.4E-03	1.0E+04
Chromium (Total)	4.3E+06	8.8E-03	4.9E+08	4.3E+06	5.7E-03	7.5E+08	4.3E+06	5.7E-03	7.5E+08
Iron	4.0E+00	8.8E-03	4.5E+02	4.0E+00	5.7E-03	7.0E+02	4.0E+00	5.7E-03	7.0E+02
Mercury	2.0E+02	8.8E-03	2.3E+04	2.0E+02	5.7E-03	3.5E+04	2.0E+02	5.7E-03	3.5E+04
Nickel	1.9E+03	8.8E-03	2.2E+05	1.9E+03	5.7E-03	3.3E+05	1.9E+03	5.7E-03	3.3E+05
Selenium	2.2E+00	8.8E-03	2.5E+02	2.2E+00	5.7E-03	3.9E+02	2.2E+00	5.7E-03	3.9E+02
Silver	1.1E+02	8.8E-03	1.3E+04	1.1E+02	5.7E-03	1.9E+04	1.1E+02	5.7E-03	1.9E+04
Thallium	9.6E+01	8.8E-03	1.1E+04	9.6E+01	5.7E-03	1.7E+04	9.6E+01	5.7E-03	1.7E+04
Vanadium	1.0E+03	8.8E-03	1.1E+05	1.0E+03	5.7E-03	1.8E+05	1.0E+03	5.7E-03	1.8E+05

TABLE I-11
VLEACH TIMESTEP AND RUN DURATION SENSITIVITY RESULTS SUMMARY
BORROW AREA RISK ASSESSMENT
CLARK COUNTY, NEVADA
(Page 1 of 1)

Parameter	Comparison Level (mg/L)[b]	100 years Max Pore Water Concentration (mg/L)			Sensitivity Notes[a]	
		Site 1	Site 4	Site 5	Increasing at 30 years?	Increasing at 100 years?
1,2,3-Trichlorobenzene	0.07	2.0E-07	6.5E-05	1.9E-06	YES	YES
2-Butanone (MEK)	7.0	5.1E-01	5.1E-01	5.1E-01	NO	NO
Acetone	5.5	2.0E+00	2.0E+00	1.9E+00	NO	NO
alpha-BHC	0.0002	7.5E-08	3.9E-05	7.6E-07	YES	YES
Arsenic	0.01	1.7E-04	1.6E-04	3.4E-04	YES	YES
Benzene	0.005	**6.7E-03**	1.8E-03	1.8E-03	YES	YES
Benzoic Acid	146	7.5E+01	7.5E+01	7.5E+01	NO	NO
Beryllium	0.004	2.2E-04	4.8E-05	4.7E-05	NO	NO
beta-BHC	0.0002	2.4E-06	**7.1E-04**	4.0E-05	YES	YES
Cadmium	0.005	3.9E-12	3.2E-11	5.9E-11	YES	YES
Carbon disulfide	1.0	1.0E-04	2.8E-05	4.1E-05	YES	NO
Chloroethane	0.0046	**9.1E-03**	2.0E-03	2.3E-03	NO	NO
Chloroform	0.08	9.3E-03	2.8E-03	2.8E-03	YES	YES
Chromium (Total)	0.1	4.9E-03	1.0E-03	1.0E-03	NO	NO
4,4'-DDD	0.00028	1.3E-14	4.3E-12	3.0E-13	YES	YES
4,4'-DDE	0.00020	1.1E-15	3.4E-13	2.4E-14	YES	YES
4,4'-DDT	0.00020	3.0E-15	9.4E-13	6.6E-14	YES	YES
delta-BHC	0.0002	8.1E-08	9.6E-05	9.5E-07	YES	YES
Dieldrin	4.2E-06	3.3E-11	1.2E-08	6.9E-10	YES	YES
Ethylbenzene	0.7	3.6E-06	1.3E-05	2.8E-06	YES	NO
gamma-BHC (Lindane)	0.0002	5.9E-08	2.8E-05	5.5E-07	YES	YES
gamma-Chlordane	0.002	9.2E-13	6.4E-10	2.3E-11	YES	YES
Hexachlorobenzene	0.001	7.0E-10	1.8E-07	1.2E-08	YES	YES
Hexavalent Chromium	0.11	5.3E-06	3.8E-05	7.2E-05	YES	YES
Iron	11	**1.4E+01**	**5.6E+01**	**8.3E+01**	YES	YES
Mercury	0.002	3.1E-10	2.3E-09	4.3E-09	YES	YES
Methylene chloride	0.0043	**7.6E-02**	**3.0E-02**	**2.9E-02**	YES	NO
m-Xylene & p-Xylene	10	5.1E-06	2.1E-05	4.6E-06	YES	NO
Nickel	0.73	9.4E-09	1.2E-07	2.7E-07	YES	YES
Selenium	0.05	1.2E-02	3.3E-02	4.3E-02	YES	YES
Silver	0.18	1.1E-06	1.3E-05	2.9E-05	YES	YES
Thallium	0.0005	2.0E-08	1.5E-07	2.6E-07	YES	YES
Toluene	0.72	1.6E-05	2.6E-05	5.9E-06	YES	NO
Vanadium	0.036	4.3E-08	5.4E-07	1.2E-06	YES	YES

[a]Many chemicals show increasing concentrations even after 100 years. However, in only one instance are these concentrations exceeding the MCL. Model durations at 100 years and greater greatly exaggerate the conservative assumptions regarding continuous source concentrations and no degradation. That is, the model assumes that the Borrow Area material placed on top of the native soil will provide a continuous contaminant load throughout the model duration with no decrease of input concentrations.

[b] For chemicals with USPEA Maximum Contaminant Levels (MCLs), the MCL was used for comparison, otherwise the USEPA Region 9 Tap Water Preliminary Remediation Goal (Tap Water PRG) was selected for comparisonn. The MCL for Total trihalomethanse (TTHMs) is used as the comparison value for chloroform. It is not conservative to use the TTHM MCL to evalaute the potential water concentration for a single TTHM constituent like chloroform. However, since chloroform is the only TTHM COPC it would also represent the TTHM concentration and as such the use of the TTHM MCL is appropriate.

Shaded cells indicate the comparison value is the Tap Water PRG, otherwise the comparison value is the MCL.

Bold indicates exceeds comparison value.

ATTACHMENT I-1

VLEACH MODEL OUTPUTS (on DVD)

ATTACHMENT I-2

LABORATORY REPORTS (on DVD)