BMI COMPLEX
CAMU SLIT TRENCH/PHASE IIIC
AIR MONITORING SUMMARY REPORT
Revision 1

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1.0 INTRODUCTION

Basic Remediation Company (BRC) retained Converse Consultants (Converse) and Tetra Tech EM Inc. (Tetra Tech) to complete a 5-month air sampling project to evaluate emissions resulting from the remediation (via excavation) of wastes from the slit trench area (STA) located in the Corrective Area Management Unit (CAMU) area of the Basic Management Inc. (BMI) Common Areas located in Clark County, Nevada. This air sampling project is one aspect of a 3-phased approach to evaluate air emissions from waste material hauling, dry/moisture-controlled pond excavations, and CAMU STA excavations.

Tetra Tech set up two temporary air-monitoring stations at the CAMU STA and collected air samples over a 5-month period from January 23, through June 25, 2009. The 5-month period covered substantially all of the work associated with excavation and remediation of the STA. Ambient samples at CAMUS1 were collected over the entire sample period from January 23 through June 25, 2009. Ambient samples at CAMUS2 were collected from January 23 through April 28, 2009. After the completion of the April 28 sample, the CAMUS2 monitoring station was relocated approximately 700 feet to the east and renamed CAMUS3. The relocation of CAMUS2 to CAMUS3 reflected the movement of the remediation activity, within the STA, further to the east over time. Ambient samples at CAMUS3 were collected from May 1 through June 25, 2009. Equipment was set up at each of the three stations to collect ambient air samples over a ten hour (hr) period from approximately 7:00 A.M. to 5:00 P.M. and correspond to slit trench excavation times. In addition, meteorological data was collected during each sample event.

The sampling parameters were based on the BRC *Perimeter Air Monitoring Plan* (PAMP) (October 2008) and *Revised Draft BMI Complex Air Quality Monitoring Project – Phase III – Summary of Sampling Approach and Chemicals of Concern at Eastside and CAMU Areas* (Tetra Tech October 2008) reviewed and approved by the Nevada Division of Environmental Protection (NDEP). Three identical air-sampling stations were constructed and the sampling equipment at each site of the three sites consisted of the following:

- Three identical polyurethane foam (PUF) hi-volume federal reference method (FRM) samplers designed to collect samples on three PUF cartridges for analysis of organic compounds contained in the U.S. Environmental Protection Agency (EPA) Compendium Methods TO-4, TO-9 and TO-13.

- One portable BGI PQ100 low-volume FRM (PQ100) sampler designed to collect samples on 47mm Teflon filters for analysis of total suspended particulate (TSP) and total metals contained in the U.S. EPA compendium methods IO-3.3 X-Ray Florescence.
- One SKC Model 224-PCXR8 (SKC) low-volume sample pump designed to collect samples on mixed cellulose ester (MCE) filters for analysis of asbestos using National Institute for Occupational Safety and Health (NIOSH) Method 7400 for phase contrast microscopy.
- One Honda EB 6500 gasoline-powered generators (or equivalent)

This report summarizes sample collection, analyses methodology, and analytical data collected between January 23, 2009 and June 25, 2009. The sampling approach, methodology, and summary of activities are presented in Section 2.0. The upwind/downwind analysis is presented in Section 3.0. The analytical data results are presented in Section 4.0. NDEP comments and BRC responses to comments on an earlier draft of this report are provided in Appendix A; Field documentation forms are provided in Appendix B; calibration and sample volume calculation worksheets are provided in Appendix C; a CD containing laboratory analytical and electronic comprehensive validation reports, an electronic copy of the report and Table 3 is provided in Appendix D.

2.0 SAMPLING APPROACH

Based on the nature of the STA excavations, one upwind and one downwind air monitoring station was identified in the CAMU STA. Temporary air monitoring stations were set up in the CAMU STA to collect air samples during the excavation of the slit trenches. Each sample event included a 10-hour sample at each monitoring station collected twice per week. CAMUS1 downwind samples were collected from January 23 through June 25, 2009; CAMUS2 upwind samples were collected from January 23 through April 28, 2009; and CAMUS3 upwind samples were collected from May 1 through June 25, 2009.

2.1 SITE SELECTION AND LOCATIONS

Based on the prevailing wind direction, available ground space, and safe access at the CAMU STA, CAMUS1 air monitoring station was placed along the north and CAMUS2 and CAMUS3 air monitoring stations were placed along the south side of the CAMU STA. Sample sites CAMUS3 and CAMUS2 were located to represent potential upwind conditions while CAMUS1 was located to represent potential downwind conditions. Tetra Tech was contacted by BMI site personnel on April 29, 2009 and notified that the CAMUS2 site would need to be relocated due to CAMU STA access issues associated with remediation activities. Tetra Tech relocated the upwind station approximately 700 feet to the east and renamed the site CAMUS3. The air monitoring station locations are presented in Figure 1.

2.2 SAMPLING EQUIPMENT CALIBRATION AND OPERATION

Tetra Tech assembled and calibrated the PUF, PQ100, and SKC air samplers prior to sample collection and after equipment had been serviced (battery changes). All samplers were calibrated using National Institute of Standards and Testing (NIST) or other authoritative reference certified equipment.

The initial calibrations on the PUF, BGI PQ100, and SKC samplers only required minor adjustments to set correct flow rates, but no major adjustments or equipment failures were observed. All equipment was checked again before sample collection began to ensure the correct flow rate(s) and timer operation.

