

**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR  
THE GALLERIA NORTH OF ROW SUB-AREA**

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

2013 JUN 24 PM 12 05

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June 21, 2013

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**Subject: Human Health Risk Assessment and Closure Report for the Galleria North of ROW Sub-Area, BMI Common Areas (Eastside), Clark County, Nevada**

Dear Greg:

On behalf of Lee Farris and Ranajit Sahu please find enclosed the *Human Health Risk Assessment and Closure Report for the Galleria North of ROW Sub-Area, BMI Common Areas (Eastside), Clark County, Nevada*. A PDF copy of the report is included on the CD in Appendix B, as well as all tables, live calculation spreadsheets, models, and text in their native format (MS Word and Excel) and an electronic version of the dataset.

Appendix K (Legal Description) will be sent separately at a later date. If you have any questions or comments, please contact me at 916-924-9378, Ranajit Sahu at 626-382-0001, or Lee Farris at 702-567-0400.

Sincerely,

Mark K. Jones  
Project Manager

Enclosures: Human Health Risk Assessment and Closure Report for the Galleria North of ROW Sub-Area, BMI Common Areas (Eastside), Clark County, Nevada

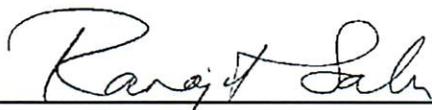


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I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession 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 was generated by a laboratory certified by the NDEP for each constituent and media presented herein.



August 1, 2013

Dr. Ranajit Sahu, C.E.M. (No. EM-1699, Exp. 10/07/2013)      Date  
BRC Project Manager

## 5.0 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The broad suite of analytes sampled for was the initial list of potential COPCs at the Site. However, to ensure that a risk assessment focuses on those substances that contribute the greatest to the overall risk (USEPA 1989); the following procedures were used to eliminate analytes as COPCs for quantitative evaluation in the risk assessment:<sup>32</sup>

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

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

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

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

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<sup>32</sup> Note that these procedures for selection of COPCs deviate somewhat from those presented in the *BRC Closure Plan*, but are consistent with discussions between BRC and NDEP and their consultants in a December 9, 2010, meeting. BRC will use these procedures for all subsequent risk assessments. BRC intends to revise the *BRC Closure Plan* accordingly to make it consistent with these procedures.

As indicated in the *Background Soil Compilation Report* (BRC and ERM 2010d), the Site is in an area of McCullough lithology (see Figure 12, Qh<sub>1</sub> label).<sup>33</sup> Therefore, comparison of Site-related soil concentrations to background levels was conducted using the shallow Qal McCullough background dataset presented in the *Background Soil Compilation Report* (BRC and ERM 2010d). The background dataset used is included in the dataset file on the enclosed report CD in Appendix B.

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

For samples with primary and field duplicate results, the Site sample and field duplicate<sup>34</sup> are treated as independent samples and both are included in all subsequent data analyses, regardless of whether one or both are non-detect. This is considered appropriate because field duplicate samples represent a discrete and unique measurement of soil chemical conditions proximal to the primary sample (unlike split samples). The field duplicates were compared to the primary sample during the course of data validation. The variances were not out of the line with the variance in results across the Site. Therefore, as distinct soil chemical measurements, they are treated as unique samples in the analyses.

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<sup>33</sup> As noted in a letter dated September 17, 2012, from Greg Lovato, NDEP, to Mark Paris, BRC, the 2003 soil background dataset collected by Environ for the City of Henderson is not used for background soil comparison purposes.

<sup>34</sup> Field duplicates are shown in Appendix B and indicated with the "FD" qualifier under the column entitled "Sample Type."

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

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

<b>Chemical</b>	<b>Greater than Background?</b>	<b>Basis</b>
<b>Aluminum</b>	<b>YES</b>	Multiple tests
<b>Antimony</b>	<b>NO</b>	Multiple tests; ND at Site
<b>Arsenic</b>	<b>YES</b>	Multiple tests
<b>Barium</b>	<b>YES</b>	Multiple tests
<b>Beryllium</b>	<b>NO</b>	Multiple tests
<b>Boron</b>	<b>YES</b>	Multiple tests
<b>Cadmium</b>	<b>YES</b>	Multiple tests
<b>Calcium</b>	<b>YES</b>	Slippage test
<b>Chromium</b>	<b>YES</b>	Multiple tests
<b>Chromium (VI)</b>	<b>YES</b>	Quantile test
<b>Cobalt</b>	<b>NO</b>	Multiple tests
<b>Copper</b>	<b>YES</b>	Multiple tests
<b>Iron</b>	<b>YES</b>	Multiple tests
<b>Lead</b>	<b>YES</b>	Multiple tests
<b>Lithium</b>	<b>YES</b>	Multiple tests
<b>Magnesium</b>	<b>YES</b>	Slippage test
<b>Manganese</b>	<b>YES</b>	Multiple tests
<b>Mercury</b>	<b>YES</b>	WRS test
<b>Molybdenum</b>	<b>YES</b>	Multiple tests
<b>Nickel</b>	<b>NO</b>	Multiple tests
<b>Potassium</b>	<b>YES</b>	Multiple tests
<b>Selenium</b>	<b>YES</b>	Multiple tests
<b>Silver</b>	<b>YES</b>	Quantile test
<b>Sodium</b>	<b>NO</b>	Multiple tests

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

Chemical	Greater than Background?	Basis
Strontium	YES	Multiple tests
Thallium	NO	Multiple tests; only (2 out of 149) detects at Site, both below max.
Tin	YES	Multiple tests
Titanium	YES	Quantile test
Tungsten	YES	Multiple tests
Uranium	YES	Multiple tests
Vanadium	YES	Multiple tests
Zinc	YES	Multiple tests
Radium-226	NO	Multiple tests
Radium-228	NO	Multiple tests
Thorium-228	NO	Multiple tests
Thorium-230	NO	Multiple tests
Thorium-232	NO	Multiple tests
Uranium-233/234	NO	Multiple tests
Uranium-235/236	NO	All other radionuclides (and uranium) not greater than background; all results near noise level of instrument
Uranium-238	NO	Multiple tests

Cumulative probability plots and side-by-side boxplots<sup>35</sup> were also prepared and are included in Appendix G. These plots give a visual indication of the similarities and differences between the Site and background datasets. The results of this comparison indicate that a number of metals are statistically significant (greater than) with respect to background levels. Due to the large number of sample data in both the Site and background datasets, even small differences between the two are identified as statistically significant. For example, although there were small differences in median concentrations, cobalt, uranium, and zinc were found to be statistically greater than background, as shown in Table 5-3.

<sup>35</sup> Site and background boxplots were segregated by depth (and all data). This is different than how the data were segregated in the development of exposure point concentrations as presented in Section 6.1.

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

Metal	Difference <sup>1</sup>
Copper	1 mg/kg
Uranium	0.05 mg/kg
Zinc	8 mg/kg
1 These differences in median concentrations were small relative to both background median concentrations and residential soil BCLs.	

It should be noted that statistically significant differences may not represent scientifically and technically relevant differences.

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

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

Chain	Equivalence Test		Secular Equilibrium?	Mean Proportion			
	Delta	p-value		Ra-226	Th-230	U-233/234	U-238
U-238	0.1	<0.0001	Yes	0.2401	0.2869	0.2448	0.2281
				Ra-228	Th-228	Th-232	
Th-232	0.1	<0.0001	Yes	0.3156	0.3459	0.3385	

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

## 5.2 ESSENTIAL NUTRIENTS

An essential nutrient is a chemical required for normal body functioning that either cannot be synthesized by the body at all, or cannot be synthesized in amounts adequate for good health, and thus must be obtained from a dietary source. USEPA (1989) states that “Chemicals that are (1) essential human nutrients, (2) present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and (3) toxic only at very high doses (i.e., much higher than those that could be associated with contact at the Site) need not be considered further in the quantitative risk assessment. Examples of such chemicals are calcium, iron, magnesium, potassium, and sodium.” As discussed with and approved by the NDEP<sup>36</sup> and consistent with guidance and standard practices, no further quantitative evaluations are required for these essential nutrients.

## 5.3 COMPARISON TO RESIDENTIAL SOILS BCLs

BCLs for residential soils are chemical-specific, risk-based concentrations in soils that are protective of a residential land use scenario (NDEP 2013). As discussed with and approved by the NDEP (see footnote 32), if the maximum detected concentration for a constituent is less than one-tenth of the residential soil BCL, then no further quantitative evaluation is required for that constituent. For those constituents with 100 percent non-detect values, if the maximum non-detect concentration<sup>37</sup> for a constituent is less than one-tenth of the residential soil BCL, no further evaluation will be conducted. If the maximum non-detect concentration is greater than one-tenth of the residential soil BCL, no further quantitative evaluation will be conducted; however, a discussion is provided in the Uncertainty Analysis (Section 7) for these constituents.

Consistent with the Closure Plan, if the TCDD TEQ concentrations do not exceed the NDEP worker BCL of 50 ppt for any sample within the Site,<sup>38</sup> dioxins/furans are not retained as COPCs. Therefore, because this criterion is met for the Site, dioxins/furans are not considered COPCs, and are not evaluated further in the HHRA. Lead was also not evaluated further in the HHRA since all concentrations were below its target goal of 400 mg/kg for residential land use.

The results of comparisons to one-tenth of the residential soil BCL are presented in Table 5-5 (Tables section). Two organic compounds and seven inorganic/metals were found to exceed their

<sup>36</sup> Meeting with NDEP on December 9, 2010.

<sup>37</sup> The non-detect value is equal to the SQL.

<sup>38</sup> See Section 2.5 for a discussion on future land use for the Galleria Dr. Right-of-Way.

respective one-tenth of the residential soil BCL (one inorganic chemical, asbestos, does not have BCLs, but does have relevant and available toxicity criteria).

#### 5.4 SUMMARY OF SELECTION OF COPCS

The procedures for COPC selection were discussed above. Results of the selection of COPCs, including the rationale for excluding chemicals as COPCs are presented in Table 5-6 (Tables section). The resulting COPCs for soil are summarized below.

- Asbestos
- Aluminum
- Lithium
- Strontium
- Carcinogenic PAHs
- Perchlorate
- Arsenic
- Manganese
- Vanadium

These procedures apply to soil results. Ambient air exposures for VOCs are evaluated on a sample-by-sample basis, per NDEP requirements, using the surface flux data measurements. See Section 6.1.2 for selection of VOCs for further evaluation in the HHRA. Therefore, the maximum surface flux risk estimates are summed with the soil risk estimates to provide an upper-bound risk for each receptor.

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**BMI COMMON AREAS (EASTSIDE)  
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Prepared by:  
Basic Remediation Company LLC  
875 Warm Springs Road  
Henderson, Nevada 89011

**JUNE 2013**

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.



June 21, 2013

Dr. Ranajit Sahu, C.E.M. (No. EM-1699, Exp. 10/07/2013)      Date  
BRC Project Manager

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## APPENDICES

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- K Legal Description of the Galleria North of ROW Sub-Area

## ACRONYMS AND ABBREVIATIONS

$\mu\text{g/L}$	microgram per liter
$\mu\text{m}$	micrometer
$\mu\text{g/m}^3$	microgram per cubic meter
$\mu\text{g/m}^2 \text{ min}^{-1}$	microgram per square meter per minute
Aa	alluvial aquifer
ADD	average daily dose
AOC3	Settlement Agreement and Administrative Order on Consent, Phase 3
ARR	asbestos-related risk
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
BCL	Basic Comparison Level
bgs	below ground surface
BMI	Basic Management, Inc.
BRC	Basic Remediation Company
CAMU	Corrective Action Management Unit
CD	compact disc
cm	centimeter
$\text{cm}^3$	cubic centimeter
CoH	City of Henderson
COPC	chemical of potential concern
CSF	cancer slope factor
CSM	conceptual site model
DAF	dilution attenuation factor
DBS&A	Daniel B. Stephens & Associates, Inc.
DOE	U.S. Department of Energy
DQIs	data quality indicators
DQOs	data quality objectives
DVSR	Data Validation Summary Report
EC	exposure concentration
ECI	Environmental Conditions Investigation
ERM	Environmental Resources Management
FSSOP	Field Sampling and Standard Operating Procedures
GC/MS	gas chromatograph/mass spectrometry
GES	Geotechnical and Environmental Services
GiSdT <sup>®</sup>	Guided Interactive Statistical Decision Tools
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	hazard index

### ACRONYMS AND ABBREVIATIONS (Continued)

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

**ACRONYMS AND ABBREVIATIONS (Continued)**

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

## EXECUTIVE SUMMARY

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

The HHRA evaluates the potential for adverse human health impacts that may occur as a result of potential exposures to residual concentrations of chemicals in soil, groundwater, and air following remediation of the Site. If the residual risks do not pose an unacceptable risk to human health and the environment, then an NFAD will be requested from the NDEP. Upon issuance of an NFAD by the NDEP, redevelopment of the Site is expected to proceed in a manner consistent with the Environmental Covenant (Instrument 201102030002818 Clark County Records Office) that is attached to the property. This report also describes the various remediation actions that were performed and presents the subsequent confirmation data collected in 2009 through 2013 at the Site.

## BACKGROUND

An initial confirmation sampling investigation was conducted at the Site in 2009 in accordance with BRC's Sampling and Analysis Plan for the Galleria North Sub-Area (SAP, approved by the NDEP on November 12, 2008), with follow-up sampling in 2010, 2013, and 2013. The SAP addressed sampling procedures such that remaining contaminants and their potential impacts to future Site uses (as discussed in Section 1.1 of the *BRC Closure Plan* for the BMI Common Areas [BRC, Environmental Resources Management (ERM), and Daniel B. Stephens & Associates, Inc. (DBS&A) 2007<sup>1</sup>]) can be determined. The Site investigation involved collection of soil matrix and surface flux samples from throughout the Site. The sampling plan performed for this purpose, as described in Section 4 of the SAP (BRC 2008), was consistent with the approach presented in Section 2 of the *Statistical Methodology Report* (NewFields 2006). The *Statistical Methodology Report* describes the statistical methods that are used to confirm the final

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

soils closure at each of the Eastside sub-areas of the BMI Common Areas. Several subsequent rounds of soil remediation and confirmation sampling were performed. The final number of samples collected was determined to be adequate for the completion of a statistically robust dataset upon which to perform an HHRA.

### **CONCEPTUAL SITE MODEL**

The conceptual site model for the Site considers current and potential future land-use conditions. Currently, the Site is undeveloped. Current receptors that may be exposed to Site chemicals of potential concern (COPCs) include on-site trespassers, occasional on-site workers, and off-site residents. Future receptors identified as “on-site receptors” are defined as receptors located within the current Site boundaries (Figure 1), while future “off-site receptors” are those located outside the current Site boundaries. Under the prospective redevelopment plan, the Site is proposed for use by residential redevelopment (low and medium density), parks and trails, and associated roads and parking areas. Therefore, the HHRA assumes unrestricted land use.

Future receptors may include on-Site residents, indoor commercial workers, outdoor maintenance workers, and construction workers. Due to the requirement for use of default reasonable maximum exposure parameters for future receptors, exposures to future receptors are greater than current exposures. Accordingly, only future receptors were assessed in the HHRA. Potential exposures to off-site residents were qualitatively evaluated.

The entire Site will be enhanced by restoration and redevelopment once remediation is complete. Therefore, there is no exposure to ecological receptors, because the Site will be prepared for human use in residential, commercial, or park setting. The HHRA conforms to the methodology included in Section 9 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010).

### **DATA REVIEW AND USABILITY EVALUATION**

A data review and usability evaluation was performed to identify appropriate data for use in the HHRA. The results of the data usability evaluation indicate that the data collected from 2009 through 2013 are adequate in terms of quality for use in a risk assessment.

### **HUMAN HEALTH RISK ASSESSMENT**

An HHRA was conducted to determine if chemical concentrations in Site soils are either: (1) representative of background conditions; or (2) do not pose an unacceptable risk to human health and the environment under current and potential future use conditions. The HHRA

followed the procedures outlined in U.S. Environmental Protection Agency (USEPA) and the NDEP guidance documents. As noted above, the HHRA also conforms to the methodology presented in Section 9 of the NDEP-approved *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010) and includes all COPCs for the Site. Radionuclides were not included as COPCs because they were consistent with background conditions. Results of the HHRA are summarized below.

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

	<b>Future On-Site Resident</b>	<b>Construction Worker</b>	<b>Commercial (Indoor) Worker</b>	<b>Maintenance (Outdoor) Worker</b>
Site Non-Cancer HI <sup>1</sup>	2.1	0.53	0.031	0.056
Background Non-Cancer HI <sup>2</sup>	1.2	--	--	--
Site Cancer Risk <sup>3</sup>	$1 \times 10^{-5}$	$2 \times 10^{-7}$	$7 \times 10^{-7}$	$1 \times 10^{-6}$
Background Cancer Risk <sup>2</sup>	$1 \times 10^{-5}$	--	--	--
Asbestos Risk <sup>4</sup>	0 to $2 \times 10^{-7}$	0 to $3 \times 10^{-7}$	0 to $4 \times 10^{-8}$	0 to $8 \times 10^{-8}$

Note that risks were calculated for the entire Site and not evaluated for separate exposure areas.

1 – HI = hazard index; the value presented is the total cumulative non-cancer HI.

2 – Background risks were calculated for future on-Site residents only.

3 – Cancer risk is the maximum theoretical upper-bound incremental lifetime cancer risk (ILCR).

4 – Asbestos risks represent the cumulative asbestos risks for chrysotile and amphibole fibers. However, the risk estimates are dominated by amphibole, which fiber type was not detected at the Site in the confirmation samples.

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

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

The NDEP has recently determined that risk assessments for Eastside property sub-areas do not need to evaluate the pathway of radon migration from groundwater to indoor air for sub-areas with a separation distance of at least 15 feet between any current or future building structure base and the high water table (letter dated November 9, 2010, from Greg Lovato, NDEP, to Mark

Paris, BRC). Therefore, given the depth to groundwater at the Site is at least 25 feet below ground surface (bgs), the intrusion of radon into indoor air is not evaluated in the HHRA.

## EVALUATION OF UNCERTAINTIES

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

## POTENTIAL IMPACTS TO GROUNDWATER

As noted in a letter dated September 17, 2012, from Greg Lovato, NDEP, to Mark Paris, BRC, HHRA reports for the project no longer evaluate the potential leaching impacts to groundwater for any sub-area. This issue will be addressed in the Eastside groundwater remedial alternatives study. As provided for in Section XVII of the Phase III Administrative Order on Consent, No Further Action Determinations issued for sub-areas are subject to continuing Work to address Water Pollution Conditions, Operation and Maintenance, maintenance of existing Institutional Controls, and/or Efficacy Review.

## SUMMARY

Based on the results of the various investigations, the HHRA, and the conclusions presented there from in this report, exposures to residual levels of chemicals in soil at the Galleria North of ROW Sub-Area should not result in adverse health effects to any of the future receptors evaluated. As a result, an NFAD for the Galleria North of ROW Sub-Area is warranted, given the following provisos:

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

2. The soils beneath 10 feet bgs of the Recorded Environmental Covenant (Instrument 201102030002818 Clark County Records Office) redevelopment grading plan for the Site have not been evaluated to date. Accordingly, the NFAD does not pertain to soil below the top 10 feet of the redevelopment grading plan for the Site. The property owner should note that these soils should not be disturbed without additional investigation or evaluation. BRC understands that this provision will be reflected in an Environmental Covenant for the Site.
3. The property owner should ensure that activities at the Site do not exacerbate existing, subsurface, environmental conditions. The redevelopment grading plan (Figure 2) that has been prepared for redevelopment of the Site has been incorporated as an Environmental Covenant for the Site to control subsurface excavation.
4. Site use is otherwise suitable for purposes of residential, recreational, civic, commercial, or industrial use.

## 1.0 INTRODUCTION

Basic Remediation Company LLC (BRC) has prepared this Human Health Risk Assessment (HHRA) and Closure Report for the Galleria North of Right-of-Way (ROW) Sub-Area (Site; Figure 1) of the Basic Management, Inc. (BMI) Common Areas (Eastside) in Clark County, Nevada. The Site consists of a portion of the Galleria North Sub-Area as originally defined within the Eastside property. The purpose of this report is to support a request for a No Further Action Determination (NFAD) by the Nevada Division of Environmental Protection (NDEP) for the Site.<sup>2</sup> As presented in Section XVII.1.a. of the *Settlement Agreement and Administrative Order on Consent: BMI Common Areas, Phase 3* (AOC3; NDEP 2006), the NDEP acknowledges that discrete Eastside areas may be issued an NFAD as remedial actions are completed for selected environmental media. Any such NFAD request shall identify the remedial actions and other work completed at the property in question, the results of such remedial actions and other work, the proposed land use(s), and the reasons supporting the eligibility of the property for an NFAD. This report provides this information for the Site.

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

1. The NFAD does not pertain to groundwater. BRC retains the responsibility to address any environmental impacts to groundwater beneath the Site, pursuant to the AOC3. As such, additional investigation may be necessary on the Site as it relates to BRC's responsibilities for groundwater. BRC must be granted access to the Site for activities such as well or soil boring installations or other investigative or remedial efforts.
2. The soils beneath 10 feet below ground surface (bgs) of the redevelopment grading plan for the Site have not been evaluated to date. Accordingly, the NFAD does not pertain to soil below the top 10 feet of the redevelopment grading plan for the Site. The property owner should note that these soils should not be disturbed without additional investigation or evaluation.

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<sup>2</sup> Note that a small portion (6.7 acres; identified on several of the figures in this report) of the Site was granted an NFAD by the NDEP on January 29, 2013. This NFAD was granted for purposes of construction of Galleria Dr. However, portions of the previous NFAD include property outside the roadway footprint. Therefore, this portion has been included in this current report as part of the Site such that the NFAD will be extended to include retail/commercial land use, along with the rest of the Site.

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

As stated in Section VI of the NDEP's *Record of Decision, Remediation of Soils and Sediments in the Upper and Lower Ponds at the BMI Complex* (ROD; NDEP 2001), cleanup of the Site proceeded under Alternative 4B (soils transferred from the Site to a dedicated Corrective Action Management Unit [CAMU] within the BMI Complex),<sup>3</sup> as identified and described in Section 9 of the Remedial Alternatives Study (RAS) for the Eastside. The *Remedial Alternatives Study for Soils and Sediments in the Upper and Lower Ponds at the BMI Complex* (Environmental Resources Management [ERM] 2000) was submitted to the NDEP in March 2000. The RAS is documented via issuance of the ROD, dated November 2, 2001, by the NDEP.

This report is consistent in format with prior closure reports for other study areas, and incorporates comments received from the NDEP on those reports. Appendix A has been reserved for potential future NDEP comments on this report and BRC's response to these comments. An electronic version of the entire report, as well as original format files (MS Word and MS Excel) of all text, tables, modeling, and risk calculations are included on the report compact disc (CD) in Appendix B.

## 1.1 PURPOSE OF THE RISK ASSESSMENT

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

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<sup>3</sup> Under this alternative, the Site could be developed in accordance with the current development plan and the recorded Environmental Covenant for the Site that assures appropriate management of soils beneath 10 feet bgs (post-graded), should they need to be disturbed in the future.

associated with past Site activities.<sup>4</sup> Pending issuance of an NFAD by the NDEP, redevelopment of the Site is expected to proceed in a manner consistent with the Recorded Environmental Covenant attached to the property.

As presented in Section 2.5 of the *Sampling and Analysis Plan for the Galleria North Sub-Area, BMI Common Areas (Eastside) Clark County, Nevada* (BRC 2008; hereinafter "SAP"; approved by the NDEP on November 12, 2008), the only remediation conducted at the Site prior to sampling in accordance with the SAP involved tamarisk and debris removal. When the sampling conducted in accordance with the SAP was performed, areas within the Site that warranted remediation were identified, as discussed in Section 3.3. These areas have been addressed.

For human health protection, BRC's goal is to remediate Site soils such that they are suitable for residential uses, assuring health-protective conditions at 1/8<sup>th</sup>-acre exposure areas. The 1/8<sup>th</sup>-acre area corresponds to the size of a typical residential lot size, as presented in the U.S. Environmental Protection Agency (USEPA) guidance (1989) and is applicable to future Site conditions. It should be noted that sampling has not occurred on every 1/8<sup>th</sup>-acre exposure area. Rather, the statistical protocol presented in the NDEP-approved *BRC Closure Plan* (BRC, ERM, and Daniel B. Stephens & Associates, Inc. [DBS&A] 2007) and *Statistical Methodology Report* (NewFields 2006) was followed, which allows estimates to be applied to 1/8<sup>th</sup>-acre exposure areas based on similar populations across the Site. The decision can hence be made simultaneously for many 1/8<sup>th</sup>-acre exposure areas based on the data and documentation that the exposure areas can be aggregated. This can result in aggregation across the entire Site if concentration distributions appear to be relatively homogeneous and representative of a single population, or within separate sub-areas of the Site if those sub-areas exhibit different distributions. Note that an assumption was made in the SAP for the Galleria North Sub-Area (see Section 3.4 of that document) that the concentration distribution across the entire Site is relatively homogeneous. This assumption was evaluated prior to performing the risk assessment, and was found to be valid for the Site (Section 6.1.1).

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<sup>4</sup> The HHRA presents total Site-related risk. Background risk is the risk to which a population is normally exposed, and does not include risks from Site contamination. Total Site-related risk includes both incremental (Site only) and background risks. Because naturally occurring constituents are typically included in a risk assessment (i.e., metals and radionuclides), the total Site-related risk will have some element of total risk included. However, because risks are only calculated for a subset of metal and radionuclides, a 'total' risk is not calculated. In instances where the total Site-related risk is calculated to exceed a cancer risk of 10<sup>-5</sup> (typically when radionuclides are included in the risk assessment calculations) or a non-cancer hazard index greater than 1.0, then a background risk, only including those naturally occurring constituents included in the risk assessment, will also be calculated to provide context to the risk assessment results.