Tetra Tech performed all calibrations according to EPA reference methods and all equipment was found to be within the calibration acceptance criteria prior to sample collection and equipment was operating within project goals. Equipment calibration worksheets are provided in Appendix C.

All PUF samplers were powered by portable gas-powered generators for each sample event. Samplers were set up and programmed at each station prior to sampling. Each station consisted of a sampling platform and air samplers were secured to the platforms during the sample events. The sampling approach proposed by BRC and Tetra Tech and approved by NDEP was to collect 10-hr samples twice per week from approximately 7:00 A.M. to 5:00 P.M. over a five month period during daylight excavating operations.

The first sample event occurred on January 23, 2009 and sampling continued through June 25, 2009. All sample parameters were documented on CAMU field documentation forms before and after each sample event. In total, 45 sample events were completed on the following dates:

- January 23, 26, 30, 2009
- February 4, 6, 10, 12, 17, 20, 24, 26, 2009
- March 3, 5, 10, 13, 17, 20, 24, 27, 31, 2009
- April 3, 7, 9, 14, 16, 21, 23, 28, 2009
- May 1, 5, 7, 13, 14, 19, 21, 26, 28, 2009
- June 2, 4, 9, 11, 16, 18, 23, 25, 2009

2.3 SAMPLE NOMENCLATURE

All samples collected at the CAMU Slit Trench area were given a sample ID according to the sample location and sample date as follows:

- CAMUS1-012309 (where CAMU denotes site location, S1 denotes site #1 and 012309 denotes that sample was collected on January 23, 2009)

This sample nomenclature was used for all samples collected at the CAMU Slit Trench Area and allows the reader to easily identify the location and date of the sample collection parameters.

2.4 SAMPLE PARAMETERS

Air samples were collected at the established monitoring stations for the analysis of site related chemicals including organochlorine pesticides, Polychlorinated Dibenzo-p-dioxins (PCDDs), Polychlorinated Dibenzo-p-furans (PCDFs), Polychlorinated biphenyls (PCBs), VOCs/SVOCs, TSP, metals, and asbestos

fibers. Upon completion of each sample event, the samples and associated information was recorded on chain-of-custody (COC) sheets and submitted to the respective laboratories for analysis. The COC included the sample identification number, sample location, sample time, beginning and ending flow rate (to calculate sample volume) and the required analysis. For all samples collected at the CAMU STA field blanks were collected on a frequency of 10 percent (one in 10 samples) for quality control purposes. The sampling and analysis procedures are summarized below. In addition, a summary of sample collection, sample handling, and analysis specifications procedures is provided in Table 1.

2.4.1 ORGANIC COMPOUNDS

At each sampling location, three PUF samplers were used to collect PUF samples for the analysis of organochlorine pesticides, PCDDs, PCDFs, PCBs, and VOCs/SVOCs using EPA Compendium Methods TO-4, TO-9, and TO-13. The PUF samplers draw approximately 0.2 cubic meters per minute of ambient air onto a 102 millimeter (mm) diameter quartz glass filter followed by a polyurethane foam plug and XAD resin contained in a glass cartridge. The TO-9 and TO-13 samples were analyzed using gas chromatography and mass spectrometry (GC/MS) and the TO-4 samples were analyzed using GC/Multi-Detector Detection (GC/MD). All PUF (organic) samples were submitted with COC form(s) to Air Toxics Ltd. Laboratory and Frontier Ltd. Laboratory for analysis. A summary of sample collection, sample handling, and analysis specifications procedures is provided in Table 1.

2.4.2 TOTAL SUSPENDED PARTICULATE MATTER AND METALS

At each sampling location, one PQ100 sampler was used to collect samples for TSP and metals. The PQ100 sampler draws approximately 0.0167 cubic meters per minute (approximately 10 total cubic meters) of ambient air onto the filter media. The TSP and metals samples were collected using 47 mm Teflon filter media and analyzed using USEPA Compendium Method IO-2.1 (gravimetric analysis). The TSP samples underwent additional analysis for metals using USEPA Compendium Method IO-3.3 X-Ray Fluorescence (Protocol number 6). All TSP and metals samples were submitted with COC form(s) to Chester Labnet Laboratory for analysis. A summary of sample collection, sample handling, and analysis specifications procedures is provided in Table 1.

2.4.3 ASBESTOS

At each sampling location, one SKC low volume sampler was used to collect samples for asbestos analysis using NIOSH Method 7400. The sampling system consisted of a low-flow pump attached to a

25-millimeter MCE filter. The SKC samplers draw approximately 1 liter per minute (lpm) (approximately 720 total liters) of ambient air onto the MCE filter. The samples were analyzed using NIOSH Method 7400 (Phase Contrast Light Microscopy). All asbestos samples were submitted with COC form(s) to AESL Laboratory for analysis. A summary of sample collection, sample handling, and analysis specifications procedures is provided in Table 1.

2.5 SIGNIFICANT SITE-RELATED EVENTS AND SAMPLING ANOMALIES

During the process of the CAMU STA excavations, numerous field observations were reported and witnessed by Tetra Tech personnel. The following observations were documented on field documentation sheets:

- Self-ignited fire witnessed at the CAMU STA on February 20, 2009 at approximately 4:45 P.M.
- Pesticide smell witnessed on south side of CAMU STA on April 3, April 7, and April 9, 2009. Wind directions for all three observations were documented as blowing from the south.
- Smoke emanating from the CAMU STA witnessed on April 14, 2009.

During the January 30, 2009 sample collection event at CAMUS2, the TO-4 PUF sampler did not complete a sample run due to equipment failure. During the February 20, 2009, the TSP sample was invalidated due to the sample being dropped and damaged. During the May 5, 2009, the TSP sample was invalidated due to equipment failure. In addition, a few sample runs were an hour short due to generator failure. All sample anomalies were documented on field documentation forms.

The sample event on March 17, 2009 recorded significant concentrations of PCDDs and PCDFs. Tetra Tech personnel contacted site management personnel in regards to CAMU STA activities that might explain the high PCDD/F sample collected on 3/17/09. CAMU STA excavations were occurring in areas SW-2 and NW-1. No odors, fires, health and safety concerned, or other anomalies were identified on this date. A copy of the BMI daily report has been provided to NDEP.

It should also be noted that the remediation contractor was conducting personnel monitoring of its staff and workers during the excavation activities, pursuant to its Health and Safety Work Plan.

3.0 UPWIND AND DOWN WIND ANALYSIS

Tetra Tech developed an approach for the quantification of upwind versus downwind air quality monitoring data collected during this air sampling project at the CAMU Site. The objective of the upwind/downwind evaluation was to evaluate if the slit trench excavation operations contributed to the degradation of the existing air quality in the vicinity of the work area. This analysis was performed with a meteorological dataset of forty-five sample events and thus Table 2 represents meteorological conditions measured during slit trench sampling from January 23 through June 25, 2009.

3.1 METEOROLOGICAL DATA SUMMARY

The upwind/downwind evaluation was conducted using meteorological data and on-site data collected at sites CAMUS1, CAMUS2, and CAMUS3. Meteorological data including wind speed and direction were measured continuously at the on-site meteorological monitoring station operated by Tetra Tech near the Eastside entrance gate.

3.2 APPROACH

The general approach for conducting the upwind/downwind evaluation consists of the following steps:

- Determine predominant wind directions
- Assign upwind/downwind stations
- Compare upwind/downwind results
- Determine those air sample results that exceeded either the RBC or PRG screening criteria
- Conduct a statistical analysis

3.3 DETERMINE PREDOMINANT WIND DIRECTION

If the wind is variable, assigning a predominant wind direction may be subject to qualitative interpretations. Tetra Tech defined predominant wind direction based on the following criteria:

- At least 50 percent of wind direction and average measurements occurs in two quadrants (southeast-southwest, or northeast-northwest)

3.4 ASSIGN UPWIND/DOWNWIND STATIONS

Meteorological data was recorded for the duration of the five month sample event and the prevailing wind direction was generally from the southwest and southeast. Six events were inconclusive with respect to upwind/downwind determination as average wind directions were out of the east or west. A summary of meteorological data during the sample events is presented in Table 2.

3.5 COMPARE UPWIND/DOWNWIND RESULTS

To meet project objectives the upwind concentrations of chemical constituents were compared to their corresponding downwind concentrations using two methods: 1) difference in concentration (in µg/m3), and 2) a matched-pairs design and resulting difference in concentration.

4.0 ANALYTICAL RESULTS

The air quality sample data collected at the CAMU locations represents a wide range of chemical compounds as presented in the PAMP. All sample data was compared to EPA Region 3 risk-based concentrations (RBC) table (April 2006), EPA Region 9 preliminary remediation goals (PRG) table (October 2004), and EPA Region 6 human health medium-specific screening levels (MSSL) table (March 2008) to determine if ambient concentrations exceeded criteria. In most cases the RBC, PRG, and MSSL were either identical or very close in chemical concentration.

The sample results demonstrate that the majority of organic (PUF) compounds were not detected in measurable concentrations in ambient air at the CAMU locations. However, a limited number of organic compounds were detected and have been further evaluated. In addition, TSP, some metals, and airborne fibers were detected.

A statistical analysis was completed for selected chemicals found in upwind and down samples using a matched-pairs design. Differences in chemical concentration (upwind-downwind) were evaluated for samples collected from January 23, 2009 through June 25, 2009.

A summary of laboratory and statistical analytical results for each subset of chemical compounds is provided below.

4.1 TSP AND METALS RESULTS

TSP was detected in all samples and concentrations ranged from 3.1 µg/m^3 to 245.17 µg/m^3. The average concentration was 40.9 µg/m^3. No screening criteria or federal standards currently exist for TSP. An analysis of the average difference calculation between the upwind sites (CAMUS2 and CAMUS3) and downwind site (CAMUS1) demonstrated an average difference of approximately -4.3 µg/m^3. The small average difference in TSP between the upwind and downwind sites shows that there were no TSP impacts from CAMU STA activity. A complete summary and statistical analysis of all TSP results are presented in Table 3 (Excel file on CD) Table 4, Figure 2, and the following statistical analysis section.

Metals were detected in a majority of the TSP samples and concentrations were reported with an uncertainty of plus/minus 3 standard deviations. The XRF detection method identifies concentrations in

extremely low concentration ranges (of less than 0.001 µg/m^3). The results were compared to the RBC, PRG, and MSSL screening criterion (of those available) and four metals exceeded the criterion: Manganese, Cobalt, Arsenic, and Cadmium.

Manganese concentrations ranged from 0.0013 µg/m^3 to 0.1669 µg/m^3 and the average concentration was 0.0311 µg/m^3. The Manganese PRG and MMSL of 0.051 µg/m^3 (RBC of 0.052 µg/m^3) was exceeded by 22 samples. Nine of these of samples were collected at site CAMUS1, six samples were collected at site CAMUS2, and seven samples were collected at site CAMUS3. The average upwind/downwind difference for all Manganese samples was -0.02 µg/m^3 indicating no significant CAMU STA activity impacts.