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

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

- Post-NFAD chemical and radionuclide concentrations in Site soils are targeted to have an associated residual, cumulative theoretical upper-bound incremental lifetime cancer risk (ILCR) level point of departure of  $10^{-6}$ . This is the target risk goal for the project. For cases where the NDEP identifies this goal to be unfeasible, it is BRC's understanding that the NDEP will re-evaluate the goal in accordance with USEPA (1991a) guidance. In no case will the residual, cumulative theoretical upper-bound carcinogenic risk levels exceed those allowed per USEPA guidance.
- Post-NFAD chemical concentrations in Site soils are targeted to have an associated cumulative, non-carcinogenic hazard index (HI) of 1.0 or less. If the screening HI is determined to be greater than 1.0, target organ-specific HIs will be calculated for primary and secondary organs. The final risk goal will be to achieve target organ-specific non-carcinogenic HIs of 1.0 or less.
- Where background levels exceed risk level goals or chemical-specific remediation goals, metal concentrations and radionuclide activities in Site soils are targeted to have risks no greater than those associated with background conditions.

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

For dioxins/furans and polychlorinated biphenyl (PCB) congeners, the USEPA toxicity equivalency (TEQ) procedure, developed to describe the cumulative toxicity of these compounds, is used. This procedure involves assigning individual toxicity equivalency factors (TEFs) to the 2,3,7,8 substituted dioxin/furan and PCB congeners. TEFs are estimates of the toxicity of dioxin-like compounds relative to the toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), which is assigned a TEF of 1.0. Calculating the TEQ of a mixture involves multiplying the concentration of individual congeners by their respective TEF. One-half the detection limit is used for calculating the TEQ for individual congeners that are non-detect in a particular sample. The sum of the TEQ concentrations for the individual congeners is the TCDD TEQ concentration for the mixture. TEFs from USEPA (2010) are used.<sup>5</sup> Consistent with the Agency for Toxic Substances and Disease Registry (ATSDR) *Update to the ATSDR Policy Guideline for Dioxins and Dioxin-Like Compounds in Residential Soil* (2008), the target goal for retail/commercial land use is the ATSDR screening value and the NDEP worker Basic Comparison Level (BCL; NDEP 2013) of 1,000 parts per trillion (ppt) TCDD TEQ.

## 1.2 METHODOLOGY AND REGULATORY GUIDANCE

This risk assessment follows procedures outlined in USEPA *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual* (RAGS; USEPA 1989), and conforms to Section 9 (Risk Assessment Methodology—Human Health) of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010) which was approved by the NDEP on July 16, 2007. Various NDEP guidance documents are also relied on for the risk assessment (as referenced throughout this report). In addition, the NDEP's BCLs (NDEP 2013) are used for comparison of Site characterization data to provide for an initial screening evaluation, assist in the evaluation of data usability, and aid in determination of extent of contamination. A full list of guidance documents consulted is provided in Section 6 and the References section at the end of this document.

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

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<sup>5</sup> Consistent with the letter dated November 9, 2010, from Greg Lovato, NDEP, to Mark Paris, BRC. BRC will revise the *BRC Closure Plan* accordingly.

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

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

### 1.3 REPORT ORGANIZATION

The closure report is composed of 11 sections, as outlined below:

- This section (Section 1) presents the purpose of the risk assessment and the methods used in this assessment.

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<sup>6</sup> As noted in the *BRC Closure Plan*, per discussions with the NDEP, the DQO process is addressed, on an Eastside sub-area by sub-area basis (for soils), in the respective sub-area SAPs developed for each sub-area relating to the soils cleanup. Therefore, the DQO process for the Site is presented in the SAP and is not repeated here. This DQO process was incorporated in the data usability/data adequacy evaluation for the Site data used in the risk assessment.

- Section 2 presents Site background, the environmental setting for the Site, and a summary of previous investigations. Section 2 also presents the CSM for the risk assessment. This includes identification of potentially exposed populations, and the potential pathways of human exposure.
- Section 3 presents the confirmation data collected from 2009 through 2013, as well as discussions on the various remedial actions conducted at the Site.
- Section 4 presents data evaluation procedures, including statistical analysis of background concentrations, and data usability and quality.
- Section 5 presents the selection of COPCs recommended for further assessment, including comparisons of Site metals and radionuclides to background conditions.
- Section 6 presents the HHRA. This includes relevant statistical analyses, determination of representative exposure point concentrations, applicable fate and transport modeling, exposure assessment, toxicity assessment, and risk characterization.
- In Section 7, the uncertainties associated with the risk assessment are discussed.
- A summary of the risk assessment results is provided in Section 8.
- The data quality assessment for the risk assessment is presented in Section 9.
- A summary of the HHRA and Closure Report is provided in Section 10; and
- A list of references is provided in Section 11.

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

## 2.0 SITE DESCRIPTION

This section presents a description of the Site, including Site background and history, the environmental setting, and a summary of previous investigations. The area known as the “BMI Common Areas,” of which the Galleria North of ROW Sub-Area is a part, is delineated in Appendix A of the AOC3. The subject Site is near the BMI Industrial Complex, in Clark County, Nevada, approximately 13 miles southeast of Las Vegas, within the City of Henderson (CoH) corporate limits, northeast of the City Hall (Figure 1). The total extent of the Site is 78 acres. The Site is a portion of the sub-area within the Eastside property that was previously defined as the Galleria North Sub-Area in Section 1 and Figure 1-2 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010).

The Site is south of the CoH northern Rapid Infiltration Basins (RIBs), east of the CoH Water Reclamation Facility (WRF), and contains the northernmost Upper Ponds portion of Eastside. The Weston Hills residential development is immediately northeast of the Site, and the Tuscany residential development is located immediately adjacent to the east of the Site. The Galleria Drive ROW forms the southern boundary of the Site; this ROW was granted an NFAD (assuming use as a roadway) by the NDEP on January 29, 2013. The width of the ROW varies from approximately 200 to 550 feet, and is larger than needed for Galleria Drive proper. Therefore, the northern portion of the ROW is included in the Site, and is evaluated in the risk assessment for unrestricted land use (see Figure 1).

The southern part of the Site contains a portion of the Upper Ponds, which were once associated with historical conveyance and/or disposal of operations effluent and cooling water by companies operating at the BMI Complex. The individual ponds are distinct and typically defined by 4- to 6-foot tall berms along the north, east, and west sides. In general, the berms are relatively uniformly shaped, often with angular corners showing little evidence of erosion. In addition, a former effluent conveyance ditch traverses the westernmost point of the Site at the edge of the City WRF. From 1942 through 1976, various plant wastewaters were discharged into this conveyance ditch (named the Beta Ditch) and the above-referenced former effluent ponds. Since 1976, these features have been unused. A segment of the Pittman Lateral pipeline traverses the Site along much of the northern Site boundary. This east-west trending subsurface feature is a major water supply conduit for the Las Vegas Valley.

## 2.1 SITE HISTORY

Approximately 400 of the more than 2,200 acres comprising the BMI Common Areas contained a network of ditches, canals, flumes, and unlined ponds that were used for the disposal of aqueous waste from the original magnesium plant and, later, other industrial plants and the adjacent municipality. Effluent wastes discharged to the ponds of the BMI Common Areas from the war-time Basic Magnesium operations can be characterized as salts from the production process (chloride salts of a variety of metals and radionuclides), organic solids, and inorganic solids and dissolved components of various types. Chlorinated organic chemicals were included in the effluent. Notable processes that contributed to the waste stream from the plants that succeeded Basic Magnesium included effluents from the manufacture of the following types of products: chlorine and sodium hydroxide (caustic soda); a variety of chlorate and perchlorate compounds, and halogenated boron compounds; manganese dioxide; titanium and related compounds; and a variety of pesticides. Among these wastes were salts, organic and inorganic chemicals, and metals. A more detailed description of these processes and their effluents is found in Sections 2.2 and 2.3 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010).

## 2.2 ENVIRONMENTAL SETTING

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

The Site (Figure 3) comprises 78 acres of undeveloped land with little surface relief that is gently sloping to the northeast. The Site is currently undeveloped, except for the former effluent ponds, the Beta Ditch segment and the Pittman Lateral. As depicted on Figure 3, the Site has no other features of historical use; this Site has historically been undeveloped and unused. The native soils are compacted, poorly sorted, non-plastic, light brown to red silty sand with varying amounts of gravel.

### 2.2.1 Site Location, Climate, and Physical Attributes

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

- Sheep Range to the north;
- Frenchman and Sunrise Mountains to the northeast;
- River Range to the east;
- McCullough Range to the south; and
- Spring Mountains and Sierra Nevada mountain range of California to the west.

The Site is within the CoH corporate limits, northeast of the City Hall, and approximately 13 miles southeast of the city of Las Vegas (Figure 1). At its closest point, the Site is approximately 1 mile south of the Las Vegas Wash. The Site is south of the CoH northern RIBs, east of the CoH WRF, and contains the northernmost Upper Ponds portion of Eastside. The Weston Hills residential development is immediately north of the Site, and the Tuscan residential development is located immediately adjacent to the northeast of the Site.

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

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

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

### 2.2.2 Geology/Hydrology

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

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

The TMCf underlies the Qal. The Muddy Creek formation, of which the TMCf is the uppermost part, is a lacustrine deposition from the Tertiary Age, and it underlies much of the Las Vegas

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

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

The Aa is an unconfined, shallower, water-bearing zone that occurs across the Site. For the most part, water in the Aa occurs in the Qal. The water surface in the Aa generally follows topography, with the water surface sloping towards the Las Vegas Wash. The depth from the surface to first groundwater at the Site ranges from approximately 30 to 60 feet bgs (Figure 3). Wells completed in the Aa are not highly productive, with sustainable flows typically less than 5 gallons per minute.

### 2.2.3 Surface Water

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

(2) decrease infiltration into native soils by covering them with man-made structures or materials (e.g., pavement).

Under current conditions, it is unlikely that ephemeral surface waters generated within the Site will migrate via overland transport to the Las Vegas Wash from the Site due to the intervening presence of the CoH WRF, northern RIB), and the Weston Hills and Tuscany developments between the Site and the Wash. However, the presence of the drainage ditches suggests the current potential for rainfall to be carried from those portions of the Site to the Wash. After redevelopment, when the ditches have been removed, there will be an even lower likelihood that ephemeral surface waters generated within the Site will migrate via overland transport to the Las Vegas Wash from the Site because of the proposed design of the future storm water facilities and the regional requirement that nuisance flows not be discharged directly into the Las Vegas Wash unless they do so under existing conditions. (Flows from future development do not meet this criterion.)

Groundwater seeps currently exist at various locations north of the BMI Common Areas near the Las Vegas Wash. No seeps currently exist within the Site. Evidence that they have existed within the Site in the past 70 years is equivocal. In the series of aerial photographs taken regularly over the 70-year period between 1941 and 2011, those from the mid- to late-1960s appear to show a dark feature that could be water. It is not possible to definitively interpret these photographs, and no photographs taken before or after this time period show the same dark feature. There is no chemical or hydrological evidence that seeps have existed on the Site. The estimated locations of any hypothesized historical seeps in the Site vicinity are depicted on Figure 3.

### 2.3 SUMMARY OF HISTORICAL INVESTIGATIONS

Several historical field investigations were conducted at the Site to characterize the nature and extent of chemical occurrence in Site soils and groundwater. Based on these sampling events, BRC identified portions of the Site that warranted remediation for protection of human health and the environment,<sup>7</sup> and subsequently performed remediation in those areas. The SAP presents a detailed analysis of data collected during the historical field investigations conducted at the Galleria North Sub-Area. Of those investigations, the following sampling events included sampling within the Site boundaries:

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<sup>7</sup> It should be noted that this determination was based on comparison of chemical detections to then-applicable human-health risk-based screening levels.

- The BMI Common Areas Environmental Conditions Investigation (ECI) conducted during March and April 1996 (dataset 1a). The soil investigation activities were performed in accordance with a work plan approved by NDEP in February 1996 (ERM 1996a). The soil sampling results for the investigation activities were presented in the ECI report (ERM 1996b), which was approved by NDEP in March 1997. Data validation results are presented in the Data Validation Summary Report (DVSR) for dataset 1a (ERM 2006a), which was approved by NDEP on September 12, 2006.
- The BMI Exclusion Areas Characterization conducted during April and May 1996 (dataset 1b). The soil investigation activities were performed in accordance with a work plan approved by the NDEP in February 1996 (ERM 1996b). The soil sampling results for the investigation activities were presented in the Environmental Characterization Report for the exclusion areas (ERM 1997). Data validation results are presented in the DVSR for dataset 1b (ERM 2006b), which was approved by the NDEP on October 10, 2006.
- Supplemental soil investigation conducted in October 1999 (dataset 6d) in the Upper Ponds. These data were not collected under a formal NDEP-approved work plan. Data validation results are presented in the DVSR for dataset 6d (ERM 2006c), which was approved by NDEP on October 10, 2006.
- Supplemental soil investigation conducted in October 2000 (dataset 8c). These data were not collected under a formal NDEP-approved work plan. Data validation results are presented in the DVSR for dataset 8c (ERM 2006d), which was approved by NDEP on October 26, 2006;
- Supplemental soil investigation conducted in May/June 2001 (dataset 20c). These data were not collected under a formal NDEP-approved work plan. Data validation results are presented in the DVSRs for dataset 20c (ERM 2007a), which same dataset was approved by the NDEP on February 5, 2007.
- Deep soil characterization conducted in June/July 2004 during monitoring well installation at one on-Site location (SB-16-B) as part of the overall Eastside 2004 Hydrologic Characterization Investigation (dataset 27). The sampling results for the investigation activities were presented in the 2004 version of the *BRC Closure Plan*, which was not approved by NDEP. Data validation results are presented in the DVSR for dataset 27 (MWH 2006), which was approved by NDEP on August 31, 2006.

- Soil sampling was conducted in June/July 2007 (dataset 46) in association with an investigation to further assess groundwater conditions within the northeast portion of the Common Areas. Data validation results are presented in the DVSR for dataset 46 (ERM 2007b), which was approved by NDEP on December 5, 2007.

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

Several of the samples collected during these historical investigations were composite samples and were collected more than 15 years ago; few of the previous samples were analyzed for all of the major chemicals or chemical families now mandated; several analyses used different analytical methods than established in the current analytical program for the BMI Common Areas; and spatial coverage of the Site was incomplete. Therefore, because of these various factors, the data collected as part of the SAP (as discussed in Section 3) are considered more representative of current Site conditions<sup>8</sup> than data collected from previous investigations, and these recent 2009 through 2013 data are therefore relied upon for risk assessment purposes as described in this report.

## 2.4 HISTORICAL REMEDIAL ACTIVITIES

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

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<sup>8</sup> This determination is also based on the data usability evaluation summarized in Section 4.2.

## 2.5 CONCEPTUAL SITE MODEL

The CSM is a tool used in risk assessment to describe relationships between chemicals and potentially exposed human receptor populations, thereby delineating the relationships between the suspected sources of chemicals identified at the Site, the mechanisms by which the chemicals might be released and transported in the environment, and the means by which the receptors could come in contact with the chemicals. The CSM provides a basis for defining DQOs, guiding Site characterization, and developing exposure scenarios. The Site history, land uses, climate, physical attributes, including geology and hydrogeology, and various field investigations are described in Sections 2.1 through 2.4 of this HHRA. The history and environmental conditions of the BMI Common Areas are described in Sections 2 and 4 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), and in the Site-wide CSM (in preparation).

The HHRA evaluates current and potential future land-use conditions. The Site is currently undeveloped. The potential on- and off-site receptors are currently trespassers, occasional on-site workers, and off-site residents. Exposures to current receptors are being managed through Site access control. Under the prospective redevelopment plan, the Site will primarily have a residential land use, as well as parks and roads.

The entire Site will be enhanced by restoration and redevelopment once remediation is complete. Therefore, exposures to ecological receptors will be mitigated or removed. Future receptors identified as “on-site receptors” are defined as receptors located within current Site boundaries (Figure 1), while future “off-site receptors” are those located outside current Site boundaries. Many potential human receptors are possible at the Site in the period during and after redevelopment. The potentially exposed populations and their potential routes of exposure are discussed in Section 2.5.3.

The current development plan for the Site is shown on Figure 6. This is an example and actual features may change in the future. To construct residences, parks, and roads, the land will be cut and/or filled, paved with roads or foundations, and nurtured with imported top soils<sup>9</sup> as needed. Figure 2 shows the redevelopment grading plan for the Site (Environmental Covenant Grading Plan), indicating which areas will be filled and which areas will be cut.

<sup>9</sup> Imported soil data are not included in risk assessment calculations. However, the chemical data for fill material from a given site may be useful for evaluating sub-areas to receive fill from that site.

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

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

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

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

### 2.5.1 Impacted Environmental Media

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

Because the background water quality of groundwater beneath the Site and in the surrounding area is generally poor (viz., high salt concentrations) and because BRC has placed Environmental Covenants in the form of a deed restriction to prevent future users from utilizing groundwater beneath the Site, the use of private water wells by residents, businesses, or parks for drinking water, irrigation water, or other non-potable uses (e.g., washing cars, filling swimming pools) will not occur in the post-redevelopment phase. Furthermore, there is no anticipated groundwater uses associated with the proposed retail/commercial land use. Therefore, exposure pathways relating to this type of use are incomplete, as defined by USEPA (1989).

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

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

### **2.5.2 Inter-Media Transfers**

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

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

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

### **2.5.3 Potential Human Exposure Scenarios**

The following subsections summarize land use and the human exposure scenarios that are assessed herein.

### 2.5.3.1 Current and Future Land Use

Current receptors that may use the Site include trespassers, occasional on-site workers, and off-site residents. Current exposures to native soils at the Site are minimal, but exposures to future receptors will be much greater. For example, future receptors evaluated in the HHRA include on-site workers who are assumed to be exposed to soil at the Site for 250 days per year for 25 years, which is much greater than any current exposure scenario. In addition, as discussed above, exposures to current receptors are limited through Site access control. Therefore, a current land use scenario is not quantitatively evaluated in this risk assessment.

USEPA risk assessment guidance (1989) states that potential future land use should be considered in addition to current land use when evaluating the potential for human exposure at a site. As indicated above, under the prospective redevelopment plan, the Site will be used for residential land use, with parks and roads. The entire Eastside property will be redeveloped in several phases. Throughout the redevelopment process, the sub-areas of the Site will be redeveloped sequentially. Future receptors identified as “on-site receptors” are defined as receptors located within the current Site boundaries (Figure 1), while future “off-site receptors” are those located outside the current Site boundaries. “On-site receptors” are those future receptors that will be located within the Site under evaluation. “Off-site receptors” are those future receptors that will be located outside the Site under evaluation that may have complete exposure pathways associated with sources within the Site. As noted above, remediation of the Site is to on-site residential standards. Consequently, risks to off-site receptors are addressed qualitatively in this risk assessment.

### 2.5.3.2 Identification of Potentially Exposed Populations and Pathways

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

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

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

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

\*Includes radionuclide exposures

<sup>†</sup>Only radionuclide exposures

<sup>‡</sup>Includes asbestos exposures

Although trespassers/recreational users and downwind off-site residents are another potential receptor identified in the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), exposures for these receptors are less than those evaluated above. As noted in Sections 9.1.1 and 9.7.1 of the *Closure Plan*, potential exposures for trespassers/recreational

users will only be evaluated in areas of the BMI Common Areas that are designated as recreational end use (specifically the Western Hook-Open Space Sub-Area shown on Figure 1). Also, as noted in Section 9.5.4 of the *Closure Plan*, off-site dust levels based on USEPA's model are much lower than those generated for on-site, construction-related activities. Therefore, risks evaluated for an on-site construction worker, as performed in this HHRA, are considered protective of off-site residents.

### 3.0 CONFIRMATION DATA PROCESS AND SUMMARY

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

#### 3.1 INITIAL CONFIRMATION SOIL SAMPLING

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

- **Stratified Random Locations:** For this purpose, the Site was covered by a 3-acre cell grid network. Within each 3-acre cell, a sampling location was randomly selected. Sampling locations were randomly selected within both full and partial grid cells if they were greater than 50 percent of the total grid cell area (based on the project-wide grid cell network and the Site boundaries; those partial grid cells that contain less than 50 percent of their area within the Site were included in the adjacent sub-area SAPs). The main objective of this stratified random sampling was to provide uniform coverage of each Site within the Eastside property.
- **Biased Locations:** Additional sampling locations were selected within or near small-scale contamination points of interests, including but not limited to previous debris locations, ponds, and berms. For this purpose, the randomly selected location within a corresponding 3-acre cell was adjusted to cover a nearby point of interest. In the event that currently unknown impacted areas were identified during remediation, the presence of these areas were drawn to the NDEP's attention, the need for additional biased sampling points to address those areas was evaluated, and the sampling program modified as needed.

A Site reconnaissance was performed in 2008 to check for environmentally significant features such as debris piles or stained soil. Twenty-three debris piles were observed within the Site boundaries during the reconnaissance (described in the Galleria North SAP and noted on Figure 8 of this HHRA). Biased sampling locations were selected at each of the debris piles/soil staining location. In some cases, random sampling locations were shifted slightly to address the

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

- GNC1-JD06 was included to provide coverage within the Beta Ditch;
- GNC1-JS07 and GNC1-JS12 through GNC1-JS18 were included to provide coverage within debris areas observed at the Site;
- GNC1-JP02 through GNC1-JP08 were included to provide coverage within former effluent ponds; and
- GNC1-JB02 through GNC1-JB10 were included to provide coverage of the berms around former effluent ponds.

BRC conducted two rounds of remediation at the Site in response to detections of elevated concentrations of various chemicals at various locations within the Site. The scope of these remediation activities is discussed in Section 3.3.

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

1. Existing surface (0 foot bgs) and 10 feet bgs for sample locations in relatively flat (ungraded) locations;
2. Existing surface (0 foot bgs), post-grading surface (post-redevelopment as shown on Figure 2), and post-grade 10 feet bgs for sample locations with substantial grading (that is, cut depths greater than 2 feet<sup>10</sup>) and the uppermost sampled soil is expected to be used as surface fill;

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

3. Existing surface (0 foot bgs) and 10 feet bgs for sample locations with minimal grading (that is, cut depths less than 2 feet) and the uppermost sampled soil is expected to be used as surface fill (at any Eastside location); and
4. Existing surface (0 foot bgs) and 10 feet bgs for sampling locations in an area expected to be covered by fill material.

Additionally, at one sampling location (GNC1-JS15), soil physical parameter data were collected at 20 feet and every subsequent 10-foot interval until groundwater was reached. The analytical sample results were then divided into surface (0- to 2-foot depth), subsurface (2- to 10-foot depth), and deep (>10-foot depth) layers, according to the following rules:

- **Rule 1:** IF the sample was collected in a relatively flat (ungraded) part of the Site (i.e., an area not targeted for substantial grading), THEN the depth of the collected soil sample is used to designate its soil layer grouping.
- **Rule 2:** IF the sample was collected in a part of the Site targeted for substantial grading, AND the sampled soil is located in an area expected to be covered by fill material (e.g., exposed excavated surfaces of ponds), THEN the current surface soil sample is classified as a surface (0- to 2-foot depth) sample, and the soil layer grouping of the remaining deeper sampled soil is determined based on the difference between its elevation and the final (post-graded) surface elevation in that part of the Site.
- **Rule 3:** IF the sample is collected in a part of the Site targeted for substantial grading, AND the cut depth is expected to be greater than 2 feet, AND the sampled soil is expected to be used as surface fill (e.g., soil within a berm), THEN the current surface soil sample is classified as a fill material sample, a final (post-graded) surface sample is classified as a surface (0- to 2-foot depth) sample, and the soil layer grouping of the remaining deeper sampled soil is determined based on the difference between its elevation and the final (post-development, graded) surface elevation in that part of the Site.
- **Rule 4:** IF the sample is collected in a part of the Site targeted for substantial grading, AND the cut depth is expected to be less than 2 feet, AND the sampled soil is expected to be used as surface fill (e.g., soil within a berm), THEN the current surface soil sample is classified as both a fill material sample and as a surface (0- to 2-foot depth) sample, and the soil layer grouping of the remaining deeper sampled soil is determined based on the difference between its elevation and the final (post-graded) surface elevation in that part of the Site.

A schematic example of these rules is shown on Figure 9. The Redevelopment Grading Plan for the Site is shown on Figure 2.<sup>11</sup> The sample-specific collection depths are presented in Table 3-1 (Tables section).

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

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

- All data: includes surface, subsurface and fill sample depths/locations, representative of potential exposures to all soil depths to a maximum post-grading depth of 10 feet bgs (representative of Site exposures if fill material remains on Site);
- Data classified as fill material only: that is, sample locations with substantial grading (cut depths greater than 2 feet) and the uppermost sampled soil is expected to be used as surface fill, including off Site;
- Data classified as fill material and/or surface soil: sample locations with cut depths less than 2 feet, therefore, given the sample depth interval, soil could represent either fill or post-grading surface soil;

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<sup>11</sup> Note that the grading plan is reflected in an Environmental Covenant for the Site as a condition to receiving an NFAD from NDEP.

- Data classified as surface soil only: includes surface sample locations where no grading will occur, or sample locations where fill material will be placed, with a subsurface sample (those samples collected less than 10 feet bgs) collected at the post-grading surface; and
- All data excluding data classified as fill material: representative of exposure to all post-grading soil to a maximum post-grading depth of 10 feet bgs.

These different soil exposure classifications are considered to represent all possible exposure potentials for all receptors, including use of soil as fill material elsewhere in the Eastside property, based on the future grade and use of Site soils. See Section 6.1.1 regarding how these different exposure depths are considered in the HHRA.

Initial sampling for the Site was conducted from January through March 2009. In addition to this initial sampling for the Site, supplemental/confirmation samples were collected at various locations in August 2009, January 2010, and January 2013. These supplemental/confirmation samples are identified in Table 3-1.

All soil samples were tagged in the database with numeric designations of their corresponding assigned soil layer grouping based on the rules presented above. The number of soil samples collected varies for different analytes and analytical suites. For example, for arsenic, initially 135 soil samples were collected from 53 soil boring locations (including field duplicates). This included 28 random and 25 biased sample locations. At these 53 locations, BRC initially collected 65 surface samples (including duplicate at 12 locations) and 70 subsurface soil samples (two subsurface sampling intervals at multiple soil boring locations). As presented in Table 3-1 (Tables section), these 135 samples represent 33 fill material (including field duplicates), 70 surface (including field duplicates), and 53 subsurface soil samples.<sup>12,13</sup> An additional 24 supplemental samples (including 2 field duplicates) and 9 confirmation samples (including one field duplicate) were subsequently collected (Section 3.3), bringing the total number of arsenic samples for the Site to 168 (135 initial samples and 33 supplemental and confirmation samples). Of the 168 arsenic samples, 12 were in remediated areas and removed from the risk assessment

<sup>12</sup> Note that in some cases, a soil sample may be considered both a fill sample and a surface sample (as indicated in Table 3-1). Therefore, the sum of the number of samples indicated for each post-grade sample type does not necessarily equal the total number of samples collected.

<sup>13</sup> As discussed with the NDEP, once a particular sub-area receives an NFAD from the NDEP, the cut material that is slated to be used as fill material elsewhere would not require additional testing. However, the chemical data for this fill material may be useful for evaluating sub-areas to receive fill (for example, if there is deeper contamination).

dataset and 7 were at a depth where the redevelopment grading plan for the Site has been modified to remove them from the potential exposure zone (the top 10 feet post-grade; see Section 3.6); thus, there are 149 arsenic samples included in the HHRA dataset.<sup>14</sup> All sampling results, from which the total number of samples can be found for each analyte, are presented electronically on the report CD in Appendix B, and in Tables B-1 through B-12.

### 3.2 CHEMICALS SELECTED FOR ANALYSIS

The analyte list for soil samples collected during the initial 2009 investigation comprised the BRC project SRC list, and was consistent with the analytical program presented in Section 3 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010)<sup>15</sup> and Table 3-2 (Tables section), with the following exceptions for this Site:

- Asbestos and dioxins/furans were only analyzed for in surface soil samples.<sup>16</sup>
- USEPA Method 8141A for organophosphorus pesticides was not conducted. There have been only 47 detections of these compounds in over 10,000 soil sample records (<0.5 percent) from throughout the Eastside. The few detections are well below the NDEP BCLs.
- USEPA Method 8151A for chlorinated herbicides was not conducted. There have been no detections of these compounds in over 1,400 soil sample records from throughout the Eastside. Detection limits are below the NDEP BCLs.
- HPLC Method for organic acids was not conducted. There have been only three detections of these compounds in 567 soil sample records (<0.5 percent) from throughout the Eastside. Moreover, the NDEP has not established BCLs for these compounds.
- USEPA Method 8015B for non-halogenated organics (e.g., methanol and glycols) was not conducted. There have been only five detections of these compounds in 420 soil sample

<sup>14</sup> Note that in Table 3-4, which summarizes the post-remediation HHRA samples, the number of samples reported in that table for a given analysis does not always equal 149. This is due to 1) exclusion of data that were removed during remediation activities; 2) inclusion in the final dataset of confirmation samples collected to assess the extent of chemical impacts in certain areas following remediation; 3) certain analytes were not included in the subsurface samples, as noted in the following section; and 4) rejected data are excluded.

<sup>15</sup> Specific analytes and analyte-specific reporting limits for each analysis are listed in Table 4 of the QAPP.

<sup>16</sup> Note that all samples collected at the Site were discrete samples, with the exception of asbestos samples, which were composite samples collected as per the NDEP-approved Standard Operating Procedure [SOP]-12 as provided in the *Field Sampling and Standard Operating Procedures* [FSSOP; BRC, ERM and MWH 2009]).

records (1 percent) from throughout the Eastside. The few detections have been well below the NDEP BCLs.

- USEPA Method 8015 for total petroleum hydrocarbons (TPH) was not conducted. There have been only three detections of these compounds in over 299 soil sample records (1 percent) from throughout the Eastside. The few detections have been below 100 mg/kg, which is the typical low-end aesthetic threshold used for these compounds. There are no indications of possible TPH source areas (e.g., abandoned vehicles, dumping of oils/hydraulic fluids) at the Site. While TPH was not analyzed for, its components were via other methods. In addition, TPH cannot be included in a risk assessment while its components can.
- Consistent with the current project analyte list, the following radionuclides were analyzed for: radium-226, radium-228, thorium-228, thorium-230, thorium-232, uranium-233/234, uranium-235/236, and uranium-238.

The soil analyte list consisted of 285 of the 418 compounds (including water-only parameters) on the project SRC list. The analytical and preparatory methods (Table 3-2) used in accordance with the SAP adhered to the most recent version of the BRC QAPP (BRC and ERM 2009a; see Section B4, Table 4 of that document). As noted in Section 3.6, the analyte list for surface flux samples was composed of the list specified in the NDEP-approved Standard Operating Procedure (SOP)-16, as provided in the *Field Sampling and Standard Operating Procedures* (FSSOP; BRC, ERM and MWH 2009). Surface flux samples were analyzed for VOCs by USEPA Method TO-15 full scan, plus selective ion mode (SIM) analyses for a subset of the analytes.

### 3.3 INTERMEDIATE SAMPLING AND CLEANUP

#### 3.3.1 2009 Removal Action

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

There were five different remediation areas proposed to address elevated detections of asbestos, metals, radionuclides, dioxins/furans, SVOCs/PAHs, and/or PCBs associated with samples

collected within the Site, primarily within former effluent infiltration/evaporation ponds. The remediation areas for this event were developed based on a Thiessen map overlaid across the Site. Thiessen maps are constructed from a series of polygons formed around each sampling location. Thiessen polygons are created so that every location within a polygon is closer to the sampling location in that polygon than any other sampling location. These polygons do not take into account the respective concentrations at each location. These polygons were used as the basis for the areal extent of remediation for each of the locations with elevated chemical levels. There were two additional remediation areas for dioxins/furans/PCB congeners for judgmental samples. For these locations, a 50 × 50 foot remediation area was used. Each of these remediation areas are shown on Figure 10.

Following remediation, confirmation surface soil samples were collected at each of the original sample locations associated with the remediation area polygons described above.<sup>17</sup> In addition, step out samples were collected at four locations (GNC1-BD25, GNC1-JB10, GNC1-JP05 and GNC1-JP07). All sampling locations are shown on Figure 11. The analyte list was composed of those analytes that triggered the remediation at each sampling location.

### 3.3.2 2010 Removal Action

Following the review of data collected from the 2009 remedial action, continued exceedances of particular chemicals triggered a further round of remedial action in three areas. These additional remediation areas are shown on Figure 10. As before, the analyte list was composed of those chemicals that triggered the remediation at each sampling location.

## 3.4 FINAL CONFIRMATION DATASET

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

- SAP sampling data, retaining the results that were not superseded by subsequent sampling;

<sup>17</sup> The naming convention for confirmation samples uses the same sample identification as the initial (pre-remediation) sample, with an updated numerical prefix. For example, confirmation samples associated with GNC1-JD06 are named SNC2-JD06 (after one round of confirmation sampling).

- Supplemental data collected subsequent to the initial SAP sampling; and
- Additional samples collected for confirmation after completion of remediation activities.

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

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

### 3.5 FINAL CONFIRMATION DATA SUMMARY

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

- NDEP BCLs for residential soil (NDEP 2013);
- NDEP BCLs for protection of groundwater (LBCL), assuming dilution attenuation factors (DAF) of 1 and 20 (NDEP 2013); and
- The maximum background concentration (for metals and radionuclides only), derived from the shallow Qal McCullough background soil dataset presented in Section 5.<sup>18</sup>

<sup>18</sup> This value, for the shallow Qal McCullough background dataset, is used for comparison only; as discussed in Section 5.1, background comparisons were performed for the Site dataset using statistical tests.

A DAF of 1 is used when little or no dilution or attenuation of soil leachate concentrations is expected, and a DAF of 20 may be used when significant attenuation of the leachate is expected due to Site-specific conditions. For the Site, the LBCLs based on a DAF of 1 were used for discussion purposes. Data for the Site, including the number of instances in which chemical concentrations exceed each of the comparison levels, are listed in Table 3-4,<sup>19</sup> and summarized below. It is important to note that these comparisons are used to provide for an initial screening evaluation, assist in the evaluation of data usability, and determine the extent of contamination. They are not used for decision-making purposes or as an indication of the risks associated with the Site.

*Aluminum*

Aluminum was detected in all 149 of the soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). All of the detections were lower than the 77,200 mg/kg BCL, but were higher than the 75 mg/kg LBCL<sub>DAF1</sub>. However, all of the detections higher than the LBCL<sub>DAF1</sub> were less than the maximum background concentration of 15,300 mg/kg.

*Arsenic*

Arsenic was detected in all of the 149 soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). All of the detections were higher than the 0.39 mg/kg BCL and the 1 mg/kg LBCL<sub>DAF1</sub>. Of these, 20 of the detections exceeded the maximum soil background concentration of 7.2 mg/kg. These 20 arsenic exceedances higher than background are identified in Table 3-5.

**TABLE 3-5: ARSENIC BCL/LBCL EXCEEDANCES  
 GREATER THAN BACKGROUND**

Sample ID	Depth (ft bgs)	Reported Value (mg/kg)	Sample ID	Depth (ft bgs)	Reported Value (mg/kg)
GNC1-JB02-15	15	7.3 J+	GNC3-BD25S-10	10	9
GNC2-JB05C-0	0	7.3 J+	GNC1-BF24-11	11	9.1 J
GNC1-JB10-8	8	7.7 J+	GNC1-JP07-14	14	9.1 J+
GNC1-JD06-10	10	7.7	GNC3-BD25C-10	10	10
GNC1-JS17-0	0	7.7	GNC1-JP07-0	0	10.3 J+
GNC1-BC22-0	0	7.9	GNC1-BE24-10	10	12

<sup>19</sup> Pre-scrape data for the target constituents are not included in Table 3-4. That is, these have been replaced by post-scrape data; however, pre-scrape data for the non-target constituents are included in Table 3-4. Because of this, the total number of analyses does not always coincide with the total number of analyses reported in the tables in Appendix B, which include all data, regardless of status.

**TABLE 3-5: ARSENIC BCL/LBCL EXCEEDANCES  
 GREATER THAN BACKGROUND**

Sample ID	Depth (ft bgs)	Reported Value (mg/kg)	Sample ID	Depth (ft bgs)	Reported Value (mg/kg)
GNC1-JA10	0	7.9 J+	GNC3-BD25E-10	10	13
GNC1-JP03-12	12	7.9 J+	GNC3-BD25N-10	10	13
GNC1-JS17-10	10	8	GNC1-BC24-11	11	14.6 J
GNC1-JS15-10	10	8.4	GNC3-BD25W-10	10	22

*Barium*

Barium was detected in all of the 149 soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). None of the detections was higher than the 15,300 mg/kg BCL, but 147 of the barium detections exceeded the 82 mg/kg LBCL<sub>DAF1</sub>. Of these, 63 of the detections exceeded the maximum soil background concentration of 445 mg/kg. These 63 barium exceedances higher than background are identified in Table 3-6.

**TABLE 3-6: BARIUM LBCL EXCEEDANCES  
 GREATER THAN BACKGROUND**

Sample ID	Depth (ft bgs)	Reported Value (mg/kg)	Sample ID	Depth (ft bgs)	Reported Value (mg/kg)
GNC1-BE26	14	446	GNC2-JD06	0	514 J+
GNC1-BC27-FD	0	447 J	GNC1-JB10	8	532
GNC1-JS07-FD	0	448	GNC1-JB03	17	538 J
GNC1-JS14	3	448 J+	GNC1-JB09	9	539 J+
GNC1-JS13	0	452 J-	GNC1-BD27	10	544 J
GNC2-BC24C	0	455 J	GNC1-JS16	10	544 J+
GNC1-BC27	0	458 J	GNC1-JS17	0	545 J
GNC3-BD25S	7	460 J-	GNC1-JB06	6	548 J
GNC1-JB07	0	461 J	GNC1-BE27	0	557
GNC1-JB03	7	466 J	GNC1-JP07	4	582
GNC1-JD06	10	472 J	GNC1-JP07	0	693
GNC1-BD26	16	475 J+	GNC1-BC29	0	571 J
GNC1-JB10	0	476	GNC1-JB09	0	572 J+
GNC1-JS15	0	476 J	GNC1-JB07	18	573 J
GNC1-BD28	10	477	GNC1-BD29	10	579 J
GNC1-JP05	0	480 J	GNC1-BC28	0	584 J
GNC2-JP07N-FD	4	481 J	GNC1-BD29	0	588 J
GNC1-BC22	11	482 J	GNC1-BE25	12	593 J+
GNC1-JP06	3	482 J	GNC1-BC26	11	594 J
GNC1-JP05	11	485 J	GNC2-JP07S	4	608 J
GNC1-BC25	14	486 J	GNC1-BE29	0	624 J
GNC1-JP03	0	490	GNC1-BC29	10	655 J
GNC1-BC21	10	495 J+	GNC1-JB07	8	672 J
GNC1-BD27	0	496 J	GNC1-JS15	10	673 J
GNC1-JS18	10	498	GNC1-BE29	10	700 J
GNC1-BC26	0	500 J	GNC1-BE29-FD	0	728 J
GNC1-JB04	17	501	GNC1-BC27	10	730 J

**TABLE 3-6: BARIUM LBCL EXCEEDANCES  
 GREATER THAN BACKGROUND**

Sample ID	Depth (ft bgs)	Reported Value (mg/kg)	Sample ID	Depth (ft bgs)	Reported Value (mg/kg)
GNC1-JS16	0	507 J+	GNC1-BD27	20	782 J
GNC2-JP07C	4	508 J	GNC1-JS17	10	830 J
GNC2-JP07W	4	509 J	GNC1-BC25	0	873 J
GNC1-JP03	12	509	GNC1-JP04	10	1270 J+
GNC2-JB04C	0	513 J			

*Boron*

Boron was detected in three of the 149 soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). None of the detections were higher than the 15,600 mg/kg BCL; however, two of the detections were higher than the 23.4 mg/kg LBCL<sub>DAFI</sub>. These two detections, which were also higher than the maximum soil background concentration (11.6 mg/kg), were as follows:

- GNC3-BD25W at 10 feet bgs: 27 J mg/kg; and
- GNC3-BD25W at 7 feet bgs: 33 J mg/kg.

The analytical reporting limits were higher than the LBCL<sub>DAFI</sub> for a small subset (14 samples) of the 146 non-detect samples.

*Cobalt*

Cobalt was detected in all 149 of the soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). Of these, no detections were higher than the 23.4 mg/kg BCL, but all 149 cobalt detections were higher than the 0.495 mg/kg LBCL<sub>DAFI</sub>. However, all of the detections higher than the LBCL<sub>DAFI</sub> were less than the maximum background concentration of 16.3 mg/kg.

*Copper*

Copper was detected in all but one of the 149 soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). None of the detections was higher than the 2,910 mg/kg BCL, but one detection was higher than the 45.8 mg/kg LBCL<sub>DAFI</sub>. This one exceedance of the LBCL<sub>DAFI</sub> (63.7 mg/kg, associated with a surface soil sample collected at GNC1-BC29) was also greater than the maximum background concentration of 25.9 mg/kg.

*Iron*

Iron was detected in all 149 of the soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). None of the detections was higher than the 54,800 mg/kg BCL, but all detections were higher than the 7.56 mg/kg LBCL<sub>DAF1</sub>. Of these, 20 detections were higher than the 19,700 mg/kg maximum soil background detection. These 20 iron exceedances higher than background are identified in Table 3-7.

**TABLE 3-7: IRON LBCL EXCEEDANCES  
 GREATER THAN BACKGROUND**

Sample ID	Depth (ft bgs)	Reported Value (mg/kg)	Sample ID	Depth (ft bgs)	Reported Value (mg/kg)
GNC1-JB08	7	19900 J	GNC1-JB02	0	21500 J
GNC2-JB05C	0	19900 J	GNC1-JP05	0	21600 J
GNC1-JB10	8	20100 J	GNC1-BC22	11	21800
GNC1-JP08	12	20600 J	GNC2-JD06	0	21900
GNC1-BF24-FD	0	20700 J	GNC1-JP05	11	21900 J
GNC1-JS12	0	20800 J	GNC1-JP08-FD	0	22000 J
GNC1-JP08	0	20800 J	GNC2-JP04C	0	22000 J
GNC2-JB04C	0	20800 J	GNC1-JB02	5	22200 J
GNC3-BD25S	7	21000	GNC1-JS12	11	22500 J
GNC1-BC25	0	21100 J	GNC1-BC22	0	24100

*Lithium*

Lithium was detected in all 149 of the soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). None of the detections was higher than the 156 mg/kg BCL, but 15 of the lithium detections were higher than the 21.9 mg/kg LBCL<sub>DAF1</sub>. Of these, nine detections were higher than the 26.5 mg/kg maximum soil background detection. These nine lithium exceedances higher than background are identified in Table 3-8.

**TABLE 3-8: LITHIUM LBCL EXCEEDANCES  
 GREATER THAN BACKGROUND**

Sample ID	Depth (ft bgs)	Reported Value (mg/kg)	Sample ID	Depth (ft bgs)	Reported Value (mg/kg)
GNC1-JS13	0	26.6 J+	GNC1-BF24	11	58.9 J+
GNC3-BD25C	10	27	GNC1-JS13	11	72.1 J+
GNC3-BD25N	10	39	GNC1-BE24	10	74 J+
GNC1-BC24	11	40.6	GNC3-BD25W	10	76
GNC3-BD25E	10	46			

*Magnesium*

Magnesium was detected in all 149 of the soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). None of the detections were higher than the 100,000 mg/kg BCL. All detections were higher than the 973 mg/kg LBCL<sub>DAF1</sub>, of which eight were higher than the 17,500 mg/kg maximum soil background detection, and are listed in Table 3-9.

**TABLE 3-9: MAGNESIUM LBCL EXCEEDANCES  
 GREATER THAN BACKGROUND**

Sample ID	Depth (ft bgs)	Reported Value (mg/kg)	Sample ID	Depth (ft bgs)	Reported Value (mg/kg)
GNC1-BC24	11	18700 J	GNC1-BE24	10	24800 J
GNC1-BF24	11	19600 J	GNC3-BD25E	10	26000
GNC3-BD25C	10	20000	GNC1-JS13	11	30000 J
GNC3-BD25N	10	21000	GNC3-BD25W	10	48000

*Manganese*

Manganese was detected in all 149 of the soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). None of the detections were higher than the 1,820 mg/kg BCL but all detections were higher than the 1.3 mg/kg LBCL<sub>DAF1</sub>. Of these, the following three manganese detections were above the 863 mg/kg maximum soil background concentration for manganese:

- GNC1-JP05 at 0 feet bgs: 867 mg/kg;
- GNC3-BD25N at 7 feet bgs: 1,000 mg/kg; and
- GNC1-BC25 at 0 feet bgs: 1,820 J mg/kg.

*Nickel*

Nickel was detected in all 149 of the soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). None of these detections exceeded the 1,540 mg/kg BCL; but 148 were higher than the 7 mg/kg LBCL<sub>DAF1</sub>. However, all of the detections higher than the LBCL<sub>DAF1</sub> were less than the maximum background concentration of 30 mg/kg.

### *Selenium*

Selenium was detected in seven of the 149 soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). None of the detections were higher than the 391 mg/kg BCL. However, all seven detections were higher than the 0.3 mg/kg LBCL<sub>DAF1</sub>. Of these, the following four were higher than the 0.6 mg/kg maximum soil background concentration:

- GNC3-BD25S at 10 feet bgs: 1 J mg/kg;
- GNC3-BD25C at 7 feet bgs: 1.1 J mg/kg;
- GNC3-BD25E at 7 feet bgs: 1.1 J mg/kg; and
- GNC3-BD25W at 7 feet bgs: 1.3 J mg/kg.

For a subset of the 142 non-detections (26 samples), the analytical reporting limits were higher than the maximum background.

### *Thallium*

Thallium was detected in two of the 149 soil samples in which it was analyzed for (64 surface and 85 subsurface samples; Table B-4). None of the detections were higher than the 5.16 mg/kg BCL, but both of the thallium detections were higher than the 0.4 mg/kg LBCL<sub>DAF1</sub>. However, neither of the two LBCL<sub>DAF1</sub> exceedances was higher than the 2 mg/kg maximum soil background concentration. For the majority of the non-detections, the analytical reporting limit was lower than the maximum background concentration.

### *Other Inorganics*

As seen in Table 3-4 (Tables section) and Tables B-3 and B-4 in Appendix B, several inorganic constituents in addition to those listed above were routinely detected in soil samples. None of these additional inorganic constituents were detected at concentrations in excess of either the BCL or the LBCL<sub>DAF1</sub>, with the exception of the following:

- Chlorate detections exceeded the 1.13 mg/kg LBCL<sub>DAF1</sub> in 20 samples;
- Total cyanide detections exceeded the 2.0 mg/kg LBCL<sub>DAF1</sub> in one sample;
- Nitrate detections exceeded the 7.0 mg/kg LBCL<sub>DAF1</sub> in 54 samples; and
- Perchlorate detections exceeded the 0.0185 mg/kg LBCL<sub>DAF1</sub> in 108 samples.

The analytical reporting limits for these additional inorganic constituents were generally lower than the BCL and LBCL<sub>DAFI</sub>.

*Dioxins and Furans*

For dioxins/furans, as discussed in Section 1.1, the USEPA TEQ procedure, developed to describe the cumulative toxicity of these compounds, is used. Dioxins and furans were analyzed for in 77 surface soil samples<sup>20</sup> (Table B-2). All of the individual dioxins and furans congeners analyzed were reported as detections in at least one sample, except 1,2,3,4,7,8-hexachlorodibenzo-p-dioxin. None of the samples analyzed had calculated TCDD TEQ concentrations in excess of the NDEP BCL of 50 ppt. LBCL<sub>DAFI</sub> values have not been established for dioxin/furans, thus the potential for impacts to groundwater quality due to their presence could not be assessed by comparisons to the LBCL<sub>DAFI</sub>.

*Organochlorine Pesticides*

Organochlorine pesticides were analyzed for in 134 soil samples<sup>20</sup> (65 surface and 69 subsurface samples; Table B-5). The following constituents were detected in at least one sample:

- 2,4 DDD
- 2,4-DDE
- 4,4-DDD
- 4,4-DDE
- 4,4-DDT
- alpha-BHC
- beta-BHC
- Eldrin aldehyde
- Methoxychlor

The organochlorine pesticides beta-BHC, 4,4-DDT, 2,4-DDE and 4,4-DDE were detected the most frequently, in more than 30 percent of the samples. None of the detections was higher than the BCL, and all of the detections except beta-BHC were lower than the LBCL<sub>DAFI</sub>. Eleven beta-BHC detections exceeded the 0.00596 mg/kg LBCL<sub>DAFI</sub>, as listed in Table 3-10.

**TABLE 3-10: BETA-BHC LBCL EXCEEDANCES**

Sample ID	Depth (ft bgs)	Reported Value (mg/kg)	Sample ID	Depth (ft bgs)	Reported Value (mg/kg)
GNC1-JS16	0	0.0061 J+	GNC1-BC24	0	0.01 J+
GNC1-JP02	0	0.0066 J+	GNC1-JP06	0	0.011
GNC1-BC26	0	0.0069 J+	GNC1-JP06-FD	0	0.017
GNC1-BE23	0	0.0075 J+	GNC1-BC25	0	0.024
GNC1-JS17	0	0.0081 J+	GNC1-JS14	0	0.027
GNC1-BC25	4	0.0081			

<sup>20</sup> As noted in Footnote 14, the number of records in the Site dataset for a given analyte may differ from those for other analytes.

The standard analytical reporting limits for organochlorine pesticides were all lower than the comparison levels.

#### *Polynuclear Aromatic Hydrocarbons*

Analysis for PAHs was performed on 134 soil samples (68 surface, 67 subsurface; Table B-6). With the exception of acenaphthene and acenaphthylene, each PAH constituent was detected in at least one soil sample. The detections did not exceed either the BCL or the LBCL<sub>DAFI</sub> for any PAH for which they are established. The standard PAH analytical reporting limits were lower than the BCL and the LBCL<sub>DAFI</sub>, thus concentrations in excess of these comparison levels, if present, would have been reported.

#### *Polychlorinated Biphenyls*

PCBs were analyzed for in 70 surface soil samples (individual PCB congeners) (Table B-7). All of the PCB congeners were detected in at least one sample except PCB 77 and PCB 81. BCL values have not been established for individual congeners. PCB congeners are included in the calculation of the TCDD TEQ, and are evaluated in this manner, not on an individual congener basis. LBCL<sub>DAFI</sub> values have not been established for individual PCB congeners.

#### *Aldehydes*

Aldehydes were analyzed for in 134 soil samples<sup>21</sup> (65 surface and 70 subsurface samples; Table B-9). Acetaldehyde was detected in 16 soil samples in which it was analyzed for (Table B-9). None of these detections were higher than the 13.9 mg/kg BCL. The analytical reporting limits were all lower than the BCL.

Formaldehyde was detected in 86 soil samples in which it was analyzed for (Table B-9). No detections were higher than the 12,200 mg/kg BCL. The analytical reporting limits were all lower than the BCL. LBCL<sub>DAFI</sub> values have not been established for these constituents.

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<sup>21</sup> As noted in Footnote 14, the number of records in the Site dataset for a given analyte may differ from those for other analytes.

### *Semi-Volatile Organic Compounds*

SVOCs were analyzed for in 132 soil samples<sup>22</sup> (64 surface and 68 subsurface samples; Table B-9). As seen in Table 3-4 and Table B-9, the following SVOCs were detected in one or more samples:

- 2-Methylnaphthalene
- bis(2-Ethylhexyl)phthalate
- Carbazole
- Diethyl phthalate
- Fluoranthene
- Naphthalene

Fluoranthene was detected the most often, in two of the samples, while the others listed were only detected once. All SVOC detections were lower than the BCL and the LBCL<sub>DAF1</sub>.

For SVOC non-detects, the standard reporting limits were lower than the BCL, except for dichloromethyl ether, which consistently had analytical reporting limits higher than the BCL.