Cobalt concentrations ranged from 0.000 µg/m^3 to 0.0108 µg/m^3 and the average concentration was 0.0027 µg/m^3. The Cobalt PRG and MSSL of 0.001 µg/m^3 was exceeded by forty five samples. Twenty of these samples were collected at Site CAMUS1, sixteen samples were collected at Site CAMUS2, and four of these samples were collected at site CAMUS3. The average upwind/downwind difference for all Cobalt samples was -0.001µg/m^3 indicating no significant CAMU STA activity impacts.

Arsenic concentrations ranged from 0.0001 µg/m^3 to 0.042 µg/m^3 and the average concentration was 0.0026 µg/m^3. The Arsenic PRG of 0.0004 µg/m^3, RBC of 0.00041 µg/m^3, and MSSL of 0.00045 µg/m^3 was exceeded by twenty-five samples. Nine of these samples were collected at Site CAMUS1, four of these samples were collected at site CAMUS2, and twelve of these samples were collected at site CAMUS3. The average upwind/downwind difference for all Arsenic samples was -0.001µg/m^3 indicating no significant CAMU STA activity impacts.

Cadmium concentrations ranged from 0.0001 µg/m^3 to 0.0239 µg/m^3 and the average concentration was 0.0074 µg/m^3. The Cadmium RBC of 0.001 µg/m^3 and PRG/MSSL of 0.001 µg/m^3 were exceeded by fifty-eight samples. Thirty of those samples were collected at Site CAMUS1, fifteen of those samples were collected at Site CAMUS2, and thirteen of those samples were collected at site CAMUS3. The average upwind/downwind difference for all Cadmium samples was -0.002 µg/m^3 indicating no significant CAMU STA activity impacts.

It must be noted that a majority of the Manganese, Cobalt, Arsenic, and Cadmium concentrations were reported at less than three times the XRF analytical uncertainty and have been so flagged. Given the level

of the detections and the lack of distinct patterns or differences in upwind/downwind concentrations it can be concluded that excavation of the STA did not adversely impact air quality with respect to ambient and TSP metals concentrations. While it can be argued that the upwind monitors are not entirely upwind all of the time and the downwind monitors are not downwind all of the time, the distinct lack of overall (average) differences between these two sets of ambient concentrations across multiple chemicals demonstrates a high level of consistency. If in fact, the excavation work had been the source of air emissions, a distinct pattern of higher downwind (or upwind) concentrations would have been observed. The statistical analysis presented in Section 4.4 showed significantly greater downwind concentrations only for Bromine which does not have an established health-based screening criterion. A complete summary and statistical analysis of metals results are presented in Table 3 (Excel file on CD), Table 4, Figure 2, and the following statistical analysis section.

4.2 ORGANIC COMPOUND RESULTS

Four out of twenty seven Organochlorine pesticides (TO-4) chemical compounds were detected above laboratory detection limits and included alpha-BHC, beta-BHC, delta-BHC, gamma-BHC (Lindane), 4,4'-DDE, and 4,4'-DDT. During the monitoring project, Alpha-BHC was detected in 71 out of 106 samples (66.9 %) and gamma-BHC (Lindane) was detected in 34 of 106 samples (32 %). Alpha-BHC and gamma-BHC were detected at both the upwind sites (CAMUS2 and CAMUS3) and downwind site (CAMUS1). An evaluation of the upwind/downwind pattern for sample events when both sites recorded data demonstrates a decrease of -1.99, -0.010, and -0.006 µg/m^3 in downwind concentrations for alpha-BHC, beta-BHC, and gamma-BHC (Lindane), respectively. Delta-BHC had an average increase of 0.06 µg/m^3 at the downwind site. An evaluation of the upwind/downwind pattern for sample events when both sites recorded data demonstrates a decrease of -0.004 µg/m^3 in downwind concentrations for 4,4'-DDE. 4,4'-DDT only had one detection at the upwind site of 0.0032 µg/m^3. A comprehensive evaluation of the data demonstrated no significant data pattern. A complete summary and statistical analysis of Organochlorine pesticides (TO4A) chemical compounds results are presented in Table 3 (Excel file on CD), Table 4, Figure 2, and the following statistical analysis section.

Twenty five PCDDs/PCDFS (TO-9) chemical compounds were detected above laboratory detection limits, ranging from 0.007 picograms (pg)/m^3 (0.000000007 µg/m^3) to 8,039 pg/m^3 (0.008 µg/m^3). The total toxic equivalent value (TEQ) was calculated from toxicity equivalence factors (World Health Organization 2005) for each of the upwind and downwind samples and compared to the 2,3,7,8-TCDD screening value of 0.045 pg/m^3. The upwind versus downwind statistical analysis completed for the

PCDDs/PCDFS data appears to show a decrease in concentrations from upwind to downwind. In many cases, the PCDDs/PCDFS upwind concentrations were significantly greater than the downwind concentration. TEQ concentrations had an average upwind/downwind decrease of -3.310 pg/m^3. 90 out of 90 samples (100%) at the slit trench areas had TEQ values that exceeded the 0.045 pg/m^3 screening value at both the upwind and downwind sites. It should be noted that significantly elevated concentrations of PCDDs/PCDFS were recorded during the sample event on March 17, 2009. Tetra Tech inquired into site activities on this date but were not provided any significant information that would explain the elevated concentrations. A complete summary and statistical analysis of PCDDs/PCDFS (TO-9) chemical compounds results are presented in Table 3 (Excel file on CD), Table 4, Figure 2, and the following statistical analysis section.

Twenty-three VOCs/SVOCs (TO-13) chemical compounds were detected above laboratory detection limits. Of the twenty-three detected compounds, only five exceeded RBC, PRG, or MSSL screening criteria and included Hexachlorobenzene, 1,4-Dichlorobenzene, Hexachloroethane, 1,2,4-Trichlorobenzene, and Hexachlorobutadiene. Twenty-one Hexachlorobenzene samples exceeded the screening criteria; thirty-one 1,4-Dichlorobenzene samples exceeded the screening criteria, three Hexachloroethane samples exceeded the screening criteria, and one sample of 1,2,4-Trichlorobenzene and Hexachlorobutadiene exceeded the screening criteria. The upwind versus downwind statistical analysis completed for Hexachlorobenzene, 1,4-Dichlorobenzene, Hexachloroethane, 1,2,4-Trichlorobenzene, and Hexachlorobutadiene does not show any distinguishable pattern with an average upwind/downwind difference of -0.008, -2.061, -0.265, -3.832, and 0.030, respectively. Based on the factors presented above and a comprehensive data review it cannot be concluded that CAMU STA excavation activities negatively impact existing air quality with respect to organic compounds. However, the statistical analysis presented in Section 4.4 demonstrates significantly greater downwind concentrations for two organic compounds, 2-Methyl-naphthalene and Naphthalene. A complete summary and statistical analysis of all VOCs/SVOCs (TO-13) chemical compounds results are presented in Table 3 (Excel file on CD), Table 4, Figure 2, and the following statistical analysis section.

4.3 ASBESTOS RESULTS

The asbestos samples were analyzed using NIOSH Method 7400 PCM. The PCM method gives a number index of airborne fibers. It is primarily used for estimating asbestos concentrations, though PCM does not differentiate between asbestos and other fibers. Asbestos fibers include chrysotile, cummingtonite-grunerite asbestos (amosite), anthophyllite asbestos, tremolite asbestos, crocidolite, and

actinolite asbestos and any of these minerals which have been chemically treated or altered. The precise chemical formulation of each species varies with the location from which it was mined. Therefore, the use of PCM is a generally accepted method for screening airborne fibers. The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 0.1 fiber per cubic centimeter (cc) of air as an 8-hour time-weighted average (TWA) and a limit of 1.0 fiber per cc averaged over a sampling period of thirty (30) minutes.

The asbestos samples ranged in concentration from 0.000 fibers per cc to 0.0088 fibers per cc and the average concentration was 0.003 fibers per cc. The OSHA TWA limit of 0.1 fibers per cc was not exceeded in any samples and asbestos concentrations at the off site locations were consistent with asbestos concentrations during the perimeter background sampling. A complete summary of all asbestos results are presented in Table 3 (Excel file on CD).

4.4 STATISTICAL COMPARISON OF UPWIND AND DOWNWIND CONCENTRATIONS

Concentrations of selected chemicals in upwind and down samples were compared using a matched-pairs design. Differences in chemical concentration (upwind-downwind) were evaluated for samples collected during the 45 sampling events between January 23, 2009 and June 25, 2009. The statistical analysis was limited to those chemicals which had a detection frequency of at least 80 percent. The list of chemicals used in the statistical analysis is presented in Table 4.

Both parametric (t-test) and nonparametric (Wilcoxon signed-rank test) paired difference tests were used to determine whether concentrations were statistically significantly higher in the downwind group of samples. All tests were conducted using the JMP 7 (version 7.0.2) statistical software package (SAS Institute). Both tests evaluated the following one-sided null (H0) and alternative (HA) hypotheses:

H0: downwind concentrations < upwind concentrations
HA: downwind concentrations > upwind concentrations

A 5 percent ($p < 0.05$) level of significance (i.e., equivalent to a 95 percent confidence level) was used to interpret the test results. The paired-difference tests test whether the overall mean (or median in the case of the nonparametric test) difference for all matched pairs of samples is zero. That is, some differences (upwind-downwind) may be positive (indicating the higher result is from the upwind sample) and some may be negative (indicating the higher result is from the downwind sample), but if there is no net

difference between pairs the mean difference will be zero (or not distinguishable from zero within the context of the statistical tests).

It should be noted that the paired-difference t-test and Wilcoxon signed-rank tests are only strictly appropriate when all of the analytical results are detected. When censored (i.e., results below the detection limit or results set to a fixed reporting limit) results are present, specialized versions of both the parametric (e.g., maximum likelihood estimation) and nonparametric (e.g., paired Prentice-Wilcoxon test) tests that explicitly account for varying levels and frequencies of censorship are recommended.

In order to minimize the confounding effect of the censored results, the analysis was restricted to chemicals with at least 80 percent detected results in both the upwind and downwind data sets. Non detect results were evaluated at the detection limit. Metals results reported by the analytical laboratory as zero were set to a concentration equal to one standard deviation. Because the treatments of results reported as zero constitutes another form of censorship, these results were also included with non detect results for the purpose of calculating the 80 percent threshold used to screen chemicals prior to conducting the statistical tests.