For the following SVOC non-detections, the analytical reporting limits are higher than the LBCL<sub>DAF1</sub>:

- 2,2'-Dichlorobenzil
- 2,4,6-Trichlorophenol
- 2,4-Dichlorophenol
- 2,4-Dinitrophenol
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene
- 3,3'-Dichlorobenzidine
- bis(2-Chloroethyl)ether
- Hexachloroethane
- Isophorone
- Nitrobenzene
- N-Nitrosodi-n-propylamine
- p-Chloroaniline
- Pentachlorophenol

### *Volatile Organic Compounds*

VOCs were analyzed for in 134 soil samples<sup>23</sup> (65 surface and 69 subsurface samples; Table B-10). As seen in Table 3-4 and Table B-10, the following 23 VOCs were detected in at least one sample:

<sup>22</sup> As noted in Footnote 14, the number of records in the Site dataset for a given analyte may differ from those for other analytes.

- 1,2,4-Trimethylbenzene
- 1,2-Dichlorobenzene
- 1,3,5-Trimethylbenzene
- 1,3-Dichlorobenzene
- 1,4-Dichlorobenzene
- Acetone
- Benzene
- Bromobenzene
- Chloromethane
- Dichloromethane (Methylene chloride)
- Ethanol
- Ethylbenzene
- Isopropylbenzene
- m,p-Xylene
- Methyl ethyl ketone (2-Butanone)
- Nonanal
- n-Propylbenzene
- o-Xylene
- sec-Butylbenzene
- Styrene
- tert-Butylbenzene
- trans-1,3-Dichloropropene
- Xylenes (total)

Dichloromethane was detected the most frequently in approximately 28 percent of the samples. Ethylbenzene, 1,2,4-trimethylbenzene and n-propylbenzene were also more frequently detected relative to other VOCs, each being detected in 12 percent of samples. None of the VOC detections were above the BCL. With the exception of dichloromethane, the VOC detections were also lower than the LBCL<sub>DAF1</sub>. Dichloromethane was detected in the 37 soil samples listed in Table 3-11 at concentrations in excess of the 0.001 mg/kg LBCL<sub>DAF1</sub>.

**TABLE 3-11: DICHLOROMETHANE DETECTIONS  
 GREATER THAN LBCL<sub>DAF1</sub>**

Sample ID	Depth (ft bgs)	Reported Value (mg/kg)	Sample ID	Depth (ft bgs)	Reported Value (mg/kg)
GNC1-JB06	6	0.0014 J	GNC1-JP02-FD	0	0.012 J
GNC1-BF23	10	0.0044 J	GNC1-BC26	0	0.013
GNC1-BF23	0	0.0055	GNC1-JB02	5	0.013
GNC1-BC22	0	0.0099	GNC1-JB02	15	0.013
GNC1-JB03	17	0.01	GNC1-JB05	17	0.013
GNC1-JB07	8	0.01	GNC1-JB07	0	0.013
GNC1-JP07	14	0.01	GNC1-JB09	0	0.013
GNC1-BC22	11	0.011	GNC1-JB09	9	0.013
GNC1-JB03	0	0.011	GNC1-JP02	10	0.013
GNC1-JB03	7	0.011	GNC1-BC25	0	0.014
GNC1-JP03	12	0.011	GNC1-BC25	4	0.014
GNC1-JP07	4	0.011	GNC1-BC25	14	0.014
GNC1-JB02	0	0.012	GNC1-JB04	0	0.014

<sup>23</sup> As noted in Footnote 14, the number of records in the Site dataset for a given analyte may differ from those for other analytes. VOC analysis was only performed for initial SAP samples (i.e., it was not included in the analyses for confirmation samples), thus the tally of VOC analyses is lower than for some of the other analytical suites, such as metals, which were often run for supplemental and confirmation samples.

**TABLE 3-11: DICHLOROMETHANE DETECTIONS  
 GREATER THAN LBCL<sub>DAF1</sub>**

Sample ID	Depth (ft bgs)	Reported Value (mg/kg)	Sample ID	Depth (ft bgs)	Reported Value (mg/kg)
GNC1-JB03-FD	0	0.012	GNC1-JB04-FD	0	0.014
GNC1-JB05	7	0.012	GNC1-BC21	10	0.016
GNC1-JB06	0	0.012	GNC1-BD23	0	0.016
GNC1-JD06	0	0.012	GNC1-JB05	0	0.017
GNC1-JS15	0	0.012	GNC1-JP07	0	0.019
GNC1-JS15	10	0.012			

It should be noted that the analytical reporting limits for dichloromethane were often higher than the LBCL<sub>DAF1</sub>. For the other VOCs, the standard reporting limits were lower than the BCL and LBCL<sub>DAF1</sub>.

*Radionuclides*

Radionuclides were detected in all 140 of the soil samples in which they were analyzed (66 surface and 74 subsurface soil samples; Table B-8). Exceedances of comparison levels for radionuclides are shown in Table 3-4 for the eight radionuclides currently included in the project analyte list (radium-226, radium-228, thorium-228, thorium-230, thorium-232, uranium-233/234, uranium-235/236, and uranium-238). Of those activities greater than comparison levels, most were lower than the maximum soil background activity, as shown in Table 3-4.

All of the reported radium-226 activities were higher than the 0.0071 picoCurie per gram (pCi/g) BCL and the 0.016 LBCL<sub>DAF1</sub>. Of these, the following two detections were higher than the 2.36 pCi/g maximum soil background activity:

- GNC1-BE28 at 10 feet bgs: 2.8 pCi/g
- GNC1-BE24 at 10 feet bgs: 2.84 pCi/g

All of the reported radium-228 activities were higher than the 0.013 picoCurie per gram (pCi/g) BCL and higher than the 0.016 pCi/g LBCL<sub>DAF1</sub>. However, none of the detections were higher than the 2.92 pCi/g maximum soil background activity.

All of the reported thorium-228 activities were higher than the 0.0078 pCi/g BCL and the 0.0023 pCi/g LBCL<sub>DAF1</sub>. Of these, the following seven detections were higher than the 2.28 pCi/g maximum soil background activity:

- GNC1-BD23 at 0 feet bgs: 2.34 pCi/g
- GNC1-JB04 at 0 feet bgs: 2.63 J pCi/g
- GNC1-JP02 at 10 feet bgs: 2.37 pCi/g
- GNC1-JP05 at 0 feet bgs: 2.8 pCi/g
- GNC1-JS17 at 0 feet bgs: 2.52 pCi/g
- GNC1-JP07 at 4 feet bgs: 5.12 pCi/g

- GNC1-BD25 at 0 feet bgs: 2.6 J pCi/g

All but two of the reported thorium-232 activities were lower than the 2.8 pCi/g BCL. These two detections (2.93 pCi/g in the sample collected from GNC1-JS17 at 0 feet bgs and 4.61 pCi/g in the sample collected from GNC1-JP07 at 4 feet bgs:) were also higher than the 2.23 pCi/g maximum soil background activity. All detections were higher than the 0.0029 pCi/g LBCL<sub>DAFI</sub>; the following additional three detections (beyond the two listed above) were higher than the 2.23 pCi/g maximum soil background activity:

- GNC1-JB03 at 7 feet bgs: 2.24 pCi/g
- GNC1-BC28 at 0 feet bgs: 2.42 pCi/g
- GNC1-BD23 at 0 feet bgs: 2.41 pCi/g

Uranium-235/236 activities were higher than the 0.11 pCi/g BCL in 15 samples; an LBCL<sub>DAFI</sub> has not been established for this constituent. Of these, eight detections were higher than the 0.21 pCi/g maximum soil background activity, as shown in Table 3-12.

**TABLE 3-12: URANIUM-235/236 DETECTIONS  
 GREATER THAN BCL AND BACKGROUND**

Sample ID	Depth (ft bgs)	Reported Value (mg/kg)	Sample ID	Depth (ft bgs)	Reported Value (mg/kg)
GNC1-BG24	0	0.222	GNC1-JS16	10	0.258
GNC1-JS16	0	0.226	GNC1-JP07	14	0.261
GNC1-BE29	0	0.227	GNC1-JS14	13	0.284
GNC2-JP07C	4	0.248	GNC1-BE28	0	0.336

All but four of the reported uranium-238 activities were higher than the 0.46 pCi/g BCL; an LBCL<sub>DAFI</sub> has not been established for this constituent. Of these, none were higher than the 2.37 pCi/g maximum soil background activity.

As presented in NDEP guidance (NDEP 2009a), as part of the process used to evaluate radionuclide data for the BMI Common Areas, BRC assessed whether radionuclides are in secular equilibrium. As discussed in Section 5.1, secular equilibrium is an indication of background conditions.

The data indicate that radionuclides are in secular equilibrium at the Site. Specifically, the mean radioactivities for the Thorium-232 decay chain (i.e., thorium-232, radium-228, and thorium-228) are comparable (1.5, 1.4, and 1.6 pCi/g, respectively). Similarly, the mean values for the uranium-238 decay chain (uranium-238, uranium-233/234, thorium-230, and radium-226) are also comparable, ranging from 0.95 to 1.2 pCi/g. All of the mean values are lower than their

respective maximum soil background activity levels. A quantitative evaluation of secular equilibrium is presented in Section 5.1.

#### *Summary of Soil Exceedances*

As summarized above and in the associated data tables (Table 3-4 and Appendix B), some BCL and LBCL<sub>DAFI</sub> exceedances are currently observed in Site soils. The following constituents were reported at concentrations higher than the residential BCL and the maximum soil background concentration (where applicable):

- Arsenic (20 samples)
- Radium-226 (2 samples)
- Thorium-228 (7 samples)
- Thorium-232 (5 samples)
- Uranium-235/236 (8 samples)

The following constituents were reported at concentrations higher than the LBCL<sub>DAFI</sub> and the maximum soil background concentration (where applicable):

- Arsenic (20 samples)
- Barium (63 samples)
- Boron (2 samples)
- Copper (1 sample)
- Iron (20 samples)
- Lithium (9 samples)
- Magnesium (8 samples)
- Manganese (3 samples)
- Nickel (1 sample)
- Selenium (4 samples)
- Radium-226 (2 samples)
- Thorium-228 (7 samples)
- Thorium-230 (1 sample)
- Thorium-232 (5 samples)
- Chlorate (20 samples)
- Cyanide (total) (1 sample)
- Nitrate (54 samples)
- Perchlorate (108 samples)
- beta-BHC (11 samples)
- Dichloromethane (37 samples)

As seen above, BCL and LBCL<sub>DAFI</sub> exceedances generally represent a small percentage of the samples in the final confirmation dataset. Therefore, there is a low likelihood of adverse impacts to human health and the environment due to residual chemical concentrations in Site soils. Consistent with the methodology in the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), an HHRA was conducted to further evaluate this possibility, as discussed in subsequent sections of this report.

### 3.6 EVALUATION OF POTENTIAL 'HOT SPOTS'

BRC, in consultation with the NDEP, identified and evaluated several potential 'hot spots' at the Site. These include the following (along with rationale for why further remediation was not considered necessary and why these areas are not considered hot spots or evaluated separately in the HHRA):

- As noted in the chemical-specific discussion above, several of the highest detections of several metals (arsenic, calcium, magnesium, lithium, strontium, and uranium) are associated with subsurface soil at sample location GNC1-BD25. Several step-out samples were also collected from this location, at 7, 10 and 13 feet bgs, with elevated levels indicated from the 10 to 13 feet bgs interval.<sup>24</sup> Concentrations of these metals in the surface and shallower subsurface samples are not elevated at this location. Field observations during drilling and sampling of the step-out samples indicated that there was a caliche layer at this location/depth which likely explains the elevated concentrations of these particular metals. Given concentrations in the shallower depths are not elevated, and based on the field observations, elevated levels of these metals do not appear to be contamination-related (via either surface deposition or groundwater), and are likely naturally occurring concentrations.
- Similar to the above regarding GNC1-BD25, elevated levels of these same metals (arsenic, calcium, magnesium, lithium, strontium, and uranium) are also associated with sample locations GNC1-BC24 (at 11 feet bgs), GNC1-BE24 (at 10 feet bgs), GNC1-BF24 (at 11 feet bgs), and GNC1-JS13 (at 11 feet bgs). Similar to GNC1-BD25, these elevated levels are all in subsurface soils, and are also likely naturally occurring.
- There are isolated elevated levels of manganese, vanadium, and radionuclides (thorium-228 and thorium-232) at sample locations GNC1-BC25, GNC1-JP07, and GNC1-JP07, respectively. All are in subsurface soils, and are not co-located with any other analytes, nor are they clustered with any other neighboring areas with elevated levels.

<sup>24</sup> Note that the original subsurface sample depths at location GNC1-BD25 were at 3 and 13 feet bgs. This indicates a 3-foot cut for the redevelopment grading plan. However, particularly high concentrations of several metals (e.g., arsenic and strontium, as well as calcium and magnesium) were found at 13 ft bgs. Therefore, the redevelopment grading plan has been modified to eliminate the 3-foot cut for this area, thus the 10 ft bgs sample depth is the lower limit of any potential exposures associated with the Site (note that this change does not affect the NFAD, which states that "...the NFAD does not pertain to soil below the top 10 feet of the redevelopment grading plan for the Site"). Although, as noted above, these levels are likely naturally-occurring, the 13 ft bgs sample results for GNC1-BD25 (as well as step-out samples from this depth) have therefore been removed from the risk assessment dataset.

Beyond these observations, due to repeated cleanups throughout the Site, there do not appear to be any other areas that might be considered potential hot spots. That is, there are not areas with multiple co-located chemicals with elevated levels, nor are there areas with clusters of adjacent sample locations with elevated levels. For example, although metals such as arsenic have numerous sample results with concentrations greater than background concentrations (see Section 5), these sample results are scattered throughout the Site and are not clustered in any particular area. Therefore, because of this, separate exposure areas were not evaluated in the HHRA; that is, the Site was evaluated as a single exposure area, consistent with the project *Statistical Methodology Report* (NewFields 2006), and as discussed further in Section 6.1.1.

### 3.7 SURFACE FLUX SAMPLING

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

It should be noted that while radon samples were collected, they are not included in this HHRA for the following reason: BRC recently submitted a technical memorandum to the NDEP (BRC 2010), in which the results of recent radon testing performed in groundwater and indoor air samples were presented. Based on the findings of this memorandum, the NDEP concluded that HHRAs for Eastside property sub-areas do not need to evaluate the pathway of radon migration from groundwater to indoor air for sub-areas with a separation distance of at least 15 feet between any current or future building structure base and the high water table (letter dated November 9, 2010, from Greg Lovato, NDEP, to Mark Paris, BRC). Based on this conclusion and given the depth to groundwater at the Site is consistently over 25 feet bgs, the intrusion of radon into indoor air is not evaluated in the HHRA. Furthermore, as discussed in Section 5.1, other radionuclides are consistent with background levels, which indicate that radon should also be consistent with background, naturally occurring levels in soil.

The flux chamber sample collection rationale was based on the project goal of obtaining a representative dataset of air emissions per sub-area. Flux chamber samples were collected from 27 locations (Figure 11) with 16 random and 11 biased locations (and 2 field duplicates). This density of sample collection is considered adequate for sub-area characterization given the biased nature of the sample locations, the size of the sub-area, and the number of sample locations

suggested by the USEPA (1986) in the flux chamber User's Guide for assessing zones of homogeneous sites.

The analyte list for surface flux samples is composed of the list provided in the most recent NDEP-approved version of SOP-16 (BRC, ERM, and MWH 2009). This analyte list is provided in Table 3-13, and consists of the USEPA Method TO-15 full scan, plus SIM analyses for a subset of the analytes. The analytical results are summarized in Table B-11 (Appendix B), and the principal investigator Report of Findings (which includes descriptions of sampling procedures) is provided in Appendix D (included on the report CD in Appendix B).<sup>25</sup> It should be noted that, in addition to VOC data for the Site, the flux chamber report also contains data for the remainder of a particular sub-area outside the Site boundaries. Data collected from outside the Site boundaries are not included in this HHRA. A data summary for the surface flux sample results is provided in Table 3-14.

As seen in Tables 3-14 and B-11, most of the organic constituents included in the TO-15 scan were detected in at least one surface flux sample. The most commonly detected constituents were chloroform and carbon tetrachloride which were detected in 100 and 97percent of the samples (by SIM analysis, both detected at a lower percentage in the standard, full scan). The highest concentrations were of methyl ethyl ketone (10.4 J micrograms per square meter per minute [ $\mu\text{g}/\text{m}^2, \text{min}^{-1}$ ] at GNC1-BE23), ethanol (6.16 J  $\mu\text{g}/\text{m}^2, \text{min}^{-1}$  at GNC1-JB05) and toluene (3.03  $\mu\text{g}/\text{m}^2, \text{min}^{-1}$  at GNC1-BE24).

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

### 3.8 LEACHATE DATA

As specified in the SAPs, samples were collected within the Site during the initial sampling event for synthetic precipitation leaching procedure (SPLP) analysis.<sup>26</sup> These samples were collected from location GNC1-JP03 at 12 feet bgs. The soil sample was analyzed for perchlorate, PAHs, radionuclides, and SVOCs. As noted in the SAPs, these constituents are considered those

<sup>25</sup> Note that this report was prepared prior to data validation; therefore, data qualifiers may differ from those in the remainder of this report.

<sup>26</sup> SPLP analysis was prepped per USEPA Method 1312 - West solution pH 4.95 with 60/40 weight sulfuric/nitric acid.

of greatest concern for potential migration and impacts to groundwater. Data associated with these SPLP samples are summarized in Appendix B, Table B-12. For reference, Table B-12 includes constituent-specific comparison levels (viz., NDEP's residential water BCLs and USEPA Maximum Contaminant Levels). As summarized in Table B-12, there were only two detections in the leachate samples (perchlorate and radium-228); organic compounds were not detected. Neither detection was higher than the comparison level. As noted in the Executive Summary, the potential leaching impacts to groundwater will be addressed in the Eastside groundwater remedial alternatives study.

#### 4.0 DATA EVALUATION

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

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

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

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

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

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

- *Data Validation Summary Report, Galleria North Sub-Area Soil Investigations, January-March 2009; July-August 2009 (Dataset 60)* (BRC and ERM 2010a), approved by the NDEP on June 14, 2010;
- *Data Validation Summary Report, Sunset North Commercial and Galleria North Sub-Areas 2<sup>nd</sup> Round Confirmation Soil Investigations – September 2009, December 2009, January 2010 and May 2010 (Dataset 60a)* (BRC and ERM 2010b), approved by the NDEP on September 10, 2010;
- *Data Validation Summary Report, 2010 Eastside North Confirmation Soil Investigations – April through September 2010 – Part I (Dataset 72a)* (BRC and ERM 2010c), approved by the NDEP on December 21, 2010; and
- *Data Validation Summary Report, Eastside North Confirmation Soil Investigations (Dataset 72f)* (BRC and ERM 2013 [pending submittal to the NDEP]).

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

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

- A narrative of qualified data is provided with each analytical data package; the laboratory provided a narrative of QA/QC procedures and results. These narratives are included as part of the DVSRs (BRC and ERM 2010a,b,c).
- QC results are provided by the laboratory, including blanks, replicates, and spikes. The laboratory QC results are included as part of the DVSRs (BRC and ERM 2010a,b,c).
- Data flags used by the laboratory were defined adequately.
- Electronic files containing the raw data made available by the laboratory are included as part of the DVSRs (BRC and ERM 2010a,b,c).

#### 4.2 CRITERION II – DOCUMENTATION REVIEW

The objective of the documentation review is to confirm that the analytical results provided are associated with a specific sampling location and collection procedure, using available documentation. For the purposes of this data usability analysis, the chain-of-custody forms prepared in the field were reviewed and compared to the analytical data results provided by the laboratory to ensure completeness of the dataset as discussed in the DVSRs (BRC and ERM 2010a,b,c). Based on the documentation review, all samples analyzed by the laboratory were correlated to the correct geographic location at the Site, as shown on Figure 11. The samples were collected in accordance with the SAP and RAWP (BRC 2008a,b, 2009), and the SOPs developed for the BMI Common Areas as provided in the FSSOP (BRC, ERM, and MWH 2009). Field procedures included documentation of sample times, dates, and locations; other sample-specific information such as sample depth was also recorded. Information from field forms generated during sample collection activities was imported into the project database.

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

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

### 4.3 CRITERION III – DATA SOURCES

The review of data sources is performed to determine whether the analytical techniques used in the Site characterization process (i.e., SAP sampling) are appropriate for risk assessment purposes. The data collection activities specified in the SAP were developed to characterize a broad spectrum of chemicals potentially present on the Site, including asbestos, aldehydes, general chemistry and ions, VOCs, SVOCs, metals, dioxins/furans, PAHs, organochlorine pesticides, radionuclides, and PCBs (SRCs and analyses performed under SAP implementation are listed in Table 3-2, and Table 3-13 for surface flux samples).<sup>27</sup> Because of the soil removals that have occurred on the Site, data collected prior to SAP implementation had significant gaps and inconsistencies in analytical methodology, and as discussed in Section 2, those historical data are not evaluated further in the data usability process, or the HHRA. Only post-remediation data collected under the SAP (and subsequent RAWPs) are being used in the HHRA, and these were subjected to the formal data usability evaluation described in this section. Figure 11 demonstrates that samples collected in accordance with the SAP are situated across the entire Site; analyses associated with these samples are summarized in Tables 3-2 (soil) and 3-13 (surface flux).

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

<sup>27</sup> Although radon samples were collected and analyzed for the Site, radon has been evaluated through a separate process and is not considered further in the data usability process (see Section 3.6).

#### 4.4 CRITERION IV – ANALYTICAL METHODS AND DETECTION LIMITS

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

Laboratory practical quantitation limits (PQLs) were based on those outlined in the reference method, the SAP and RAWP (BRC 2008, 2009), and the project QAPP. In accordance with respective laboratory SOPs, the analytical processes included performing instrument calibration, laboratory method blanks, and other verification standards used to ensure QC during the analyses of collected samples.

The range of SQLs achieved in soil field samples was compared to NDEP Soil BCLs (NDEP 2013). As seen in the summary of the Site soil dataset provided in Table 3-4, of the standard analytes, only two constituents had SQLs that exceeded their respective residential soil BCLs. The SQLs exceedances of NDEP BCLs are discussed below.

- The SQL for dichloromethyl ether was higher than the BCL in all 133 samples analyzed. This compound was not detected in any samples. The dichloromethyl ether SQL is greater than 100 times the BCL and a reduction in the SQL is not likely to be achieved by the laboratory. Therefore, the analytical SQLs are considered adequate for risk assessment purposes.
- The SQL for N-nitroso-di-n-propylamine in 56 of 133 soil samples exceeded the residential BCL. N-nitroso-di-n-propylamine was not detected in any soil sample. The SQL for most samples was at or below the BCL; therefore, the analytical SQLs are considered adequate for risk assessment purposes.

- The radium-226, radium-228, and thorium-228 minimum detectable activity (MDA) in all sample analyses were higher than the BCL; the uranium-235/236 MDA in most sample analyses and the uranium-238 MDA in one sample analysis were higher than the BCL. However, all radionuclides were statistically similar to background.

SPLP SQLs were compared to residential water BCLs (see Table B-12).

- The following analytes have SPLP SQLs higher than their residential water BCL: 1,2-diphenylhydrazine, 1,4-dioxane, 2,2'-dichlorobenzil, 2,4,6-trichlorophenol, 2,4-dinitrotoluene, 3,3-dichlorobenzidine, aniline, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-chloroethyl)ether, bis(2-chloroisopropyl)ether, bis(2-ethylhexyl)phthalate, dibenzo(a,h)anthracene, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, indeno(1,2,3-cd)pyrene, naphthalene, nitrobenzene, N-nitrosodi-n-propylamine, p-chloroaniline, and pentachlorophenol.
- Only benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and bis(2-ethylhexyl)phthalate were detected in soils, and the soil concentrations were all below the LBCL<sub>DAF1</sub>.
- Because the remaining non-detect SPLP constituents were also not detected in soils, they are not anticipated to be of concern with respect to potential impacts to groundwater.

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

#### 4.5 CRITERION V – DATA REVIEW

The data review portion of the data usability process focuses primarily on the quality of the analytical data received from the laboratory. Soil and surface flux sample data were subject to data validation. DVSRs were prepared as separate deliverables (BRC and ERM 2010a,b,c; Appendix F). The analytical data were validated according to the internal procedures using the principles of USEPA National Functional Guidelines (USEPA 1999, 2004d, 2005a, 2008) and were designed to ensure completeness and adequacy of the dataset. Additionally, the DVSRs were issued utilizing the NDEP's two *Supplemental Guidance on Data Validation* documents

(NDEP 2009c,d). Any analytical errors and/or limitations in the data have been addressed and an explanation for data qualification provided in the respective data tables. The results of ERM's data review for these issues are presented in the DVSRs and are summarized below. Data qualifications are discussed in the subsections that follow.

#### 4.5.1 Holding Time Exceedances / Sample Condition Qualifications

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

USEPA guidance for validation allows professional judgment to be used in evaluating qualification due to holding time exceedances. Sample results that were generated after the required holding time, but less than two times after the holding time, were qualified as estimated (J- or UJ flagged). If the samples were prepared after two times the holding time was exceeded, non-detect results were qualified as rejected (R) and detections were qualified as estimated (J-). Qualifications to 32 samples (dataset 60) were made on the basis of exceeded holding times (see Table 2-2 of DVSR 60 [BRC and ERM 2010a]; Appendix F; included on the report CD in Appendix B), as follows:

- Hexavalent chromium results for 16 soil samples (one batch) were qualified due to holding time exceedance. The length of time between sample preparation and analysis for this batch was five days (one day beyond the method-prescribed four-day period). The samples qualified are listed in Table 4-1.

**TABLE 4-1: HEXAVALENT CHROMIUM SAMPLES QUALIFIED  
 DUE TO HOLDING TIME EXCEEDANCES**

Sample ID	Lab ID	Sample ID	Lab ID
GNC1-BD25-0	F9B030166014	GNC1-JB09-0	F9B030166001
GNC1-BD25-3	F9B030166015	GNC1-JB09-19	F9B030166003
GNC1-BD26-0	F9B030166008	GNC1-JB09-9	F9B030166002
GNC1-BD26-0-FD	F9B030166009	GNC1-JS14-0	F9B030166017
GNC1-BD26-16	F9B030166011	GNC1-JS14-13	F9B030166007
GNC1-BD26-6	F9B030166010	GNC1-JS14-3	F9B030166006

**TABLE 4-1: HEXAVALENT CHROMIUM SAMPLES QUALIFIED DUE TO HOLDING TIME EXCEEDANCES**

Sample ID	Lab ID	Sample ID	Lab ID
GNC1-BE25-0	F9B030166012	GNC1-JS16-0	F9B030166004
GNC1-BE25-12	F9B030166013	GNC1-JS16-10	F9B030166005

- Cyanide results for 16 soil samples (one batch) were qualified due to holding time exceedance. The length of time between sample preparation and analysis for this batch was 16 days (two days beyond the method-prescribed 14-day period). The samples qualified are listed in Table 4-2.