Results of the statistical comparisons for 50 chemicals are summarized in Table 4. The raw output from the JMP software is provided in Figure 2. The conclusions presented in Table 4 are based on the most sensitive of the t-test and signed-rank test results (i.e., lowest p value). Only three chemicals, 2-methylnaphthalene, naphthalene, and bromine, were found to be present at statistically significantly higher concentrations in the downwind samples. None of these chemicals are believed to be of significance in the context of the remediation activities at the CAMU STA. A series of graphics are included in the panels for each chemical in Figure 2 that show the relative distribution of the observed differences for all matched pairs of samples. Figure 2 also provides the time series plots (plots of observed result versus sequential sampling event) for the upwind and downwind results. A key is provided at the end of Figure 2 to aid in the interpretation of the raw statistical output.

5.0 REFERENCES

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APPENDIX A

NDEP COMMENTS AND BRC RESPONSES TO COMMENTS

APPENDIX B

FIELD DOCUMENTATION FORMS

APPENDIX C

CALIBRATION AND SAMPLE VOLUME CALCULATION WORKSHEETS

APPENDIX D

CD CONTAINING LABORATORY ANALYTICAL RESULTS AND ECVP REPORTS, ELECTRONIC COPY OF APPENDIX B, TABLE 3, AND COMPLETE REPORT

FIGURES

FIGURE 1 INSERTED HERE

FIGURE 2 INSERTED HERE

TABLES

TABLE 1
SAMPLE COLLECTION SAMPLE HANDLING AND ANALYSIS SPECIFICATIONS FOR SLIT TRENCH AREA
AIR SAMPLING STATIONS
CAMU AREA
HENDERSON, NEVADA

Analytical Parameter	Equipment Manufacturer/ Model	Sample Media	Sample Frequency/ Sample Events	Sample Handling Temperature/ hold time	Laboratory/ Analytical Method
Organochlorine Pesticides (TO-4A)	Tisch Environmental/ TE-1000	Polyurethane foam cartridge/102 mm quartz fiber filter	24hr. cont. sample/every 3 days/10 events	<4°C/7 days	Air Toxics Ltd./Method TO-4A
PCDDs/PCDFs (TO-9A)	Tisch Environmental/ TE-1000	Polyurethane foam cartridge/102 mm quartz fiber filter	24hr. cont. sample/every 3 days/10 events	<4°C/7 days	Frontier Ltd./Method TO-9A
VOCs/SVOCs (TO-13A)	Tisch Environmental/ TE-1000	Polyurethane foam cartridge/102 mm quartz fiber filter	24hr. cont. sample/every 3 days/10 events	<4°C/7 days	Air Toxics Ltd./Method TO-13A
TSP/Metals	BGI, Inc./PQ100	47mm Teflon fiber filter	24hr. cont. sample/every 3 days/10 events	None/30 days	Chester Labnet/ Method IO-2.1; Method IO-3.3
Asbestos	SKC, Inc. 224-PCXR8	25mm mixed cellulose ester filter	24hr. cont. sample/every 3 days/10 events	None/N/A	AES Laboratory/ NIOSH 7400

Notes:

< = less than
°C = degree Celsius
cont. = continuous
hr = hour
PM_{10} = particulate matter less than 10-microns
N/A = not applicable
$\mu g/m^3$ = microgram per cubic meter

TABLE 2
METEOROLGICAL DATA RECORD DURING SLIT TRENCH SAMPLING
JANUARY 23 –JUNE 25, 2009
HENDERSON, NEVADA

Sample Date	Average Wind Degrees	Average Wind Speed (m/s)	Quadrant Wind Blowing From	Respective Upwind Site	Respective Downwind Site
January 23, 2009	1.04	140.26	Southeast	CAMUS2	CAMUS1
January 26, 2009	1.96	232.04	Southwest	CAMUS2	CAMUS1
January 30, 2009	1.56	260.05	Southwest	CAMUS2	CAMUS1
February 4, 2009	1.02	140.24	Southeast	CAMUS2	CAMUS1
February 6, 2009	6.63	164.65	Southeast	CAMUS2	CAMUS1
February 10, 2009	3.62	309.81	Northwest	Indeterminate	Indeterminate
February 12, 2009	3.03	229.23	Southwest	CAMUS2	CAMUS1
February 17, 2009	5.33	210.88	Southwest	CAMUS2	CAMUS1
February 20, 2009	1.04	243.78	Southwest	CAMUS2	CAMUS1
February 24, 2009	1.56	111.39	Southeast	CAMUS2	CAMUS1
February 26, 2009	1.60	150.06	Southeast	CAMUS2	CAMUS1
March 3, 2009	4.35	204.21	Southwest	CAMUS2	CAMUS1
March 5, 2009	1.91	201.77	Southwest	CAMUS2	CAMUS1
March 10, 2009	2.51	69.60	Northeast	Indeterminate	Indeterminate
March 13, 2009	3.30	101.97	Southeast	CAMUS2	CAMUS1
March 17, 2009	0.99	186.32	Southwest	CAMUS2	CAMUS1
March 20, 2009	1.58	89.91	East	Indeterminate	Indeterminate
March 24, 2009	2.57	208.01	Southwest	CAMUS2	CAMUS1
March 27, 2009	4.01	86.02	East	Indeterminate	Indeterminate
March 31, 2009	1.50	83.36	East	Indeterminate	Indeterminate
April 3, 2009	6.40	252.97	Southwest	CAMUS2	CAMUS1
April 7, 2009	2.86	113.23	Southeast	CAMUS2	CAMUS1
April 9, 2009	2.84	110.55	Southeast	CAMUS2	CAMUS1
April 14, 2009	5.64	196.87	Southwest	CAMUS2	CAMUS1
April 16, 2009	3.19	242.52	Southwest	CAMUS2	CAMUS1
April 21, 2009	0.71	195.59	Southwest	CAMUS2	CAMUS1
April 23, 2009	3.81	149.82	Southeast	CAMUS2	CAMUS1
April 28, 2009	6.14	218.28	Southwest	CAMUS2	CAMUS1
May 1, 2009	2.40	120.44	Southeast	CAMUS3	CAMUS1
May 5, 2009	1.96	208.93	Southwest	CAMUS3	CAMUS1

Sample Date	Average Wind Degrees	Average Wind Speed (m/s)	Quadrant Wind Blowing From	Respective Upwind Site	Respective Downwind Site
May 7, 2009	1.99	226.76	Southwest	CAMUS3	CAMUS1
May 13, 2009	4.38	35.05	Northeast	Indeterminate	Indeterminate
May 14, 2009	1.65	120.40	Southeast	CAMUS3	CAMUS1
May 19, 2009	5.07	216.17	Southwest	CAMUS3	CAMUS1
May 21, 2009	1.89	106.82	Southeast	CAMUS3	CAMUS1
May 26, 2009	2.06	214.62	Southwest	CAMUS3	CAMUS1
May 28, 2009	1.46	165.39	Southeast	CAMUS3	CAMUS1
June 2, 2009	2.49	120.48	Southeast	CAMUS3	CAMUS1
June 4, 2009	3.66	172.71	Southeast	CAMUS3	CAMUS1
June 9, 2009	4.03	150.03	Southeast	CAMUS3	CAMUS1
June 11, 2009	2.63	210.16	Southwest	CAMUS3	CAMUS1
June 16, 2009	4.12	147.88	Southeast	CAMUS3	CAMUS1
June 18, 2009	2.01	181.49	Southwest	CAMUS3	CAMUS1
June 23, 2009	2.24	101.27	Southeast	CAMUS3	CAMUS1
June 25, 2009	3.17	102.63	Southeast	CAMUS3	CAMUS1

Notes:

m/s meters per second

TABLE 3

CAMU SLIT TRENCH AIR QUALITY MONITORING SUMMARY

JANUARY 23, 2009 THROUGH JUNE 25, 2009

(Excel File on Attached CD)

TABLE 4

SUMMARY STATISTICS AND RESULTS FOR PAIRED-DIFFERENCE TESTS COMPARING CHEMICAL CONCENTRATIONS IN UPWIND AND DOWNWIND SAMPLES

Chemical	Units	Upwind		Downwind		Mean	Paired Difference Test[b]		Downwind
		Detection Frequency	Maximum Detected	Detection Frequency	Maximum Detected	Difference[a] (Upwind-Downwind)	t-Test p	Signed-Rank p	Significantly Greater Than Upwind?[c]
1,2,3,4,6,7,8-HpCDD	pg/m^3	45 / 45	1,046	45 / 45	312	16.4	0.84	1.00	No
1,2,3,4,6,7,8-HpCDF	pg/m^3	45 / 45	101	45 / 45	30.8	2.50	0.94	1.00	No
1,2,3,4,7,8-HxCDD	pg/m^3	45 / 45	24.1	45 / 45	6.66	0.39	0.84	0.58	No
1,2,3,4,7,8-HxCDF	pg/m^3	45 / 45	112	45 / 45	30.0	2.18	0.88	1.00	No
1,2,3,4,7,8,9-HpCFD	pg/m^3	45 / 45	32.2	45 / 45	8.78	0.92	0.96	1.00	No
1,2,3,6,7,8-HxCDD	pg/m^3	45 / 45	543	45 / 45	137	9.07	0.84	1.00	No
1,2,3,6,7,8-HxCDF	pg/m^3	45 / 45	48.2	45 / 45	13.9	1.00	0.90	1.00	No
1,2,3,7,8-PeCDD	pg/m^3	45 / 45	66.3	45 / 45	19.2	1.08	0.85	1.00	No
1,2,3,7,8-PeCDF	pg/m^3	45 / 45	36.2	45 / 45	9.56	0.81	0.91	1.00	No
1,2,3,7,8,9-HxCDD	pg/m^3	45 / 45	354	45 / 45	92.0	5.83	0.84	0.95	No
1,2,3,7,8,9-HxCDF	pg/m^3	45 / 45	27	45 / 45	7.6	0.54	0.89	1.00	No
1,4-Dichlorobenzene	µg/m^3	36 / 45	15.0	42 / 45	1.70	0.96	1.00	1.00	No
2-Methyl-naphthalene	µg/m^3	37 / 45	0.23	43 / 45	0.740	0.01	0.56	0.02	Yes
2,3,4,6,7,8-HxCDF	pg/m^3	45 / 45	49.8	45 / 45	15.5	0.90	0.88	1.00	No
2,3,4,7,8-PeCDF	pg/m^3	45 / 45	78.0	45 / 45	23.5	1.34	0.86	1.00	No
2,3,7,8-TCDD	pg/m^3	45 / 45	9.5	45 / 45	2.19	0.17	0.85	0.92	No
2,3,7,8-TCDF	pg/m^3	45 / 45	21.7	45 / 45	5.09	0.54	0.93	1.00	No
alpha-BHC	µg/m^3	43 / 44	0.300	43 / 44	0.480	0.03	0.92	0.95	No
Aluminum	µg/m^3	41 / 42	5.29	42 / 42	2.93	0.26	0.94	0.77	No