**TABLE 4-2: CYANIDE SAMPLES QUALIFIED DUE TO HOLDING TIME EXCEEDANCES**

Sample ID	Lab ID	Sample ID	Lab ID
GNC1-BC27-0	F9B050269012	GNC1-BD29-10	F9B050269005
GNC1-BC27-0-FD	F9B050269013	GNC1-BE29-0	F9B050269001
GNC1-BC27-10	F9B050269014	GNC1-BE29-0-FD	F9B050269002
GNC1-BC28-0	F9B050269010	GNC1-BE29-10	F9B050269003
GNC1-BC28-11	F9B050269011	GNC1-JP05-0	F9B050269015
GNC1-BC29-0	F9B050269006	GNC1-JP05-11	F9B050269016
GNC1-BC29-10	F9B050269007	GNC1-JS17-0	F9B050269008
GNC1-BD29-0	F9B050269004	GNC1-JS17-10	F9B050269009

As noted in the DVSRs (BRC and ERM 2010a,b,c), all samples were received at the laboratory within the required temperatures range of  $4^{\circ} \pm 2^{\circ}$  Celsius. No sample results were qualified based on sample temperatures.

#### 4.5.2 Blank Contamination

Blanks are artificial samples designed to evaluate the nature and extent of contamination of environmental samples that may be introduced by field or laboratory procedures. Field and laboratory blanks for soil samples, consisting of contaminant-free water, were prepared and analyzed as part of standard QA/QC procedures to monitor for potential contamination of field equipment, laboratory process reagents, and sample containers. As presented in the DVSRs (BRC and ERM 2010a,b,c), 943 results were qualified as undetected (U or UJ) or estimated (J or J+) due to laboratory or field blank contamination, as discussed below. Most of the results (930) were qualified as undetected. Detections of constituents qualified as non-detections due to comparable detections in laboratory or field blanks are known as “censored” data, and are presented in Tables 2-5 and 2-6 of DVSR 60, Table 2-4 of DVSR 60a, and Tables 2-3, 2-4 and 2-5 of DVSR 72a (Appendix F). In these cases, non-detections are represented in the database as

“< [the PQL]” in the case of inorganics detected below the PQL, or as “<[result value]” for all others.<sup>28</sup>

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

- Acetone (105 samples)
- Ammonia (26 samples)
- Cadmium (39 samples)
- Cyanide (27 samples)
- Dichloromethane (47 samples)
- Styrene (44 samples)
- Mercury (102 samples)
- Orthophosphate (31 samples)
- 1,2,4-Trimethylbenzene (117 samples)
- Antimony (22 samples)

In addition, 91 of the sample results qualified due to laboratory blank contamination were surface flux samples. Benzene (32 results) was the most frequently censored in surface flux samples.

Table 4-3 presents the metals most likely to be affected by this issue.

**TABLE 4-3: METALS MOST FREQUENTLY CENSORED DURING BLANK SAMPLE EVALUATION**

Metal	Number of Detect	Number of Samples	Number of Censored Results	Max Non-Detect (mg/kg)	NDEP Residential BCL (mg/kg)
Antimony	0	156	22	2.6	31.3
Cadmium	78	156	39	0.5	77.7
Mercury	15	155	109	0.0504	23.5
Molybdenum	106	156	21	3.8	391

What this table demonstrates is that while the number of censored results is numerous for some metals compared to the number of detections, the censored values are still much lower than soil BCLs.

<sup>28</sup> Although NDEP has issued recent guidance regarding qualifying data due to blank contamination (NDEP 2012b); BRC has addressed this issue in the *Technical Memorandum – BRC Comments on NDEP Blank Contamination Guidance* (BRC 2011) and, consistent with this Technical Memorandum, no changes were made to the Site dataset.

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

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

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

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

As discussed in the DVSRs (BRC and ERM 2010a,b,c), 569 inorganic sample results and no organic sample results were qualified as estimated based on MS/MSD recoveries (either UJ for non-detections or J for detections; “+” or “-” added to denote potential high or low bias, respectively). One mercury result was rejected due to MS/MSD recoveries less than 30% (sample GNC1-JA08). The qualifications applied on the basis of MS/MSD recoveries were as follows:

- The nitrate result for one soil sample (GNC1-JB03-0) was qualified as estimated due to a recovery greater than the acceptance criteria.
- The perchlorate results for three soil samples (GNC1-BC22-0, GNC1-BC22-11, and GNC1-BE25-0) were qualified as estimated (J+) due to recoveries greater than the acceptance criteria.
- The ammonia result for one soil sample (GNC1-BC28-0) was qualified as estimated due to recoveries less than the acceptance criteria.
- The sulfate result for one soil sample (SNC1-JS02-0) was qualified as estimated due to a recovery greater than the acceptance criteria.

- The Total Kjeldahl Nitrogen results for six soil samples (GNC1-BD22-0, GNC1-BD22-10, GNC1-BD23-0, GNC1-BD23-12, GNC1-BD24-0, and GNC1-BD24-11) were qualified as estimated due to recoveries greater than the acceptance criteria.
- Metals results for soil samples in various laboratory data packages were qualified due to recoveries outside the acceptance criteria, as summarized in Table 4-4 (Tables section).

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

As indicated in that table, reported detections and non-detects for soil data were flagged as estimated (“J-” or “UJ,” respectively) due to low MS/MSD recoveries (*i.e.*, from 30 to 74 percent for metals).<sup>29</sup> Non-detects associated with “very low” MS/MSD recoveries (*i.e.*, less than 30 percent for metals), are generally rejected as unusable. Only one result was rejected due to MS/MSD recoveries.

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

#### 4.5.3.2 Qualifications Due to LCS/LCSD Recoveries Outside Acceptance Criteria

Organic and inorganic constituent results for 22 soil samples were qualified as estimated (either UJ for non-detections or J for detections; “+” or “-“ added to denote potential high or low bias, respectively) based on LCS/LCSD recoveries. The qualifications applied on the basis of LCS/LCSD recoveries to soil samples are presented in Table 4-5.

<sup>29</sup> If additional validation criteria (aside from the MS/MSD recoveries) did not suggest a low bias for a given result, the sample result was flagged with “J” (no bias inferred).

**TABLE 4-5: RESULTS QUALIFIED DUE TO  
 LCS/LCSD RECOVERIES OUTSIDE ACCEPTANCE CRITERIA**

Laboratory Data Package	1,2,3,4,6,7,8-HpCDD	Chromium VI	Cobalt
F9A300184	-		
F9B020113			+
F9B030166			+
F9B040141		+	

In addition, three flux samples were qualified as estimated based on LCS/LCSD recoveries (benzene in samples GNC1-BD23, GNC1-BE23R, and GNC1-BE24).

As noted above, recoveries below the lower laboratory limits are of the most concern in terms of data usability. Appendix E, Table E-11 (included on the report CD in Appendix B) lists the samples and associated analytes exhibiting LCS/LCSD percent recoveries below the lower laboratory control limit. The data flagged as estimated based on low LCS/LCSD recoveries were subjected to further review in terms of data usability for the Site, as discussed in Section 4.6.2.3.

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

The following 16 soil field duplicates were collected during the sampling activities:

- GNC1-BC27-0-FD
- GNC1-BE29-0-FD
- GNC1-BG23-0-FD
- GNC1-JB04-0-FD
- GNC1-JP04-0-FD
- GNC1-JP08-0-FD
- GNC1-JA14-FD
- GNC2-JB10C-0-DUP
- GNC1-BD26-0-FD
- GNC1-BF24-0-FD
- GNC1-JB03-0-FD
- GNC1-JP02-0-FD
- GNC1-JP06-0-FD
- GNC1-JS07-0-FD
- GNC2-JP07N-4-DUP
- GNC2-JB03C-0-DUP

In addition, two surface flux field duplicates were collected during the sampling activities: GNC1-BE23R and GNC1-JP02R.

Field duplicate differences in excess of acceptance limits were noted in 15 of the 17 field duplicate pairs of soil samples and in both pairs of duplicate flux samples. The differences are presented in Appendix E, Table E-12 (included on the report CD in Appendix B). All associated

data were flagged as estimated (J/UJ). No data were rejected on the basis of sample/field duplicate differences.

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

At least one duplicate analysis (LCSD, MSD, or LR) was performed with each batch of environmental samples processed in the laboratory. The laboratory calculated the RPD between the two detected values for MSD and LR analyses. RPD values within the acceptable limits indicate both laboratory precision and minimal matrix heterogeneity of compounds detected in the samples.

RPDs for MS/MSD pairs, LCS/LCSD pairs, and LR pairs calculated by the laboratory were generally within the laboratory's acceptance criteria. Data are not qualified based on RPDs if any of the MS/MSDs or LCS/LCSDs are within acceptance limits (BRC, ERM, and MWH 2009). No results were qualified due to MS/MSD RPDs or LCS/LCSD RPDs. Data qualified due to laboratory duplicate sample imprecision are presented in Table 2-11 of DVSR 60 and Table 2-9 of DVSR 60a.

Of the samples representing post-remediation conditions (i.e., not including those data points associated with samples from soil intervals subsequently removed from the Site), results for the 38 soil samples (45 data points) identified in Table 4-6 had sample/laboratory duplicate differences greater than permissible values for radionuclides (i.e., absolute difference greater than 1 pCi/g). No other chemical analytes had sample/laboratory duplicate differences greater than permissible values.

**TABLE 4-6: SOIL RESULTS QUALIFIED DUE TO SAMPLE/LABORATORY DUPLICATE DIFFERENCES OUTSIDE ACCEPTANCE CRITERIA**

Field Sample ID	Lab Sample ID	Analyte	Result	Unit	Difference
GNC2-JP07C-4	244276009	Thorium-228	1.89	pCi/g	Difference = 1.36
GNC2-JP07C-4	244276009	Thorium-232	1.9	pCi/g	Difference = 1.104
GNC2-JP07E-4	244276010	Thorium-228	1.73	pCi/g	Difference = 1.36
GNC2-JP07E-4	244276010	Thorium-232	1.46	pCi/g	Difference = 1.104
GNC2-JP07N-4	244276011	Thorium-228	1.17	pCi/g	Difference = 1.36
GNC2-JP07N-4	244276011	Thorium-232	0.996	pCi/g	Difference = 1.104
GNC2-JP07N-4-DUP	244276012	Thorium-228	2.01	pCi/g	Difference = 1.36
GNC2-JP07N-4-DUP	244276012	Thorium-232	1.88	pCi/g	Difference = 1.104
GNC2-JP07S-4	244276007	Thorium-228	2.15	pCi/g	Difference = 1.36
GNC2-JP07S-4	244276007	Thorium-232	1.82	pCi/g	Difference = 1.104
GNC2-JP07W-4	244276008	Thorium-228	1.56	pCi/g	Difference = 1.36
GNC2-JP07W-4	244276008	Thorium-232	1.52	pCi/g	Difference = 1.104

**TABLE 4-6: SOIL RESULTS QUALIFIED DUE TO SAMPLE/LABORATORY  
 DUPLICATE DIFFERENCES OUTSIDE ACCEPTANCE CRITERIA**

Field Sample ID	Lab Sample ID	Analyte	Result	Unit	Difference
GNC1-BC21-0	223713006	Radium-228	1.18	pCi/g	Difference=1.166
GNC1-BC21-10	223713007	Radium-228	1.68	pCi/g	Difference=1.166
GNC1-BD22-0	223713008	Radium-228	1.76	pCi/g	Difference=1.166
GNC1-BD22-10	223713009	Radium-228	1.85	pCi/g	Difference=1.166
GNC1-BD23-0	223713013	Radium-228	1.92	pCi/g	Difference=1.166
GNC1-BD23-12	223713014	Radium-228	1.15	pCi/g	Difference=1.166
GNC1-BD24-0	223713015	Radium-228	0.925	pCi/g	Difference=1.166
GNC1-BD24-11	223713016	Radium-228	1.07	pCi/g	Difference=1.166
GNC1-BD25-0	223833003	Thorium-228	2.6	pCi/g	Difference=1.01
GNC1-BD25-3	223833004	Thorium-228	1.8	pCi/g	Difference=1.01
GNC1-BD26-0	223833009	Thorium-228	2	pCi/g	Difference=1.01
GNC1-BD26-0-FD	223833010	Thorium-228	1.11	pCi/g	Difference=1.01
GNC1-BD26-16	223833012	Thorium-228	1.65	pCi/g	Difference=1.01
GNC1-BD26-6	223833011	Thorium-228	1.44	pCi/g	Difference=1.01
GNC1-BE24-0	224260010	Radium-228	1.52	pCi/g	Difference=1.41
GNC1-BE24-10	224260011	Radium-228	1.25	pCi/g	Difference=1.41
GNC1-BE25-0	223833001	Thorium-228	1.34	pCi/g	Difference=1.01
GNC1-BE25-12	223833002	Thorium-228	2.18	pCi/g	Difference=1.01
GNC1-BF24-0	224260007	Radium-228	1.17	pCi/g	Difference=1.41
GNC1-BF24-0-FD	224260008	Radium-228	0.966	pCi/g	Difference=1.41
GNC1-BF24-11	224260009	Radium-228	0.955	pCi/g	Difference=1.41
GNC1-BG24-0	224260005	Radium-228	<0.531	pCi/g	Difference=1.41
GNC1-BG24-11	224260006	Radium-228	1.89	pCi/g	Difference=1.41
GNC1-JB09-0	223833013	Thorium-228	1.78	pCi/g	Difference=1.01
GNC1-JB09-19	223833015	Thorium-228	1.7	pCi/g	Difference=1.01
GNC1-JB09-9	223833014	Thorium-228	1.49	pCi/g	Difference=1.01
GNC1-JS13-0	224260012	Radium-228	1.49	pCi/g	Difference=1.41
GNC1-JS13-11	224260013	Radium-228	<0.776	pCi/g	Difference=1.41
GNC1-JS14-0	223833006	Thorium-228	1.78	pCi/g	Difference=1.01
GNC1-JS14-13	223833008	Thorium-228	1.31	pCi/g	Difference=1.01
GNC1-JS14-3	223833007	Thorium-228	1.32	pCi/g	Difference=1.01
GNC1-JS16-0	223833016	Thorium-228	0.854	pCi/g	Difference=1.01
GNC1-JS16-10	223833017	Thorium-228	1.71	pCi/g	Difference=1.01

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

#### 4.5.4 Internal Standards Outside Acceptance Criteria

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

compounds in the sample with the response and retention time of specific internal standards added to the sample extract prior to analysis.

As presented in the DVSRs (BRC and ERM 2010a,b,c), the following results were qualified as estimated (J/UJ) due to internal standard exceedances:

- PCB results for six soil samples were qualified as estimated (J/UJ) due to low or high internal standard recoveries if the percent recovery was below 25 percent or above 150 percent. Qualified samples are presented in Table 4-7.

**TABLE 4-7: PCB SOIL SAMPLE RESULTS QUALIFIED DUE TO INTERNAL STANDARDS OUTSIDE ACCEPTANCE CRITERIA**

Laboratory Data Package #	Sample ID
F9B050269001	GNC1-BE29-0
F9B140120014	GNC1-JD06-0
F9B120113002	GNC1-JP07-0
F9B050269013	GNC1-BC27-0-FD
F9B110228002	GNC1-JB08-0
F9A300184004	GNC1-BD22-0

- VOC results for five soil samples (GNC1-BC21-0, GNC1-BC21-10, GNC1-BC28-0, GNC1-BD23-0, GNC1-BE25-0) were qualified as estimated (J/UJ) because of internal standard recoveries below the area limit. Qualified samples are presented in Table 4-8.

**TABLE 4-8: VOC SOIL SAMPLE RESULTS QUALIFIED DUE TO INTERNAL STANDARDS OUTSIDE ACCEPTANCE CRITERIA**

Laboratory Data Package #	Sample ID
F9A300184016	GNC1-BC21-0
F9A300184017	GNC1-BC21-10
F9B050269010	GNC1-BC28-0
F9A300184009	GNC1-BD23-0
F9B030166012	GNC1-BE25-0

- VOC results for 12 flux samples were qualified as estimated (J/UJ) due to high internal standard recoveries. Qualified samples are presented in Table 4-9.

**TABLE 4-9: VOC SURFACE FLUX SAMPLE RESULTS QUALIFIED DUE TO INTERNAL STANDARDS OUTSIDE ACCEPTANCE CRITERIA**

Laboratory Sample ID	Sample ID
35	GNC1-BD23
52	GNC1-BD29
15	GNC1-BE23
25	GNC1-BE25
27	GNC1-BE27
29	GNC1-BE28
19	GNC1-BF23
13	GNC1-BG23
14	GNC1-BG24
41	GNC1-JB07
47	GNC1-JP08
24	GNC1-JS14

- Dioxins/furans results for seven soil samples were qualified as estimated (J/UJ) due to low internal standard recoveries (below 40 percent). Qualified samples are presented in Table 4-10.

**TABLE 4-10: DIOXIN/FURAN SOIL SAMPLE RESULTS QUALIFIED DUE TO INTERNAL STANDARDS OUTSIDE ACCEPTANCE CRITERIA**

Laboratory Data Package #	Sample ID
F9B030166012	GNC1-BE25-0
F9B050269001	GNC1-BE29-0
F9H140144009	GNC1-JA08
F9H140144012	GNC1-JA11
F0A080512003	GNC2-JB05C-0
F0A070524021	GNC2-JP05NW-0

#### 4.5.5 Surrogate Percent Recoveries Outside Laboratory Control Limit

As discussed in the DVSRs (BRC and ERM 2010a,b,c), surrogate spikes were added to each of the samples submitted for organic analysis to monitor potential interferences from the matrix. Results associated with unacceptable surrogate recoveries were qualified as estimated (J+, J- or UJ). Generally, when surrogate recoveries are less than 10 percent, associated non-detect results are qualified as rejected (R) because false negatives are a possibility. No sample results were rejected due to surrogate recoveries. The soil samples listed in Table 4-11 were qualified due to surrogate recovery exceedances.

**TABLE 4-11: RESULTS QUALIFIED DUE TO SURROGATE RECOVERIES OUTSIDE LABORATORY CONTROL LIMIT**

Sample ID	Lab ID	Analysis	Recovery	Acceptable Range
GNC1-BC23-0	F9B110228005	Organochlorine Pesticides	168	61-150
GNC1-BC24-0	F9B110228012	Organochlorine Pesticides	189	61-150
GNC1-BC26-0	F9B130146015	Organochlorine Pesticides	169	61-150
GNC1-BC29-0	F9B050269006	Organochlorine Pesticides	225	61-150
GNC1-BD28-0	F9B040141013	Organochlorine Pesticides	219	61-150
GNC1-BE25-0	F9B030166012	VOCs	156	46-150
GNC1-JB05-0	F9B120113005	Organochlorine Pesticides	153, 165	61-150
GNC1-JB06-0	F9B140120013	Organochlorine Pesticides	158, 203	61-150
GNC1-JB08-0	F9B110228002	Organochlorine Pesticides	155	61-150
GNC1-JP02-0	F9B130146009	Organochlorine Pesticides	298	61-150
GNC1-JP02-0-FD	F9B130146010	Organochlorine Pesticides	298	61-150
GNC1-JP04-0-FD	F9B110228020	Organochlorine Pesticides	184	61-150
GNC1-JP05-0	F9B050269015	Organochlorine Pesticides	179	61-150
GNC1-JS07-0	F9B040141006	Organochlorine Pesticides	189	61-150
GNC1-JS07-0-FD	F9B040141007	Organochlorine Pesticides	182	61-150
GNC1-JS15-0	F9B140120001	Organochlorine Pesticides	160	61-150
GNC1-JS16-0	F9B030166004	Organochlorine Pesticides	152,235	61-150
GNC1-JS17-0	F9B050269008	Organochlorine Pesticides	163	61-150
GNC1-JS18-0	F9B040141011	Organochlorine Pesticides	151	61-150

In addition, three flux samples (GNC1-BF23, GNC1-JP02, and GNC1-JP04) were qualified due to surrogate recovery exceedances, all higher than the acceptable range.

All surrogate recoveries outside the acceptance criteria were higher than the upper laboratory control limit. No further review of surrogate recoveries is necessary in terms of data usability for the Site, as discussed in Section 4.6.2.3.

**4.5.6 Calibrations Outside Laboratory Control Limits**

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

percent of the actual continuing calibration concentration recovered. As the percentage decreases, the potential for false negatives increases.

No metals results were qualified during the evaluation of the continuing calibrations.

Table 4-12 summarizes the SVOC results that were qualified during the evaluation of the continuing calibrations.

**TABLE 4-12: SUMMARY OF SEMI-VOLATILE ORGANIC COMPOUND RESULTS QUALIFIED DUE TO CALIBRATIONS OUTSIDE LABORATORY CONTROL LIMIT**

Analyte	# of Samples Qualified	Percent of Qualified Non-Detect	Percentage of Analyte Recovered during CCV
1,4-Dioxane	11	100%	67-72
3,3-Dichlorobenzidine	11	100%	69-74
3-Nitroaniline	21	100%	58-71
4-Nitroaniline	34	100%	63-68
4-Nitrophenol	1	100%	
Acetophenone	11	100%	69-71
Aniline	13	100%	72
Benzoic acid	47	100%	55-74
Benzyl alcohol	29	100%	74
bis(2-Chloroethyl)ether	13	100%	74
bis(2-Chloroisopropyl)ether	13	100%	73
bis(p-Chlorophenyl) sulfone	6	100%	74
Carbazole	6	83%	74
Diphenylsulfone	6	100%	74
Hexachlorocyclopentadiene	14	100%	48-59
Hydroxymethyl phthalimide	14	100%	64-73
Octachlorostyrene	5	100%	69
Phthalic Acid	95	100%	45-74

Note: The control limits are 75-125% (%D ≤ 25%). Detected and non-detect results associated with calibration recoveries below the lower control limit were qualified as estimated (J-/UJ).

Table 4-13 summarizes the organochlorine pesticide results that were qualified due to continuing calibrations.

**TABLE 4-13: SUMMARY OF ORGANOCHLORINE PESTICIDE RESULTS QUALIFIED DUE TO CALIBRATIONS OUTSIDE LABORATORY CONTROL LIMIT**

Analyte	# of Samples Qualified	Percent of Qualified Non-Detect	Percentage of Analyte Recovered during CCV
2,4-DDD	4	0%	83-79%
2,4-DDE	10	0%	82-84%
4,4-DDD	3	0%	81-84.9%
4,4-DDE	24	0%	73-84.7%
4,4'-DDT	57	58%	75-83%
Alpha-BHC	2	0%	82.5-84.6%

**TABLE 4-13: SUMMARY OF ORGANOCHLORINE PESTICIDE  
 RESULTS QUALIFIED DUE TO CALIBRATIONS  
 OUTSIDE LABORATORY CONTROL LIMIT**

Analyte	# of Samples Qualified	Percent of Qualified Non-Detect	Percentage of Analyte Recovered during CCV
Beta-BHC	5	0%	82-84.9%
Endrin aldehyde	2	0%	73-80%
Heptachlor	24	100%	82-84%
Methoxychlor	47	91%	76-83%
Toxaphene	15	100%	51-84%

Note: The control limits are 85-115% (%D ≤ 15%). Detected and non-detect results associated with calibration recoveries below the lower control limit were qualified as estimated (J-/UJ). Detected results associated with calibration recoveries above the upper control limit were qualified as estimated (J+).

Table 4-14 summarizes the VOC results that were qualified in soil samples due to continuing calibrations.

**TABLE 4-14: SUMMARY OF VOLATILE ORGANIC COMPOUND  
 SOIL RESULTS QUALIFIED DUE TO CALIBRATIONS  
 OUTSIDE LABORATORY CONTROL LIMIT**

Analyte	# of Samples Qualified	Percent of Qualified Non-Detect	Percentage of Analyte Recovered during CCV
Acetone	21	91%	30-64%
Acetonitrile	8	100%	71%
Ethanol	4	100%	61%
Freon 12	8	100%	71%
Methyl iodide	8	100%	71%
MTBE	2	100%	73%

Note: The control limits are 75-125% (%D ≤ 25%). Detected and non-detect results associated with calibration recoveries below the lower control limit were qualified as estimated (J-/UJ). Detected results associated with calibration recoveries above the upper control limit were qualified as estimated (J+).

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

One 2,3,7,8-tetrachlorodibenzofuran result was qualified because the percent recovered was 63, and the limit is ≥70%.

Table 4-15 summarizes the VOC (TO-15) results that were qualified in surface flux samples due to continuing calibrations.

**TABLE 4-15: SUMMARY OF VOLATILE ORGANIC COMPOUND (TO-15)  
 SURFACE FLUX SAMPLE RESULTS QUALIFIED DUE TO CALIBRATIONS  
 OUTSIDE LABORATORY CONTROL LIMIT**

Analyte	# of Samples Qualified	Percent of Qualified Non-Detect	Percentage of Analyte Recovered during CCV
1,1,2,2-Tetrachloroethane	1	100%	58%
1,1-Dichloroethene	3	100%	65-69.6%
1,2,3-Trichloropropane	6	100%	62-68%
1,2,4-Trichlorobenzene	24	87%	41-69.6%
1,2,4-Trimethylbenzene	12	75%	64-67%
1,2-Dichlorobenzene	27	93%	56-69%
1,3-Dichlorobenzene	15	100%	60%
1,4-Dichlorobenzene	20	95%	60-69.6%
2-Methyl-1-propanol	29	100%	45-66%
2,2-Dichloropropane	1	100%	67%
2-Hexanone	5	20%	69%
Acetone	26	46%	46-62%
Acetonitrile	6	50%	46-55%
Benzyl chloride	29	97%	38-63%
Bromoform	6	100%	61-67%
Bromomethane	1	100%	31%
Carbon disulfide	7	62%	59-68%
Chloroethane	1	0%	69%
cis-1,3-Dichloropropene	1	100%	66%
Cymene	6	83%	56-65%
Dibromochloropropane	27	100%	38-50%
Dichloromethane	1	0%	70%
Ethanol	23	70%	45-64%
Heptane	1	0%	68%
Hexachlorobutadiene	28	96%	43-68%
Isopropylbenzene	5	60%	61%
n-Butylbenzene	18	94%	51-69%
n-Propylbenzene	5	80%	66%
sec-Butylbenzene	5	80%	60%
tert-Butylbenzene	20	90%	53-69%
trans-1,3-Dichloropropene	1	100%	49%
Vinyl acetate	1	100%	69.5%
Vinyl chloride	1	100%	62%

Note: The control limits are 70-130% (%D ≤ 30%). Detected and non-detect results associated with calibration recoveries below the lower control limit were qualified as estimated (J-/UJ). Detected results associated with calibration recoveries above the upper control limit were qualified as estimated (J+).

Table 4-16 summarizes the VOC (TO-15 SIM) results that were qualified in surface flux samples due to continuing calibrations.

**TABLE 4-16: SUMMARY OF VOLATILE ORGANIC COMPOUND (TO-15 SIM)  
 SURFACE FLUX SAMPLE RESULTS QUALIFIED DUE TO CALIBRATIONS  
 OUTSIDE LABORATORY CONTROL LIMIT**

Analyte	# of Samples Qualified	Percent of Qualified Non-Detect	Percentage of Analyte Recovered during CCV
1,1,2,2-Tetrachloroethane	1	100%	58%
1,1,2,2-Tetrachloroethane	2	100	67%
1,2,3-Trichloropropane	24	100%	34-57%
Benzene	10	90%	32-67%
Benzyl chloride	7	86%	63-67%
Dibromochloromethane	2	0%	49-51%
Dibromochloropropane	16	100%	32-38%
Hexachlorobutadiene	10	100%	64, 138%
Naphthalene	8	75%	60-70%
Trichloroethene	21	67%	56-67%

Note: The control limits are 70-130% (%D ≤ 30%). Detected and non-detect results associated with calibration recoveries below the lower control limit were qualified as estimated (J-/UJ). Detected results associated with calibration recoveries above the upper control limit were qualified as estimated (J+).

#### 4.5.7 Tentatively Identified Compounds

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

- .beta.-Sitosterol
- 1,1,2,2-Tetrachloroethane
- 11H-Benzo[a]fluoren-11-one
- 28-Nor-17.alpha.(H)-hopane
- 4-Thiazolemethanol, 2-(4-chlorophenyl)-
- 9,10-Anthracenedione
- 9-Octadecenamide, (z)-
- Androstane
- Benzo[b]naphtho[2,1-d]thiophene
- Benzo[c]phenanthrene
- Benzo[ghi]fluoranthene
- Chrysene, 1-methyl-
- Cyclopenta(def)phenanthrenone
- Dodecanamide
- Eicosane, 7-hexyl-
- Hexadecanamide
- 1(2H)-Phenanthrenone, 3,4,9,10-tetrahydro
- 1,1'-Binaphthalene
- 11H-Benzo[b]fluorene
- 4H-Cyclopenta[def]phenanthrene
- 7H-Benz[de]anthracen-7-one
- 9-Anthracenecarbonitrile
- Androst-2,16-diene
- Benzo[b]fluoranthene
- Benzo[b]naphtho[2,3-d]thiophene
- Benzo[e]pyrene
- Benzo[j]fluoranthene
- Chrysene, 6-methyl-
- Diacetone alcohol
- Eicosane
- Erucylamide
- Indeno(1,2,3-ij)isoquinoline

- n-Dodecane
- Nordihydroguaiaretic acid
- Octacosane
- Pentadecanamide, 15-bromo-
- Phenanthrene, 2-methyl-
- Tetradecanamide
- Triphenylene, 2-methyl-
- Nonacosane
- n-Tridecane
- Octadecanamide
- Perylene
- Pyrene, 1-methyl-
- Thiazole, 4,5-dimethyl-2-(4-methylphenyl)

Several are target analytes or substituted target analytes (generally substituted PAHs). In addition to the above, an unknown aldol condensate was also reported by the laboratory as being present in 132 samples; the reported concentrations were flagged “U” due to blank contamination. With the exception of nordihydroguaiaretic acid and beta-sitosterol, the above named compounds are indicative of column breakdown and are not likely Site related. Nordihydroguaiaretic acid is a compound found in creosote bush, and beta-sitosterol is a plant sterol. These constituents could be present due to some organic matter collected along with the soil sample.

#### 4.5.8 Data Review Summary

For 6,298 of the 38,989 analytical results in the final HHRA dataset, quality criteria were not met and various data qualifiers were added to indicate limitations and/or bias in the data. The definitions for the data qualifiers, or data validation flags, used during validation are those defined in SOP-40 (BRC, ERM and MWH 2009) and the project QAPP (BRC and ERM 2009a). Sample results are rejected based on findings of significant deficiencies in the ability to properly collect or analyze the sample and meet QC criteria. Only rejected data are considered unusable for decision-making purposes, and rejected analytical results are not used in the HHRA.

As noted above, one sample result was rejected in the Site dataset and excluded from the HHRA for the reasons previously noted. Other data points were excluded from the risk assessment not due to data quality issues, but for one of the following reasons: (1) the sample was reanalyzed by the laboratory, or (2) the sample location was removed during a remedial action.

#### 4.6 CRITERION VI – DATA QUALITY INDICATORS

DQIs are used to verify that sampling and analytical systems used in support of project activities are in control and the quality of the data generated for this project is appropriate for making decisions affecting future activities. The DQIs address the field and analytical data quality aspects as they affect uncertainties in the data collected for Site characterization and risk assess-

ment. The DQIs include PARCC. The project QAPP provides the definitions and specific criteria for assessing DQIs using field and laboratory QC samples and is the basis for determining the overall quality of the dataset. Data validation activities included the evaluation of PARCC parameters, and all data not meeting the established PARCC criteria were qualified during the validation process using the guidelines presented in the National Functional Guidelines for Laboratory Data Review for Organics, Inorganics, and Dioxin/Furans (USEPA 1999, 2004d, 2005a, 2008).

#### 4.6.1 Evaluation of Data Precision

Precision is a measure of the degree of agreement between replicate measurements of the same source or sample. Precision is expressed by RPD between replicate measurements. Replicate measurements can be made on the same sample or on two samples from the same source. Precision is generally assessed using a subset of the measurements made. The precision of the data was evaluated using several laboratory QA/QC procedures. Based on BRC's review of the results of these procedures, the overall level of precision for the Site data and the background data (BRC and ERM 2009b) does not limit the usability of a particular analyte, sample, method, or dataset as a whole.

#### 4.6.2 Evaluation of Data Accuracy

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

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

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

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

There is a potential for analyte loss if the holding time for a sample is exceeded. As discussed in Section 4.5.1, holding times were exceeded in 16 soil samples for hexavalent chromium analysis (11 percent of the samples analyzed for that constituent) and in 16 soil samples for cyanide analysis (12 percent of the samples). All of the samples were qualified as estimated.

As presented in the DVSRs (BRC and ERM 2010a,b,c), all Site samples with temperature requirements were received at the laboratory within the required range of  $4^{\circ}\pm 2^{\circ}$  Celsius. Three radionuclide samples were qualified due to inadequate sample preservation. This is less than 3 percent of samples for radionuclides and is unlikely to have significant potential for a low bias to Site soils for radionuclides. No other sample results were qualified based on sample temperatures or due to lack of proper preservation.

#### *4.6.2.2 Calibration Violations Indicating a Low Bias*

The instrument calibration checks that resulted in a low bias are summarized in the tables presented in Section 4.5.6. Hexachlorocyclopentadiene and phthalic acid had recoveries below 50 percent in some samples. Both analytes were non-detect in all samples and have never or seldom been detected at BRC Common Areas. One VOC in soil (acetone) had recoveries in some samples below 50 percent. For the other non-detect analytes with BCLs, the maximum SQLs were compared to the soil BCL. It is unlikely, even with a potential for a false negative, that the bias could affect the result to such a degree that the analyte is present at the Site in excess of the BCL.

There were 10 TO-15 surface flux analytes (1,2,4-trichlorobenzene, 2-methyl-1-propanol, acetone, acetonitrile, benzyl chloride, bromomethane, dibromochloropropane, ethanol, hexachlorobutadiene, and trans-1,3-dichloropropene) that had recoveries below 50 percent in some samples. 1,2,4-Trichlorobenzene, 2-methyl-1-propanol, benzyl chloride, dibromochloropropane and ethanol were qualified in all samples due to calibration violations. However, only

dibromochloropropane had recoveries below 50 percent in all samples. 1,2,4-Trichlorobenzene and dibromochloropropane were non-detect in all samples. There were four TO-15 SIM surface flux analytes (1,2,3-trichloropropane, benzene, dibromochloromethane, and dibromochloropropane) that had recoveries below 50 percent in some samples. 1,2,3-Trichloropropane was qualified in all samples due to calibration violations and non-detect in all samples. The remainder of the surface flux analytes were detected in at least one surface flux sample.

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

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

- Antimony results for 22 soil samples in TestAmerica data packages F0H030409 and F9B120113 (all results were either non-detections or qualified as non-detect due to blank contamination);
- Mercury results for 3 soil samples in TestAmerica data package F9H140144 (2 results were qualified as non-detect due to blank contamination);
- Strontium results for 5 soil samples in TestAmerica data package F9H140144 (all results were detected); and
- Tungsten results for 4 soil samples in TestAmerica data package F0H030409 (all results were either non-detections or qualified as non-detect due to blank contamination).

Antimony was qualified for a significant number of samples, but it was not detected in any of the 149 samples analyzed. It is only sporadically detected in the BMI Common Areas, therefore, it is unlikely to be present in these samples. Given the limited number of samples qualified for the other inorganics, these data points are not likely to have a significant effect on risk assessment.

<sup>30</sup> Only samples associated with MS/MSD results in which both recoveries were below 50 percent are listed.

There were no organic MS/MSD percent recoveries less than 30 percent.

Given the small number of samples involved, these data points are not likely to have a significant effect on the HHRA.

As noted in Section 4.5.3, LCS/LCSD recoveries lower than the lower laboratory control limit were observed for 1,2,3,4,6,7,8-HpCDD in 5 soil samples in TestAmerica data package F9A300184 (four results were detected). The recoveries were only slightly lower than the lower laboratory control limit; therefore, no concerns were identified regarding their usability.

*4.6.2.4 Surrogate Percent Recoveries below Laboratory Control Limit*

As noted in Section 4.5.5, 14 soil samples had high surrogate recoveries for organochlorine pesticides. One soil sample had high surrogate recoveries for VOCs. No results were rejected based on surrogate recoveries above the laboratory control limit.

*4.6.2.5 Blank Contamination*

As noted in Section 4.5.2, certain detections were flagged during the data review as being non-detections or estimated with a high bias due to laboratory or field blank contamination. If the associated constituent qualified as being a non-detection was, in fact, present in the samples related to the affected blank sample, revising its status to non-detect could result in risk underestimation. In the dataset for the Site, 930 results were censored due to blank contamination. Affected soil analytes are listed in Table 4-17.

**TABLE 4-17: SUMMARY OF SOIL ANALYTES CENSORED DURING BLANK SAMPLE EVALUATION**

Analyte	# of Censored Results	Analyte	# of Censored Results
1,2,3,4,6,7,8-HpCDD	1	Nitrite	1
1,2,4-Trichlorobenzene	1	Octachlorodibenzodioxin	7
1,2,4-Trimethylbenzene	117	Orthophosphate as P	31
1,2-Dichlorobenzene	4	o-Xylene	2
1,3,5-Trimethylbenzene	4	PCB 105	7
1,3-Dichlorobenzene	6	PCB 118	6
1,4-Dichlorobenzene	6	PCB 156	7
Acetaldehyde	3	PCB 167	7
Acetone	105	PCB 189	5
Ammonia (as N)	26	Radium-226	14

**TABLE 4-17: SUMMARY OF SOIL ANALYTES CENSORED  
 DURING BLANK SAMPLE EVALUATION**

Analyte	# of Censored Results	Analyte	# of Censored Results
Antimony	22	Radium-228	5
Beryllium	16	Selenium	16
Boron	10	Silver	10
Bromide	3	Styrene	44
Cadmium	39	Sulfate	5
Carbon disulfide	1	Thallium	9
Chloroform	4	Thorium-230	6
Chromium (VI)	10	Tin	9
Cyanide, Total	27	Toluene	1
Dichloromethane	47	Total Kjeldahl Nitrogen	7
Ethylbenzene	4	Total Organic Carbon	14
Fluoride	2	Tungsten	8
Formaldehyde	11	Uranium-233/234	9
m,p-Xylene	2	Uranium-235/236	2
Mercury	102	Uranium-238	16
Molybdenum	17	Xylenes (total)	1

In addition, there were several TICs qualified due to blank contamination. See discussion of TICs in Section 4.5.7. Affected surface flux analytes are listed in Table 4-18.

**TABLE 4-18: SUMMARY OF SURFACE FLUX ANALYTES CENSORED  
 DURING BLANK SAMPLE EVALUATION**

Analyte	# of Censored Results	Analyte	# of Censored Results
1,1,2,2-Tetrachloroethane	1	Carbon disulfide	1
1,1,2-Trichloroethane	1	Hexachlorobutadiene	1
1,2,4-Trichlorobenzene	1	Isopropylbenzene	2
1,2-Dichlorobenzene	2	m & p-Xylenes	1
1,3-Dichlorobenzene	3	Methyl ethyl ketone	2
1,4-Dichlorobenzene	9	o-Xylene	4
Acetone	4	Tetrachloroethene	12
Acetonitrile	1	Toluene	5
Benzene	32	Trichloroethene	9

The constituents for which this potential concern has the most bearing in risk assessment are those in soil samples for which the detections are close to or exceed either (1) background

conditions, or (2) relevant human health comparison levels (e.g., NDEP BCLs). As determined during that evaluation, qualification of detections as non-detections based on blank contamination are not likely to have an appreciable effect on the risk estimates, as discussed below.

Censored results that are less than the maximum background concentration and 1/10<sup>th</sup> the residential soil BCL have a negligible impact on risk assessment findings. If a portion of the result reflects an actual Site concentration, then the uncertainty related to the censored result is low. However, data censored at values at or above background or greater than 1/10<sup>th</sup> the residential soil BCLs may pose a potential underestimation of human health risks. Therefore, censored results at values in excess of 1/10<sup>th</sup> the residential soil BCL (or the maximum background concentration, if higher) were evaluated further. Although some soil data for certain radionuclides and thallium were censored due to blank contamination at concentrations in excess of the BCLs, none exceeded background. Table 4-19 identifies the analytes that were censored with results greater than the BCLs.

**TABLE 4-19: SUMMARY OF CHEMICAL RESULTS CENSORED AT VALUES ABOVE 1/10<sup>TH</sup> THE RESIDENTIAL BCL**

Analyte	1/10 <sup>th</sup> BCL	Number of Samples Censored Above 1/10 <sup>th</sup> BCL	Range of Reported Concentrations
Radium-226	0.00071 pCi/g	6	1 pCi/g
Radium-228	0.0013 pCi/g	6	1 pCi/g
Thallium	0.548 mg/kg	5	1 mg/kg
Uranium-233/234	0.42 pCi/g	9	1 pCi/g
Uranium-235/236	0.011 pCi/g	2	1 pCi/g
Uranium-238	0.046 pCi/g	16	0.708 - 1 pCi/g

Sample results censored above 1/10<sup>th</sup> BCL are limited to five radionuclides and thallium, with generally few samples for each analyte. None were selected as COPCs, as described in Section 5. Therefore, the censored results in soil that exceed 1/10<sup>th</sup> the BCL do not affect the results of the risk assessment.

Surface flux data are not comparable with BCLs. Benzene is associated with 32 censored data points; the remaining censored analytes were associated with 12 or fewer surface flux samples. Widespread blank contamination was noted for both the full scan and SIM soil flux analysis of benzene. Benzene is discussed further in the Uncertainty Analysis (Section 7) of this report.

#### 4.6.2.6 Data Usability Summary

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

#### 4.6.3 Evaluation of Data Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of the population at a sampling point or an environmental condition (USEPA 2002a). There is no standard method or formula for evaluating representativeness, which is a qualitative term. Representativeness is achieved through selection of sampling locations that are appropriate relative to the objective of the specific sampling task, and by collection of an adequate number of samples from the relevant types of locations. The sampling locations at the Site were based on both systematic sampling with random point placement within each grid cell, as well as focused samples collected from specific areas to further investigate potential areas of concern.

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

#### 4.6.4 Evaluation of Data Completeness

Completeness is commonly expressed as a percentage of measurements that are valid and usable relative to the total number of measurements made. Analytical completeness is a measure of the number of overall accepted analytical results, including estimated values, compared to the total number of analytical results requested on samples submitted for analysis after review of the analytical data. Some of the data were eliminated due to data usability concerns. The percent completeness for the Site is 99.9 percent and includes the surface flux chamber data. The percent completeness for the soil only dataset is 99.9 percent. The percent completeness for the background dataset used in the HHRA is 98.8 percent.

#### 4.6.5 Evaluation of Data Comparability

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

One exception may be uranium-235/236, which has reported activities that are slightly elevated compared to background and other reported isotopes of uranium. The laboratory that performed the Site radionuclide analysis has indicated that the activities for uranium-235/236 hover around the noise level of the instrument and secular equilibrium is still achieved. Therefore, activities at the noise level of the instrument may vary between the instruments used.

There are differences in SQLs among datasets that may affect data comparability for datasets comprised primarily of non-detect values. Examples of the differences in SQLs at the Site and in background soil for several analytes with low detection frequency are provided in Table 4-20.

**TABLE 4-20: LOW DETECTION ANALYTES EXHIBITING SQL DIFFERENCES BETWEEN BACKGROUND AND SITE SAMPLES**

Analyte	Background Min SQL	Background Max SQL	Site Min SQL	Site Max SQL <sup>31</sup>
Antimony	0.3298	0.3298	0.225	2.6
Boron	3.2	3.2	2.99	82.5
Mercury	0.0072	0.0072	0.005	0.0504
Selenium	0.1579	0.1579	0.225	3.8
Silver	0.2609	0.2609	0.041	1.5
Thallium	0.5428	0.5428	0.105	3.75
Tin	--	--	0.5	3.75
Tungsten	0.0175	0.0175	0.185	6.25

All results in units of mg/kg.

Cumulative probability plots and side-by-side boxplots for the background and Site datasets are included in Appendix G. For these datasets, left-censored data can result in difficulties in

<sup>31</sup> The SQLs reported here may differ from the detection limits reported elsewhere (e.g., background comparisons). Detection limits may be raised due to blank contamination.

differentiating whether datasets are actually different or merely an artifact of detection limits. Note that for constituents with SQLs that meet project limit requirements, comparisons between Site and background may be less important as these left-censored data are likely to indicate conditions that pose an “acceptable” risk and further evaluation is not necessary.

#### 4.7 DATA ANALYSIS

Data validation and usability evaluations tend to look at the data on a result by result basis. The data analysis step is intended to take a step back and look at the dataset as a whole. The intent of this is to identify any anomalies or unusual data trends that may indicate any potential laboratory issues. This is performed by reviewing summary statistics, cumulative probability plots and side-by-side boxplots, or other visual aids. The soil dataset used for the HHRA is summarized in tabular format in Table 3-4. While it is not feasible to present all the detected analytes in a graphical format, cumulative probability plots and side-by-side boxplots are provided in Appendix G for the analytes included in the background comparisons (that is, metals and radionuclides). No anomalies in the dataset were identified.

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

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

- Results associated with holding time exceedances;

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

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

## 5.0 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The broad suite of analytes sampled for was the initial list of potential COPCs at the Site. However, to ensure that a risk assessment focuses on those substances that contribute the greatest to the overall risk (USEPA 1989); the following procedures were used to eliminate analytes as COPCs for quantitative evaluation in the risk assessment:<sup>37</sup>

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

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

The Site has been subjected to a number of remedial actions (see discussion in Section 3.3). Subsequent to these remedial actions, mitigated areas were resampled (in some cases, resampled several times) to confirm achievement of mitigation objectives. Because the two remediation areas were targeted primarily for metals reduction, for other inorganics, organics, asbestos, and radionuclides, the cumulative Site dataset is considered representative for all three exposure areas. For metals, each of the three exposure areas is evaluated separately. Therefore, for the purposes of this assessment, a total of three exposure areas were identified for evaluation—the two removal areas, and Site-wide. Based on the data sources considered representative of these locations, these three exposure areas are referred to as: SRC-J02/03, SRC-J21, and Site-Wide.

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<sup>37</sup> Note that these procedures for selection of COPCs deviate somewhat from those presented in the BRC *Closure Plan*, but are consistent with discussions between BRC and NDEP and their consultants in a December 9, 2010, meeting. BRC will use these procedures for all subsequent risk assessments. BRC will also revise the *Closure Plan* accordingly to make it consistent with these procedures.

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

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

As indicated in the *Background Soil Compilation Report* (BRC and ERM 2010d), the Site is in an area of McCullough lithology (see Figure 12, Qh<sub>1</sub> label). Because Site data extends to 21 ft bgs, consideration was given to performing separate background comparisons for shallow (0 to 10 ft bgs) and deep (greater than 10 ft bgs) soil, using separate shallow and deep background soil datasets. However, this resulted in no changes to the final list of COPCs.<sup>38</sup> Therefore, comparison of Site-related soil concentrations to background levels was conducted using the shallow Qal McCullough background dataset presented in the *Background Soil Compilation Report* (BRC and ERM 2010d). The background dataset used is included in the dataset file on the enclosed report CD in Appendix B.

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

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<sup>38</sup> As noted in a letter dated September 17, 2012, from Greg Lovato, NDEP, to Mark Paris, BRC, the 2003 soil background dataset collected by Environ for the City of Henderson is not used for background soil comparison purposes.

background. If the detection frequency is less than 40 percent in either the background or Site datasets, then the constituent is evaluated based on boxplots and summary statistics.

For samples with primary and field duplicate results, the Site sample and field duplicate<sup>39</sup> are treated as independent samples and both are included in all subsequent data analyses, regardless of whether one or both are non-detect. This is considered appropriate because field duplicate samples represent a discrete and unique measurement of soil chemical conditions proximal to the primary sample (unlike split samples). The field duplicates were compared to the primary sample during the course of data validation. The variances were not out of the line with the variance in results across the Site. Therefore, as distinct soil chemical measurements, they are treated as unique samples in the analyses.

For metals, the shallow Qal McCullough background dataset was compared to the HHRA dataset for the three areas separately (Site-Wide, SRC-J02/03, and SRC-J21). For radionuclides, the shallow Qal McCullough background dataset as a whole was compared to the HHRA dataset as a whole. The shallow Qal McCullough background dataset is presented in the *Background Soil Compilation Report* (BRC and ERM 2010d), and is included in the dataset file on the enclosed report CD in Appendix B. The results of these background comparison statistics are presented in Tables 5-1a, 5-1b and 5-1c (Tables section) and summarized below in Tables 5-2a, 5-2b, and 5-2c.

**TABLE 5-2a: BACKGROUND COMPARISON  
 EVALUATION SUMMARY – SITE-WIDE**

Chemical	Greater than Background?	Basis
Aluminum	YES	Multiple tests
Antimony	NO	Multiple tests
Arsenic	NO	Multiple tests
Barium	YES	Multiple tests
Beryllium	YES	Multiple tests
Boron	YES	Multiple tests
Cadmium	YES	Multiple tests
Calcium	NO	Multiple tests
Chromium	YES	Multiple tests

<sup>39</sup> Field duplicates are shown in Appendix B and indicated with the “FD” qualifier under the column entitled “Sample Type”.