Chemical	Units	Upwind		Downwind		Mean	Paired Difference Testb		Downwind
		Detection Frequency	Maximum Detected	Detection Frequency	Maximum Detected	Differencea (Upwind-Downwind)	t-Test p	Signed-Rank p	Significantly Greater Than Upwind?c
Barium	µg/m^3	41 / 42	0.096	39 / 42	0.134	0.004	0.83	0.91	No
Bromine	µg/m^3	42 / 42	0.014	42 / 42	0.018	-0.001	0.02	0.00	Yes
Calcium	µg/m^3	42 / 42	12.1	42 / 42	14.70	0.29	0.70	0.46	No
Chlorine	µg/m^3	42 / 42	3.79	42 / 42	6.63	-0.04	0.42	0.89	No
Copper	µg/m^3	41 / 42	0.046	41 / 42	0.050	0.00	0.07	0.07	No
Iron	µg/m^3	42 / 42	3.38	42 / 42	2.92	0.19	0.93	0.89	No
Lead	µg/m^3	35 / 42	0.09	37 / 42	0.024	0.00	0.91	0.89	No
Magnesium	µg/m^3	41 / 42	3.33	41 / 42	2.72	0.16	0.88	0.82	No
Manganese	µg/m^3	42 / 42	0.167	42 / 42	0.075	0.019	1.00	1.00	No
Naphthalene	µg/m^3	40 / 45	0.230	43 / 45	1.60	-0.125	0.03	<0.001	Yes
OCDD	pg/m^3	45 / 45	820	45 / 45	209	13.3	0.83	0.99	No
OCDF	pg/m^3	45 / 45	40	45 / 45	12.4	3.40	1.00	0.99	No
Potassium	µg/m^3	42 / 42	3.04	42 / 42	2.59	0.16	0.92	0.94	No
Rubidium	µg/m^3	39 / 42	0.015	38 / 42	0.010	0.00	0.96	0.98	No
Silicon	µg/m^3	42 / 42	16.4	42 / 42	10.6	0.73	0.90	0.71	No
Strontium	µg/m^3	42 / 42	0.118	41 / 42	0.093	0.00	0.85	0.70	No
Sulfur	µg/m^3	42 / 42	0.80	42 / 42	0.78	0.002	0.55	0.43	No
Titanium	µg/m^3	42 / 42	0.50	42 / 42	2.59	-0.01	0.41	0.99	No
Total HpCDD	pg/m^3	45 / 45	2,006	45 / 45	605	31.32	0.84	1.00	No
Total HpCDF	pg/m^3	45 / 45	219	45 / 45	64.7	5.170	0.93	1.00	No
Total HxCDD/	pg/m^3	45 / 45	6,666	45 / 45	1,878	107.5	0.84	1.00	No

Chemical	Units	Upwind		Downwind		Mean	Paired Difference Testb		Downwind
		Detection Frequency	Maximum Detected	Detection Frequency	Maximum Detected	Differencea (Upwind-Downwind)	t-Test p	Signed-Rank p	Significantly Greater Than Upwind?c
Total HxCDF	pg/m^3	45 / 45	647	45 / 45	194	11.92	0.88	1.00	No
Total PeCDD/	pg/m^3	45 / 45	8,040	45 / 45	2,623	122	0.84	1.00	No
Total PeCDF	pg/m^3	45 / 45	1,397	45 / 45	411	24.0	0.86	1.00	No
Total TCDD	pg/m^3	45 / 45	6,588	45 / 45	1,960	104	0.84	1.00	No
Total TCDF	pg/m^3	45 / 45	2,404	45 / 45	568	39.6	0.83	1.00	No
TOTAL TEQ (Calculated)	pg/m^3	45 / 45	230	45 / 45	63	4	0.85	1.00	No
TSP	µg/m^3	44 / 44	210	44 / 44	245	4.6	0.71	0.61	No
Vanadium	µg/m^3	39 / 42	0.024	37 / 42	0.022	0.00	0.97	0.99	No
Zinc	µg/m^3	42 / 42	0.410	42 / 42	0.850	-0.013	0.27	0.92	No
Zirconium	µg/m^3	37 / 42	0.038	37 / 42	0.025	0.003	0.98	0.98	No

Notes:

[a] The mean difference for all pairs (Upwind-Downwind) of samples

[b] Parametric (t-test) and nonparametric (Wilcoxon signed-rank) paired difference tests of the following 1-sided null (H0) and alternative (HA) hypotheses- H_0: Downwind < Upwind; H_A: Downwind > Upwind. p is the significance level for the tests. If p is less than or equal to 0.05 H0 is rejected and it is concluded that the downwind results are significantly higher. Results should be interpreted witih caution for chemicals with censored (nondetect) results in one or both data sets. Censored results were evaluated at the detection limit. Specialized parametric (maximum likelihood estimation) and nonparametric (paired Prentice-Wilcoxon tests) methods that account for left-censored results are recommended to eliminate potential bias in these cases, however, these tests are not currently available in mainstream commercial statistical software packages. Only chemicals with at least 80 percent detected results in both the upwind and downwind data sets are presented in this table (results reported as zero by the laboratory were set to one standard deviation in the database and therefore were treated as censored results for the purpose of calculating the 80 percent minimum threshold for inclusion in this table).

[c] Conclusion based on the most sensitive (lowest p value) test result.

µg/m^3 micrograms per cubic meter
pg/m^3 picograms per cubic meter