**TABLE 5-2a: BACKGROUND COMPARISON  
 EVALUATION SUMMARY – SITE-WIDE**

Chemical	Greater than Background?	Basis
Chromium (VI)	YES	Quantile test
Cobalt	YES	Multiple tests
Copper	YES	Multiple tests
Iron	YES	Multiple tests
Lead	YES	Multiple tests
Lithium	NO	Multiple tests
Magnesium	NO	Multiple tests
Manganese	YES	Multiple tests
Mercury	YES	WRS test
Molybdenum	NO	Multiple tests
Nickel	NO	Multiple tests
Potassium	NO	Multiple tests
Selenium	YES	Multiple tests
Silver	YES	Multiple tests
Sodium	YES	Multiple tests
Strontium	YES	Multiple tests
Thallium	NO	Multiple tests
Tin	YES	Multiple tests
Titanium	YES	Multiple tests
Tungsten	YES	Multiple tests
Uranium	YES	Multiple tests
Vanadium	YES	Multiple tests
Zinc	YES	Multiple tests
Radium-226	NO	Multiple tests
Radium-228	NO	Multiple tests
Thorium-228	NO	Multiple tests; see text
Thorium-230	NO	Multiple tests
Thorium-232	NO	Multiple tests; see text
Uranium-233/234	NO	Multiple tests
Uranium-235/236	NO	Secular equilibrium; all results near noise level of instrument
Uranium-238	NO	Multiple tests

**TABLE 5-2b: BACKGROUND COMPARISON  
 EVALUATION SUMMARY – SRC-J02/J03**

Chemical	Greater than Background?	Basis
Aluminum	YES	Multiple tests
Antimony	NO	ND in Site
Arsenic	NO	Multiple tests
Barium	YES	Multiple tests
Beryllium	YES	WRS test
Boron	NO	ND in Site
Cadmium	YES	Multiple tests
Calcium	NO	Multiple tests
Chromium	YES	Multiple tests
Chromium (VI)	YES	Multiple tests
Cobalt	YES	Multiple tests
Copper	YES	Multiple tests
Iron	YES	Multiple tests
Lead	YES	Multiple tests
Lithium	NO	Multiple tests
Magnesium	YES	Multiple tests
Manganese	YES	Multiple tests
Mercury	NO	Multiple tests
Molybdenum	NO	ND in Site
Nickel	YES	Multiple tests
Potassium	YES	Multiple tests
Selenium	NO	ND in Site
Silver	YES	Multiple tests
Sodium	YES	Multiple tests
Strontium	YES	Multiple tests
Thallium	NO	ND in Site
Tin	YES	Multiple tests
Titanium	YES	Multiple tests
Tungsten	YES	Multiple tests
Uranium	YES	Multiple tests
Vanadium	YES	Multiple tests
Zinc	YES	Multiple tests

**TABLE 5-2c: BACKGROUND COMPARISON  
 EVALUATION SUMMARY – SRC-J21**

<b>Chemical</b>	<b>Greater than Background?</b>	<b>Basis</b>
<b>Aluminum</b>	<b>YES</b>	Multiple tests
Antimony	NO	ND in Site
Arsenic	NO	Multiple tests
<b>Barium</b>	<b>YES</b>	Multiple tests
Beryllium	NO	Multiple tests
Boron	NO	ND in Site
<b>Cadmium</b>	<b>YES</b>	Multiple tests
Calcium	NO	Multiple tests
<b>Chromium</b>	<b>YES</b>	Multiple tests
<b>Chromium (VI)</b>	<b>YES</b>	Multiple tests
<b>Cobalt</b>	<b>YES</b>	Multiple tests
<b>Copper</b>	<b>YES</b>	Multiple tests
<b>Iron</b>	<b>YES</b>	Multiple tests
<b>Lead</b>	<b>YES</b>	Multiple tests
Lithium	NO	Multiple tests
<b>Magnesium</b>	<b>YES</b>	Multiple tests
<b>Manganese</b>	<b>YES</b>	Multiple tests
Mercury	NO	Multiple tests
Molybdenum	NO	ND in Site
<b>Nickel</b>	<b>YES</b>	Multiple tests
<b>Potassium</b>	<b>YES</b>	Multiple tests
Selenium	NO	ND in Site
<b>Silver</b>	<b>YES</b>	Multiple tests
<b>Sodium</b>	<b>YES</b>	Multiple tests
<b>Strontium</b>	<b>YES</b>	Multiple tests
Thallium	NO	Multiple tests
<b>Tin</b>	<b>YES</b>	Multiple tests
<b>Titanium</b>	<b>YES</b>	Multiple tests
<b>Tungsten</b>	<b>YES</b>	Multiple tests
<b>Uranium</b>	<b>YES</b>	Multiple tests
<b>Vanadium</b>	<b>YES</b>	Multiple tests
<b>Zinc</b>	<b>YES</b>	Multiple tests

Cumulative probability plots and side-by-side boxplots<sup>40</sup> were also prepared and are included in Appendix G. These plots give a visual indication of the similarities/differences between the Site and background datasets. The results of this comparison indicate that a large number of metals are statistically significant (greater than) background levels for each of the three areas.

Note that arsenic failed a single background comparison test in one of the separate exposure areas (SRC-J02/J03); however, the detection limits for arsenic are comparatively high, and for this particular exposure area over half the samples (17 of 28) were qualified as non-detects due to blank contamination. BRC notes that had it used NDEP's more recent data validation guidance for metals (that is, rather than substituting the PQL for the reported concentration for the 17 samples affected by blank contamination as was done based on USEPA guidance, the report concentration would have been used) then the background comparison for this area would pass. Therefore, arsenic is considered similar to background throughout the Site.

**Secular Equilibrium for Radionuclides.** For radionuclides, secular equilibrium exists when the quantity of a radioactive isotope remains constant because its production rate (due to the decay of a parent isotope) is equal to its decay rate. In theory, if secular equilibrium exists, the parent isotope activity should be equivalent to the activity of all daughter radionuclides. Pure secular equilibrium is not expected in environmental samples because of the effect of natural chemical and physical processes. However, approximate secular equilibrium is expected under background conditions (NDEP 2009e). Both the thorium-232 and uranium-238 chains were determined to be in approximate secular equilibrium following equivalence testing outlined in the NDEP's *Guidance for Evaluating Secular Equilibrium at the BMI Complex and Common Areas February* (NDEP 2009e). The results of the equivalence testing for secular equilibrium are provided in Table 5-3.

**TABLE 5-3: SECULAR EQUIVALENCE TESTING RESULTS**

Chain	Equivalence Test		Secular Equilibrium?	Mean Proportion			
	Delta	p-value		Ra-226	Th-230	U-233/234	U-238
U-238	0.1	<0.0001	Yes	0.2272	0.2561	0.2681	0.2486
Th-232	0.1	<0.0001	Yes	0.3441	0.3537	0.3022	

<sup>40</sup> Site was segregated by area (and all data).

Two radionuclides failed a single background comparison test (thorium-228 and thorium-232, slippage test);<sup>41</sup> however, their means were comparable to their respective background activities. Intensity plots for these two radionuclides are included in Appendix I, Figures I-41 through I-43. It is also notable that there were no remediation activities involving the presence of elevated radionuclides. That is, there were no pre-scrape elevated radionuclides activities that required remediation at the Site. As stated in the NDEP (2009a) guidance “If the radionuclide data exhibit secular equilibrium, then either the data are similar to background, or there is more general contamination for all radionuclides in the decay chain.” Because radionuclides exhibit secular equilibrium, and there is no evidence of general contamination for all radionuclides, all radionuclides are considered to be similar to background. Radionuclides are therefore not evaluated further in the HHRA.

## 5.2 ESSENTIAL NUTRIENTS

An essential nutrient is a chemical required for normal body functioning that either cannot be synthesized by the body at all, or cannot be synthesized in amounts adequate for good health, and thus must be obtained from a dietary source. USEPA (1989) states that “Chemicals that are (1) essential human nutrients, (2) present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and (3) toxic only at very high doses (i.e., much higher than those that could be associated with contact at the Site) need not be considered further in the quantitative risk assessment. Examples of such chemicals are calcium, iron, magnesium, potassium, and sodium.” As discussed with and approved by the NDEP,<sup>42</sup> and consistent with guidance and standard practices, no further quantitative evaluations are required for these essential nutrients.

## 5.3 COMPARISON TO RESIDENTIAL SOILS BCLs

BCLs for residential soils are chemical-specific, risk-based concentrations in soils that are protective of a residential land use scenario (NDEP 2012a). As discussed with and approved by the NDEP (see footnote 37), if the maximum detected concentration for a constituent is less than one-tenth of the residential soil BCL, then no further quantitative evaluation is required for that constituent. For those constituents with 100 percent non-detect values, if the maximum non-detect concentration<sup>43</sup> for a constituent is less than one-tenth of the residential soil BCL, no

<sup>41</sup> As noted in Section 4.6, the laboratory that performed the Site radionuclide analysis has indicated that the activities for uranium-235/236 hover around the noise level of the instrument.

<sup>42</sup> Meeting with NDEP on December 9, 2010.

<sup>43</sup> The non-detect value is equal to the SQL.

further evaluation will be conducted. If the maximum non-detect concentration is greater than one-tenth of the residential soil BCL, no further quantitative evaluation will be conducted; however, a discussion is provided in the Uncertainty Analysis (Section 7) for these constituents.

Consistent with the Closure Plan, if the TCDD TEQ concentrations do not exceed the NDEP residential BCL of 50 ppt for any sample within the Site,<sup>44</sup> dioxins/furans are not retained as COPCs. Therefore, because this criterion is met for the Site, dioxins/furans are not considered COPCs, and are not evaluated further in the HHRA. Lead was also not evaluated further in the HHRA since all concentrations were below its target goal of 400 mg/kg for residential land use.

The results of comparisons to one-tenth of the residential soil BCL for Site-Wide, SRC-J02/03, and SRC-J21 are presented in Tables 5-4a, 5-4b, and 5-4c (Tables section). Three organic compounds and seven inorganic/metals were found to exceed their respective one-tenth of the residential soil BCL (two inorganic chemicals do not have BCLs, but do have relevant and available toxicity criteria [ammonia, asbestos]).

#### 5.4 SUMMARY OF SELECTION OF COPCS

The procedures for COPC selection were discussed above. Results of the selection of COPCs, including the rationale for excluding chemicals as COPCs for Site-Wide, SRC-J02/03, and SRC-J21, are presented in Tables 5-5a, 5-5b, and 5-5c (Tables section). The resulting COPCs for soil are provided in Table 5-6 below.

**TABLE 5-6: RESULTS OF THE SELECTION OF COPCS FOR SOIL**

Chemical	COPC		
	Site Wide	SRC-J02/J03	SRC-J11
<b>Inorganics</b>			
Aluminum	Yes	Yes	Yes
Ammonia	Yes	Yes	Yes
Asbestos	Yes	Yes	Yes
Cobalt	Yes	Yes	Yes
Manganese	Yes	Yes	Yes
Perchlorate	Yes	Yes	Yes
Vanadium	Yes	Yes	Yes

<sup>44</sup> See Section 2.5 for a discussion on future land use for the Southern RIBs sub-area.

**TABLE 5-6: RESULTS OF THE SELECTION OF COPCS FOR SOIL**

Chemical	COPC		
	Site Wide	SRC-J02/J03	SRC-J11
<b>Polynuclear Aromatic Hydrocarbons</b>			
Benzo(a)anthracene	Yes	Yes	Yes
Benzo(a)pyrene	Yes	Yes	Yes
Benzo(b)fluoranthene	Yes	Yes	Yes
Benzo(k)fluoranthene	Yes	Yes	Yes
Chrysene	Yes	Yes	Yes
Dibenzo(a,h)anthracene	Yes	Yes	Yes
Indeno(1,2,3-cd)pyrene	Yes	Yes	Yes
<b>Semi-Volatile Organic Compounds</b>			
Hexachlorobenzene	Yes	Yes	Yes
<b>Volatile Organic Compounds</b>			
Formaldehyde	Yes	Yes	Yes

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

## 6.0 HUMAN HEALTH RISK ASSESSMENT

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

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

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

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

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

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

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

## 6.1 DETERMINATION OF EXPOSURE POINT CONCENTRATIONS

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

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

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

### 6.1.1 Soil

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

A 95 percent UCL was calculated using the `summary.stats()` function in the GiSdT<sup>®</sup> package (Neptune and Company 2009) in R (R Core Team 2012). Section 5.1 outlines the treatment of sample locations with field duplicates prior to the 95 percent UCL statistical calculations described in this section. For these calculations, chemical non-detect results are assigned a value of one-half the SQL. The formulas for calculating the 95 percent UCL COPC concentration (as the representative exposure concentration) are presented in USEPA (1992c, 2002c) and GiSdT<sup>®</sup> (Neptune and Company 2009). Three UCL methods are employed in the GiSdT<sup>®</sup> library. They include the Student's t UCL, the bootstrap percentile UCL, and the bootstrap BCa UCL. The maximum UCL of these three methods was used as the exposure point concentration, unless the maximum UCL of the three methods was greater than the maximum detected concentration. In these cases, the maximum detected concentration was selected as the exposure point concentration.

The representativeness of the 95 percent UCLs for the exposure area, that is, a Site-wide mean concentration is valid for all receptors at the Site, is further supported by the intensity plot figures included in Appendix I. Figures for each of the COPCs are included in Appendix I (in addition to figures developed for all metals). A figure is also presented for TCDD TEQ. Although not COPCs for the Site, TCDD TEQ is a primary chemical of interest for the project. Based on the results of the background comparison tests, a review of the probability plots, boxplots, and distribution and intensity plot figures, data across the Site are assumed to be uncorrelated, that is, there is no discernible spatial correlation.<sup>39</sup> Although there may be spatial correlation of data across the Site, it has not been observed. Thus, the assumption is made for statistical testing purposes that the data are not spatially correlated.<sup>40</sup> This results in lower p-values and hence a greater number of statistical differences than would be the case if spatial correlation were accounted for. Ignoring correlation therefore causes conservatism, and the need to further evaluate spatial correlation is not warranted. Therefore consistent with the project *Statistical Methodology Report* (NewFields 2006), each measurement is assumed to be equally representative for that chemical at any point in the Site and calculation of the 95 percent UCL is appropriate. The data were also reviewed for the presence of hot spots, and as discussed in Section 3.6, no potential hot spots were identified at the Site; therefore, separate exposure areas were not evaluated in the HHRA.

Representative exposure concentrations for soil are based on the potential exposure depth for each of the receptors. For all receptors, five different exposure depths are considered, based on the sample depth rules schematic presented in Section 3: all data (surface, subsurface, and fill), data classified as fill material only, data classified as fill material and/or surface soil, data classified as surface soil only, and all data excluding data classified as fill material.

These different soil exposure classifications are considered to represent all possible exposure potential for all receptors, based on the future grade and use of Site soils. Ninety-five percent UCLs are calculated for each of these five different exposure depth scenarios. Although specific-receptors would not necessarily be exposed to all depth ranges (for example, residents and

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<sup>39</sup> Although the *Statistical Methodology Report* states that confirmation measurements of each chemical in a given soil layer will be used to compute variograms, as noted in the text above, this was not conducted for the Site, which is a deviation from the *BRC Closure Plan* methodology.

<sup>40</sup> Some variability of the data is expected, if there was perfect homogeneity then only one sample would be needed to represent the Site. This natural variability is demonstrated by the background datasets for the project. As shown on the probability and boxplots in Appendix G, the data generally follow a normal distribution, and their variability are similar to the background data.

construction workers are considered to have potential exposures to 10 feet bgs, while commercial workers only to surface soils), to be conservative, the highest of the five values was used in the risk estimates for each COPC. The 95 percent UCL for each COPC is presented in Table 6-1 (Tables section). For indirect exposures, this concentration was used in fate and transport modeling.

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

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

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

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

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

$$\text{95 percent UCL of Poisson Distribution Mean} = \text{CHIINV}(1 - \text{upper confidence percentile}, 2 \times (\text{Long fiber count} + 1)) / 2$$

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

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

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

### 6.1.2 Indoor Air

#### *USEPA's 2002 Vapor Intrusion Guidance*

BRC has reviewed USEPA's 2002 Vapor Intrusion Guidance (2002d), and believes that the approach used for the Site conforms to this guidance. The guidance recommends and BRC has followed a tiered approach to address vapor intrusion for each of the Eastside sub-areas, including the Galleria North of ROW Sub-Area. First, in each of the sub-area SAPs, including that for the Site, BRC has identified each of the chemicals (VOCs and volatile SVOCs) to be evaluated further in each sub-area (that is, a Tier 1 assessment).

Second, BRC explicitly compared the existing groundwater data for wells that are located within (or adjacent to) that sub-area with the USEPA 2002 Tier 2 comparison values (provided in lookup tables in the guidance document). Thus, this Tier 2 assessment was done in the NDEP-approved SAPs for each of the sub-areas. The Tier 2 comparison table for the Site is provided in Appendix J (Table J-1; note that groundwater concentrations have been updated with the most recent groundwater monitoring event for VOCs in August 2012). As shown in this table, with the exception of chloroform (see discussion below), all VOCs and volatile SVOCs pass a Tier 2 assessment.

Third, BRC has conducted a site-specific human health risk assessment for vapor intrusion using surface flux data on a sample-by-sample basis, per NDEP recommendations (that is, a Tier 3 assessment; see below). As noted in USEPA's 2002 guidance for a Tier 3 site-specific assessment: "If buildings are not available or not appropriate for sampling, for example in cases where future potential impacts need to be evaluated, other more direct measures of potential impacts, such as emission flux chambers or soil gas surveys, may need to be conducted in areas underlain by subsurface contamination." Thus flux measurements are allowed under USEPA's guidance.

Fourth, BRC has also evaluated the various factors pertaining to vapor intrusion, including depth to groundwater (now and in the future), the nature of the soil column from ground surface to groundwater, and, water quality (*i.e.*, the constituents likely to be present in groundwater and which might pose any vapor intrusion concerns). BRC has performed a more detailed site-specific evaluation of vapor intrusion potential at a comparison study area within the Eastside

property. Based on Site-specific conditions, including depth to groundwater, VOC concentrations in groundwater (which are generally less near the Site - for example, chloroform concentration in groundwater of 32 to 360 µg/L at the Site versus 180 to 1,200 µg/L at the comparison study area), and expected similar soil physical property, the comparison study area presents a similar potential for vapor intrusion than the Site (and as shown below, in all cases ILCRs and non-cancer HIs are at or below acceptable levels). See the table below for various parameters.

Parameter	Comparison Study Area	Galleria North of ROW Sub-Area	Units
Particle Density <sup>1</sup>	1.8	1.8	g/cm <sup>3</sup>
Gravimetric Soil Moisture <sup>1</sup>	4.46	4.26	percent
Porosity <sup>1</sup>	33.8	33.3	percent
Permeability <sup>1</sup>	0.0019	0.0011	cm/sec
Bulk Density <sup>1</sup>	2.7	2.7	g/cm <sup>3</sup>
Organic Carbon Content <sup>1</sup>	1.1	2.0	percent
USCS Soil Types	SM/GM/GW/ML	SM/GM/GW/ML	--
Depth to Groundwater	49 to 60	29 to 59	ft bgs
Chloroform in Groundwater	180 to 1,200	32 to 360	µg/L

<sup>1</sup>Values presented are averages for each area. For example, the range of permeabilities for the Site are 0.00067 to 0.0015 cm/sec, while those for the comparison study area are 0.00029 to 0.0065 cm/sec.

BRC has performed a detailed evaluation of vapor intrusion risk assessments for chloroform at the comparison study area location, showing that risks were acceptable (residential indoor ILCRs ranged from  $1 \times 10^{-8}$  to  $9 \times 10^{-7}$ , and non-cancer HIs were well below 1.0).<sup>41</sup> The comparison study area risk estimate calculations are provided electronically in Appendix J (included on the report CD in Appendix B). Input parameters and results for the indoor air calculations for the comparison study area location are also provided in Appendix J (Tables J-2 through J-6).

Finally, BRC is aware of USEPA's recent *Review of the Draft 2002 Subsurface Vapor Intrusion Guidance*. Issues and recommendations identified in this documents as well as the USEPA

<sup>41</sup> For comparison, chloroform residential indoor ILCRs for the Site were  $1 \times 10^{-8}$  to  $3 \times 10^{-6}$  and non-cancer HIs were well below 1.0; and vapor intrusion ILCRs for the Mohawk sub-area were  $4 \times 10^{-8}$  to  $9 \times 10^{-7}$  and non-cancer HIs were well below 1.0.

Office of Inspector General's *Evaluation Report—Lack of Final Guidance on Vapor Intrusion Impedes Efforts to Address Indoor Air Risks* (December 14, 2009), focus primarily on Tier 1 and Tier 2 assessments, and ultimately will not affect how indoor air exposures have been evaluated for the Site.

### *Site-Specific Tier 3 Assessment*

Concentrations of volatile constituents (VOCs and certain SVOCs) in soil and groundwater that may infiltrate buildings to be constructed at the Site through cracks in the foundations are estimated using USEPA surface emission isolation flux chamber (flux chamber) measurements collected at the Site in accordance with USEPA (1986) guidance and the Flux Chamber SOP-16 (BRC, ERM, and MWH 2009). The flux chamber is used to measure the emission rates from surfaces emitting gas species. Use of the flux chamber reduces the need for modeling surface flux rates, which potentially reduces the uncertainty in the air representative exposure concentrations and the risk characterization. Because the flux chamber measurements were conducted outdoors on open soil, an “infiltration factor” is applied to the outdoor surface flux data to generate data supporting the inhalation of indoor air exposure pathway. The infiltration factor is based on the factors found in the American Society for Testing and Materials (ASTM) *Standard Guide for Risk Based Corrective Action* (2000). The indoor air concentrations are determined from the surface flux measurements using the following mixing equation:

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

where:

- $C_a$  = indoor air concentration (milligram per cubic meter [ $\text{mg}/\text{m}^3$ ])
- $J$  = measured flux of chemical ( $\text{mg}/\text{m}^2\text{-min}$ )
- $\eta$  = foundation crack fraction (unitless)
- $L$  = enclosed space volume/infiltration area ratio (meter [ $\text{m}$ ])
- $ER$  = enclosed space air exchange rate (1/min)

Default parameter values from ASTM (2000) for residential and commercial buildings were used (as presented in Section 9 of the NDEP-approved *BRC Closure Plan* [BRC, ERM, and DBS&A 2007; Section 9 revised March 2010]). These default parameters are presented in the electronic indoor air calculation files in Appendix J (included on the report CD in Appendix B). As noted in

Section 5.4, indoor air exposures are evaluated on a sample by sample basis, per NDEP requirements, using the surface flux data measurements.

Those VOCs and volatile SVOCs that did not pass the Tier 2 assessment (see above) are evaluated at each individual surface flux location. However, to be consistent with the selection of COPCs for soil; one-tenth of the groundwater Tier 2 comparison values were used. Based on this, carbon tetrachloride, chloroform, tetrachloroethene, and trichloroethene were evaluated further in the vapor intrusion Tier 3 assessment.

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

### 6.1.3 Outdoor Air

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

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

where:

- PEF = Particulate emission factor (m<sup>3</sup>/kg)
- Q/C<sub>wind</sub> = Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source (g/m<sup>2</sup> -s per kg/m<sup>3</sup>)
- V = Fraction of vegetative cover (unitless)
- U<sub>m</sub> = Mean annual windspeed (m/s)
- U<sub>t</sub> = Equivalent threshold value of windspeed at 7m (m/s)
- F(x) = Function dependent on U<sub>m</sub>/U<sub>t</sub> derived using USEPA (1985) (unitless)

and

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

where

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

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

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

$$PEF = \frac{I}{\left( \left( \frac{I}{PEF_{sc}} \right) + \left( \frac{I}{PEF_{sc\_road}} \right) \right)}$$

where:

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

Input soil concentrations for the model are the exposure point concentrations as described above. The construction dust model and all relevant equations and parameters utilized to generate the construction worker PEF from this guidance are provided in Table 6-5. Site-specific surface soil moisture data were collected in January-April and June-September. The average of the surface soil data is 3.5 percent. This is considered an adequate representation of the annual average; therefore, this value is used for the percent moisture in dry road surface parameter instead of the NDEP model default value.

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

The flux chamber measurements as described in Section 6.1.2 above are used for exposures to VOCs and volatile SVOCs in outdoor air if the chemical was present in the TO-15 analyte list. If the VOC or volatile SVOC was measured in soil but not on the TO-15 analyte list, then the exposure point concentration was estimated using USEPA's volatilization factor. Outdoor surface flux data are divided by the dispersion factor for volatiles ( $Q/C_{vol}$  for Las Vegas; from USEPA 2002b) for use in the outdoor air exposure pathway. The same dispersion factor is used for all scenarios. The dispersion factor for the construction worker is not adjusted to account for

soil intrusion activities. Outdoor air concentrations based on soil data for all receptors are shown in Table 6-6. Outdoor air concentrations based on the surface flux data measurements are shown in the electronic indoor air calculation files in Appendix H (included on the report CD in Appendix B) and are summarized in Table 6-3.

#### 6.1.4 Homegrown Produce

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

Aboveground plant uptake factor:

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

Belowground plant uptake factor:

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

where:

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

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

## 6.2 EXPOSURE ASSESSMENT

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

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

### 6.2.1 Exposure Parameters

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

### 6.2.2 Quantification of Exposure

In this section, the concentrations of COPCs at the points of potential human exposure are combined with assumptions about the behavior of the populations potentially at risk to estimate the dose of COPCs that may be taken in by the exposed individuals. Later, in the risk

characterization step of the assessment, the doses are combined with toxicity parameters for COPCs to estimate whether the calculated intake levels pose a threat to human health.

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

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

where:

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

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

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

where:

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

Pathway-specific equations for calculating ADDs and LADDs are provided in Table 9-6 of the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010). For conservatism, the relative oral bioavailability (BIO) of all COPCs was assumed to be 100 percent, except for arsenic. Consistent with the *BRC Closure Plan* (BRC, ERM, and DBS&A 2007; Section 9 revised March 2010), an arsenic oral bioavailability of 30 percent is used.

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

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

### 6.2.3 Asbestos

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

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

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

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

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

### 6.3 TOXICITY ASSESSMENT

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

#### 6.3.1 Toxicity Values

Toxicity values, when available, are published by the USEPA in the on-line Integrated Risk Information System [IRIS]; USEPA 2013). CSFs (in units of milligrams per kilogram per day [ $\text{mg/kg-d}$ ]<sup>1</sup>) are chemical-specific and experimentally derived potency values that are used to calculate the risk of cancer resulting from exposure to potentially carcinogenic chemicals. Inhalation unit risks (IURs) represent the upper-bound excess lifetime cancer risk from continuous exposure to a chemical at a concentration of 1 microgram per cubic meter ( $\mu\text{g/m}^3$ ). A higher value implies a more potent carcinogenic potential. Reference dosages (RfDs) are experimentally derived “no-effect” levels used to quantify the extent of toxic effects other than cancer due to exposure to chemicals (in units of  $\text{mg/kg-d}$ ). Similarly, a reference concentration (RfC) is the derived “no-effect” concentration for a lifetime of continuous inhalation exposure (in units of milligrams per cubic meter [ $\text{mg/m}^3$ ]). With RfDs or RfCs, a lower value implies a more potent toxicant. These criteria are generally developed by USEPA risk assessment work groups and listed in the USEPA risk assessment guidance documents and databases. Available toxicity values for all Site COPCs used in the risk assessment were obtained using the following hierarchy for selecting toxicity criteria (based on USEPA 2003c):

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

#### 8. Peer-reviewed scientific literature.

In addition, toxicity criteria and toxicological surrogates recommended by the NDEP are used in the risk assessment. Toxicity criteria are consistent with those used in the development of the NDEP's BCLs (NDEP 2013), unless newer values are available from USEPA. Toxicity criteria have not been developed by BRC for elements or compounds that do not have criteria published in the above sources.

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

#### 6.3.2 Non-Carcinogenic Health Effects

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

Four major types of uncertainty factors are typically applied to NOAELs in the derivation of RfDs or RfCs. Uncertainty factors of 10 are used to (1) account for the variability between humans, (2) extrapolate from animals to humans, (3) account for a NOAEL based on a subchronic study instead of a chronic study, and (4) extrapolate from a lowest-observed-adverse-

effect-level (LOAEL) to a NOAEL, if necessary. In addition, a modifying factor can be used to account for adequacy of the database. Typically, the modifying factor is set equal to one.

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

### 6.3.3 Carcinogenic Health Effects

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

### 6.3.4 Asbestos

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

## 6.4 RISK CHARACTERIZATION

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

### 6.4.1 Methods for Assessing Cancer Risks

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

$$Risk = EC \times IUR \text{ or } LADD \times CSF$$

where:

- LADD = lifetime average daily dose (mg/kg-d)
- EC = exposure concentration (mg/m<sup>3</sup>)
- IUR = inhalation unit risk (mg/m<sup>3</sup>)<sup>-1</sup>
- CSF = cancer slope factor (mg/kg-d)<sup>-1</sup>

and:

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

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

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

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

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

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

where:

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

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

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

$$\text{Hazard Index} = \Sigma \text{Hazard Quotients}$$

Any HI less than 1.0 indicates the exposure is unlikely to be associated with a potential health concern. If the HI is greater than 1.0, then the HQs are summed by the specific target organs affected by a particular chemical or chemicals. This is also summed across pathways and chemicals. Target organs are identified primarily by the source of the toxicity criteria (e.g., IRIS). Since a chemical may affect more than one organ, in addition to the source of the toxicity criteria Oak Ridge National Laboratory's (ORNL) Risk Assessment Information System's toxicity profiles were also searched for target organ information (ORNL 2013). The target organs for the COPCs are shown in Table 6-13 (Tables section).

#### 6.4.3 Methods for Assessing Asbestos Risks

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

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

where:

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

This equation considers male smokers, male non-smokers, female smokers, and female non-smokers. In addition, because both chrysotile and amphibole have been detected at the BMI Common Areas, both amphibole and chrysotile fibers are evaluated in the risk assessments,

regardless of if either was detected within an exposure area (as calculated using the 95 percent UCL of the mean of the assumed underlying Poisson distribution).

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

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

where:

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

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

#### 6.4.4 Risk Assessment Results

The calculation of theoretical upper-bound ILCRs and non-cancer health effects are presented by receptor in Tables 6-14 through 6-18 (Tables section) and are discussed in Section 8. These

tables present the theoretical upper-bound ILCRs and non-cancer health effects calculations for residential (including background), construction worker, commercial (indoor) worker, and maintenance (outdoor) worker receptors. The risk of death from lung cancer or mesothelioma as a consequence of exposure to asbestos on a Site-wide basis is presented in Table 6-19 (Tables section). All calculation spreadsheets are provided in Appendix H (included on the report CD in Appendix B). As discussed in Section 8, based on the results of the HHRA, exposures to residual levels of chemicals in soil at the Galleria North of ROW Sub-Area should not result in adverse health effects to any of the future receptors evaluated.

## 7.0 UNCERTAINTY ANALYSIS

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

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

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

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

## 7.1 ENVIRONMENTAL SAMPLING

The HHRA for the Site was based on the sampling results obtained from investigations conducted from 2009 through 2013. Errors in sampling results can arise from the field sampling, laboratory analyses, and data analyses.

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

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

The laboratory data are another potential source of uncertainty. Maximum SQLs for dichloromethyl ether and N-nitrosodi-n-propylamine exceeded one-tenth their residential soil BCL. These chemicals were not evaluated quantitatively in the HHRA as they were not detected in any Site samples. This may result in an underestimation of risk.

Widespread blank contamination was noted for the full scan surface flux analysis of benzene. Benzene was associated with 32 censored data points (of 58 surface flux samples<sup>42</sup>). Benzene has been detected in groundwater across the BMI Complex. The highest detected flux is 1.43  $\mu\text{m}^3, \text{min}^{-1}$ , while the highest censored result is over 20 times less than that result. Therefore, censoring this data is not resulting in a significant underestimation of risk.

Dibromochloropropane was subject to a widespread blank contamination resulting in the "UJ" qualification of all 58 flux samples. The laboratory has stated that dibromochloropropane is very difficult to clean from laboratory materials due to its low vapor pressure and affinity for surfaces. Dibromochloropropane is not anticipated to be Site-related, but the qualification may result in an underestimation of risk.

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<sup>42</sup> Twenty-nine locations were analyzed using both TO-15 full scan and TO-15 SIM.

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

NDEP has issued recent guidance regarding qualifying data due to blank contamination (NDEP 2011). As noted in the guidance, NDEP requires that data validated before June 2011 and impacted by blank contamination be discussed in any report that uses such data. In so doing, a semi-quantitative comparison of the potential differences between approaches taken previously and the requirements specified in the guidance will be described and explained. The discussion below provides this semi-quantitative comparison for data impacted by blank contamination for the Site.

All but a few sample results for the Site were collected and validated prior to June 2011; therefore, the majority of data were qualified using existing USEPA and NDEP guidance. The issue of blank contamination is not one that affects the typical primary risk drivers for the project, including those for the Site. The primary risk drivers for the Site are aluminum, arsenic, lithium, manganese, strontium, and vanadium, none of which, had blank contamination issues. Therefore, the impact of these samples on the background comparison statistics is unlikely to be significant. The following other metals had samples qualified due to blank contamination: antimony (22 samples), beryllium (16 samples), boron (12 samples), cadmium (39 samples), hexavalent chromium (10 samples), mercury (102 samples), molybdenum (17 samples), selenium (16 samples), silver (10 samples), thallium (9 samples), tin (9 samples), and tungsten (8 samples). Given the number of samples qualified due to blank contamination for several of these, this may have an impact on the background comparison statistics. However, in all cases, except for thallium, the maximum detected concentrations for these metals are less than one-tenth their respective BCLs (and their maximum non-detect concentrations are also less than one-tenth their BCLs). Therefore, this issue has no material effect on the selection of COPCs and the results of the HHRA for the Site.

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

described in Section 3.1, and the maximum of the UCLs for the subsets of data was used as the exposure point concentration. There is some uncertainty in the choice of subsetting on the concentrations of interest, and there is a potential small overestimation of risk by choosing the maximum of the UCLs as the exposure point concentration. The effects are likely to be small given the data, since there is not much variation in the different UCLs.

## 7.2 ESTIMATES OF EXPOSURE

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

### 7.2.1 Aggregation of Exposure Areas

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

### 7.2.2 Types of Exposures Examined

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

### 7.2.3 Intake Assumptions Used

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

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

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

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

unlikely to contribute significantly to the risk. Consequently, the effect on the risk assessment of excluding perchlorate from the soil-to-plant pathway is likely to be small.

Soil preparation for a backyard garden is not accounted for in the HHRA and would result in reduced soil concentrations. Las Vegas area soils are "...alkaline, clayish, caliche or hard and salty. [In addition,]...soils are lacking organic matter and nutrients" (Mills, 2000). Therefore, residential gardening cannot occur in Site soils in its existing condition. For non-native vegetation to grow, soil amendments must be added. Recommended soil preparations for the area include thoroughly blending equal amounts of organic matter with the soil as well as the addition of other soil amendments (e.g., fertilizers).

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

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

### 7.3 TOXICITY ASSESSMENT

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

#### 7.3.1 COPCs Lacking Toxicological Data

Toxicity criteria have not been established for some of the chemicals detected at the Site. These chemicals were not quantitatively evaluated in the HHRA. For example, potassium is an analyte for which no USEPA toxicity criteria have been established. The health effects and levels of concern for potassium in soil are not known. While not including potassium may have resulted in

a low degree of underestimation of quantitative Site risk estimates, the available toxicological information suggests that this underestimation will not likely affect the decisions made relative to Site risks.

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

### 7.3.2 Uncertainties in Animal and Human Studies

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

Typically, test animals are administered high doses (e.g., maximum tolerated dose) of a chemical in a standard diet or in air. Humans are generally exposed to much lower doses in the environment, which may affect the toxicity of the chemical. In these studies, test animals, often laboratory rodents, are exposed daily to the chemical agent for various periods of time up to their 2-year lifetimes. Humans have an average 70-year lifetime and may be exposed either intermittently or regularly for an exposure period ranging from weeks to a full lifetime. Because of these differences, it is not surprising that extrapolation error is a large source of uncertainty in a risk assessment.

### 7.3.3 Non-Carcinogenic Toxicity Criteria

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

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

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

### 7.3.5 Carcinogenic Toxicity Criteria

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

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

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

which is a function of the variability in the input animal data, is taken as the CSF. CSFs are then used directly in cancer risk assessment.

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

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

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

### **7.3.6 Uncertainties with the Asbestos Risk Assessment**

For the risk assessment, asbestos concentrations were presented two ways, as a best estimate and upper bound based upon the UCL of the mean of the Poisson distribution. Asbestos risk estimates are highly dependent on the number of samples to increase or decrease the pooled analytical sensitivity. That is, a larger number of non-detect samples with similar individual analytical sensitivity results in a lower pooled analytical sensitivity and subsequently a lower estimated ARR, whereas a smaller number of non-detect samples results in a higher ARR. Uncertainty is, thus, reduced as more samples are collected.

## 7.4 CUMULATIVE EFFECT OF UNCERTAINTIES

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

## 8.0 SUMMARY OF RESULTS

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

The risk estimates are based on reasonable maximum exposure scenarios, which results in estimates of the potential reasonable maximum, or high-end, risks associated with the Site. The calculated chemical theoretical upper-bound ILCRs and HIs are presented in Tables 6-14 through 6-18 for residential (including background), construction worker, commercial (indoor) worker, and maintenance (outdoor) worker receptors, respectively. Asbestos estimated risk of death from lung cancer or mesothelioma on a Site-wide basis are presented in Table 6-19.

### 8.1 RESIDENTS

For chemical exposures, the total cumulative non-cancer HI for future residential receptors at the Site is 2.1 (including the surface flux air risk estimates<sup>43</sup>) (Table 6-14), with metals (primarily lithium, manganese, and strontium) soil exposures via the oral ingestion and homegrown produce pathways being the primary contributors. Because the HI exceeds the target HI of 1.0, is driven primarily by metals, and as noted in USEPA guidance (1989), 'If background risk might be a concern, it should be calculated separately from site-related risk.' background risk estimates were also evaluated (Table 6-15). Background risk estimates are only evaluated for those metals selected as COPCs (aluminum, arsenic, lithium, manganese, strontium, and vanadium) and evaluated in the HHRA. In addition, representative exposure concentrations for background are the 95 percent UCL concentrations based on the background dataset used in Section 5. The background non-cancer HI for future residential receptors at the Site is 1.2 (Table 6-15).

The maximum theoretical upper-bound ILCR for future residential receptors at the Site is  $1 \times 10^{-5}$  (including the surface flux air risk estimates see Table 6-14). The theoretical upper-bound ILCR is above the risk goal of  $1 \times 10^{-6}$ , but within USEPA's acceptable risk range of  $10^{-6}$  to  $10^{-4}$ ; and is driven primarily by arsenic soil exposures. The background theoretical upper-bound ILCR for future residential receptors at the Site is  $1 \times 10^{-5}$  (Table 6-15).

<sup>43</sup> The minimum and maximum surface flux risk estimates are summed with the soil risk estimates to provide a range of cumulative risks. The minimum and maximum surface flux risk estimates are provided in Appendix H (included on the report CD in Appendix B) and the receptor-specific chemical risk summary tables. The risks shown are cumulative risks using the maximum surface flux risk estimate.

The estimated risks for death from lung cancer or mesothelioma for asbestos exposures to future residential receptors were below  $1 \times 10^{-6}$ . For residential receptors, the best estimate and upper bound concentrations for chrysotile fibers are  $1 \times 10^{-9}$  and  $3 \times 10^{-9}$ ; and zero and  $2 \times 10^{-7}$  for amphibole fibers (Table 6-19). These estimated risks are below the low end of the risk goal of  $1 \times 10^{-6}$ . The upper-bound estimated risk of death from lung cancer or mesothelioma is estimated based on the 95 percent UCL of the count of the number of fibers detected, assuming a Poisson distribution for the count.

## 8.2 CONSTRUCTION WORKERS

For chemical exposures, the total cumulative non-cancer HI for construction worker receptors at the Site is 0.53 (including the surface flux air risk estimates) (Table 6-16), with metals soil exposures via the oral ingestion pathway being the primary contributors. The HI does not exceed the target HI of 1.0. As a result, BRC did not evaluate background non-cancer HI values.

The maximum theoretical upper-bound ILCR for construction worker receptors at the Site is  $2 \times 10^{-7}$  (including the surface flux air risk estimates see Table 6-16) with arsenic soil exposures via the oral ingestion and dermal contact pathways the primary contributor. The theoretical upper-bound ILCRs are all below the low end of the risk goal of  $1 \times 10^{-6}$ .

The estimated risks for death from lung cancer or mesothelioma for asbestos exposures to construction workers were below  $1 \times 10^{-6}$ . For construction worker receptors, the best estimate and upper-bound concentrations for chrysotile fibers are  $2 \times 10^{-9}$  and  $5 \times 10^{-9}$ , and zero and  $3 \times 10^{-7}$  for amphibole fibers (Table 6-19). These estimated risks are at or below the low end of the risk goal of  $1 \times 10^{-6}$ .

## 8.3 COMMERCIAL (INDOOR) WORKERS

For chemical exposures, the total cumulative non-cancer HI for commercial (indoor) worker receptors at the Site is 0.031 (including the surface flux air risk estimates) (Table 6-17), with metals soil exposures via the oral ingestion pathway being the primary contributors. The HI does not exceed the target HI of 1.0. As a result, BRC did not evaluate background non-cancer HI values.

The maximum theoretical upper-bound ILCR for commercial (indoor) worker receptors at the Site is  $7 \times 10^{-7}$  (including the surface flux air risk estimates see Table 6-17) with arsenic soil exposures via the oral ingestion and dermal contact pathways the primary contributor. The theoretical upper-bound ILCRs are all below the low end of the risk goal of  $1 \times 10^{-6}$ .

The estimated risks for death from lung cancer or mesothelioma for asbestos exposures to commercial (indoor) workers were below  $1 \times 10^{-6}$ . For commercial (indoor) worker receptors, the best estimate and upper-bound concentrations for chrysotile fibers are  $2 \times 10^{-10}$  and  $7 \times 10^{-10}$ , and zero and  $4 \times 10^{-8}$  for amphibole fibers (Table 6-19). These estimated risks are below the low end of the risk goal of  $1 \times 10^{-6}$ .

#### 8.4 MAINTENANCE (OUTDOOR) WORKERS

For chemical exposures, the total cumulative non-cancer HI for commercial (outdoor) worker receptors at the Site is 0.056 (including the surface flux air risk estimates) (Table 6-18), with metals soil exposures via the oral ingestion pathway being the primary contributors. The HI does not exceed the target HI of 1.0. As a result, BRC did not evaluate background non-cancer HI values.

The maximum theoretical upper-bound ILCR for commercial (outdoor) worker receptors at the Site is  $1 \times 10^{-6}$  (including the surface flux air risk estimates see Table 6-18) with the soil theoretical upper-bound ILCRs for arsenic via the oral ingestion and dermal contact pathways the primary contributor. The theoretical upper-bound ILCRs are all at or below the low end of the risk goal of  $1 \times 10^{-6}$ .

The estimated risks for death from lung cancer or mesothelioma for asbestos exposures to maintenance (outdoor) workers were below  $1 \times 10^{-6}$ . For maintenance (outdoor) worker receptors, the best estimate and upper-bound concentrations for chrysotile fibers range from  $5 \times 10^{-10}$  to  $2 \times 10^{-9}$  and zero and  $8 \times 10^{-8}$  for amphibole fibers (Table 6-19). These estimated risks are below the low end of the risk goal of  $1 \times 10^{-6}$ .

## 9.0 DATA QUALITY ASSESSMENT

Sample size calculations were conducted for the nine selected COPCs for the Site,<sup>44</sup> as well as TCDD TEQ. TCDD TEQ was included because it is a chemical of primary concern for the overall project.

The formula used here for calculation of sample size is based on a non-parametric test (the Wilcoxon signed rank test), and on simulation studies performed by Pacific Northwest National Laboratories (PNNL 2009) that formed the basis for an approximate formula that is based on the normal distribution. Essentially, the formula is the one that would be used if a normal-based test were being performed, but an adjustment is made (multiply by 1.16) to account for the intent to perform a non-parametric test. The formula is as follows:

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

where:

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

For each chemical, inputs for the calculations include an estimate of the variance from the measured data, a desired significance level, and desired power of the test that must be specified at a concentration of interest (which determines the tolerable difference from the threshold value). For arsenic, the Site mean concentration exceeds its BCL based on the target cancer risk level of  $10^{-6}$ . It is not appropriate to apply this calculation where the threshold value is less than the mean concentration. Therefore, an adjustment of the threshold value was used based on a  $10^{-5}$  target cancer risk level. The calculations provided here cover a range of Type I and Type II error

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<sup>44</sup> Note that benzo(a)pyrene was selected as a COPC based on exceeding the one-tenth BCL criteria. Other carcinogenic PAHs were also selected as COPCs because of benzo(a)pyrene. Therefore, sample size calculations were only performed for benzo(a)pyrene, as representative of PAHs.

tolerances, and the point at which the Type II error is specified. Results are presented in Table 9-1. In this table, various combinations of input values are used, including values of  $\alpha$  of 5, 10, and 15 percent; values of  $\beta$  of 15, 20, and 25 percent; and a gray region of width 10, 20, and 30 percent of the threshold level. It is clear from Table 9-1 that the number of samples collected is adequate for the Site. That is, all calculated adequate sample numbers are less than those actually collected at the Site for use in the HHRA.

Note also that there are 58 samples collected for asbestos analysis. Amphibole was not detected in any of these samples; however, because of the number of samples collected, the ARR is all less than  $1 \times 10^{-6}$ . Consequently, sufficient samples have been collected to address ARRs.

## 10.0 SUMMARY

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

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

Although the total cumulative non-cancer HI for future residential receptors at the Site exceeds the non-cancer target HI of 1.0, the background non-cancer HI for future residential receptors is also above 1.0. Two removal actions were conducted at the Site, in 2009 and 2010. These removal actions were primarily driven by metals, asbestos, dioxins/furans/PCB congeners, and SVOCs/PAHs. All removal actions have fully addressed the identifiable contamination at the Site.

Aluminum, arsenic, lithium, manganese, strontium, and vanadium were selected as COPCs because they failed background statistical comparisons, as well as being greater than one-tenth their respective residential BCLs. However, a review of the statistical plots presented in Appendix G, as well as the intensity plots in Appendix I, demonstrate that elevated concentrations of these metals (as well as other metals such as calcium, magnesium, and uranium) occur primarily in subsurface soils. Thus, there is no evidence of contamination and these concentrations likely reflect naturally occurring levels.

Therefore, given the successful removal actions conducted at the Site, considering the concentrations of metals at the Site likely reflect naturally occurring levels, and the Site is essentially undeveloped desert with no evidence of contamination by surface runoff or dust deposition, further removal actions at the Site will not affect the risk estimates in this HHRA.

Therefore, BRC requests that the incremental risk estimates be considered in any risk management decisions for the Site.

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

- Data collected for use in the HHRA are adequate and usable for their intended purpose;
- All relevant and reasonable exposure scenarios and pathway have been evaluated; and
- Residential, construction worker, commercial (indoor) worker, and maintenance (outdoor) worker cancer and non-cancer risk estimates are within or below the risk goals for the project, and/or concentrations of metals are consistent with naturally occurring levels.

Following the Tiered approach from the USEPA 2002 Vapor Intrusion Guidance, BRC believes that it has demonstrated that there is no likelihood of adverse vapor intrusion into any indoor spaces that may be constructed in the Galleria North of ROW Sub-Area. Therefore, based on the results of the HHRA, and the conclusions in this report, exposures to residual levels of chemicals in soil at the Galleria North of ROW Sub-Area should not result in adverse health effects to all future receptors. Therefore, BRC concludes that an NFAD for the Galleria North of ROW Sub-Area is warranted and requests that the NDEP issue the NFAD (see Appendix K for the legal description of the Site).

## 11.0 REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Update to the ATSDR Policy Guideline for Dioxins and Dioxin-Like Compounds in Residential Soil. U.S. Department of Health and Human Services, Public Health Service. November.
- American Society for Testing and Materials (ASTM). 2000. Standard Guide for Risk-Based Corrective Action. E2081-00.
- BRC. 2008. Sampling and Analysis Plan for the Galleria North Sub-Area, BMI Common Areas (Eastside), Clark County, Nevada. October.
- BRC. 2009. Removal Action Work Plan for Soil, Galleria North and Sunset North Sub-Areas, Henderson, Nevada. September 22.
- BRC. 2010. Technical Memorandum – Correlation of Radon Activities in Indoor Air and Shallow Zone Groundwater, BMI Common Areas (Eastside) Site, Clark County, Nevada. August 30.
- BRC. 2011. BRC Comments on NDEP Blank Contamination Guidance. Technical Memorandum. Draft. August 15.
- BRC and Environmental Resources Management (ERM). 2009a. BRC Quality Assurance Project Plan. BMI Common Areas, Clark County, Nevada. May.
- BRC and ERM. 2009b. 2008 Supplemental Shallow Soil Background Report. BMI Common Areas (Eastside), Clark County, Nevada. September.
- BRC and ERM. 2010a. Data Validation Summary Report. Galleria North Sub-Area Soil Investigations; January-March 2009; July-August 2009 (Dataset 60). BMI Common Areas (Eastside), Clark County, Nevada. Revision 1. May.
- BRC and ERM. 2010b. Data Validation Summary Report. Sunset North Commercial and Galleria North Sub-Areas 2nd Round Confirmation Soil Investigations; September 2009; December 2009; January 2010 and May 2010 (Dataset 60a). BMI Common Areas (Eastside), Clark County, Nevada. Revision 1. July.
- BRC and ERM. 2010c. Data Validation Summary Report. 2010 Eastside North Confirmation Soil Investigations – April through September 2010 – Part I (Dataset 72a). BMI Common Areas (Eastside), Clark County, Nevada. Revision 1. November.

- BRC and ERM. 2010d. Background Soil Compilation Report. BMI Complex and Common Areas, Clark County, Nevada. April.
- BRC, ERM, and Daniel B. Stephens & Associates, Inc. (DBS&A). 2007. BRC Closure Plan, BMI Common Areas, Clark County, Nevada. May. [Section 9 revised March 2010]
- BRC, ERM, and MWH. 2009. BRC Field Sampling and Standard Operating Procedures, BMI Common Areas, Clark County, Nevada. December.
- Berman D.W. 2003a. Analysis and Interpretation of Measurements for the Determination of Asbestos in Core Samples Collected at the Southdown Quarry in Sparta, New Jersey, November 12.
- Berman D.W. 2003b. Evaluation of Asbestos Measurements and Assessment of Risks Attendant to Excavation and Use of Soils Within the Proposed Borrow Area of the BRC Corrective Action Management Unit, Henderson, NV, November 25.
- Berman D.W. 2005. Draft Preliminary Evaluation of the Implications of Airborne Asbestos Exposure Concentrations Observed During Simulation of a Selected Set of Common, Outdoor Residential Activities Conducted at the North Ridge Estates Site, Klamath Falls, Oregon, February 18.
- Berman, D.W., and E.J. Chatfield. 1990. Interim Superfund Method for the Determination of Asbestos in Ambient Air. Part 2: Technical Background Document, Office of Solid Waste and Remedial Response, U.S. EPA, Washington, D.C., EPA/540/2-90/005b, May.
- Berman, D.W., and K. Crump. 1999a. Methodology for Conducting Risk Assessments at Asbestos Superfund Sites—Part 1: Protocol. Interim Version. Prepared for USEPA Region 9, February 15.
- Berman, D.W., and K. Crump. 1999b. Methodology for Conducting Risk Assessments at Asbestos Superfund Sites—Part 2: Technical Background Document. Interim Version. Prepared for USEPA Region 9, February 15.
- Berman, D.W., and K.S. Crump. 2001. Technical Support Document for a Protocol to Assess Asbestos-Related Risk. Prepared for Mark Raney, Volpe Center, U.S. Department of Transportation, 55 Broadway, Kendall Square, Cambridge, MA 02142. Under EPA Review.

- Berman D.W., and K.S. Crump. 2003. Final draft: Technical support document for a protocol to assess asbestos-related risk. Prepared for Mark Follensbee, Syracuse Research Corporation, Syracuse, NY, and the Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, DC. USEPA #9345.4-06. Limited revision draft.
- Berman, D.W., and A. Kolk. 2000. Modified Elutriator Method for the Determination of Asbestos in Soils and Bulk Material. May (Revision 1).
- Carlsen, C.L., R.C. Lunnis, and D.E. Prudie. 1991. Changes in water levels and water quality in shallow groundwater, Pittman-Henderson Area, Clark County, Nevada, Resulting from diversion of industrial cooling water from ditch to pipeline in 1985. U.S. Geological Survey Water-Resources Investigation Report 89-4093. Carson City, Nevada.
- Clark County GIS Management Office. 2003. 5 Foot Contours for the Las Vegas Valley, Mesquite and Laughlin. Fall 2003 Flight of Clark County.
- Daniel B. Stephens & Associates, Inc. (DBS&A). 2009. Revised Technical Memorandum: Sources/Sinks and Input Parameters for Groundwater Flow Model, BMI Common Areas, Eastside Area.
- Environmental Resources Management (ERM). 1996a. Environmental Conditions Investigation Work Plan, BMI Common Areas, Henderson, Nevada. February.
- ERM. 1996b. Draft Environmental Conditions Investigation Report, BMI Common Areas, Henderson, Nevada. August.
- ERM. 1997. Environmental Characterization Report – BMI Exclusion Areas 3, 4A, 4B, 5/6 - Henderson, Nevada.
- ERM. 2000. Remedial Alternatives Study for Soils and Sediments in the Upper and Lower Ponds at the BMI Complex. Henderson, Nevada. March 1.
- ERM. 2006a. Data Validation Summary Report Common Areas Sampling Event #1a - 1996 Environmental Conditions Investigation. August.
- ERM. 2006b. Data Validation Summary Report Common Areas Sampling Event #1b – 1996 Environmental Conditions Investigation – Exclusion Areas. January.

- ERM. 2006c. Data Validation Summary Report Common Areas Sampling Event #6d - October 1999 Pond and Ditch Sampling Miscellaneous Samples. July.
- ERM. 2006d. Data Validation Summary Report Common Areas Sampling Event #8c – October 2000, Former Pond Sampling. October.
- ERM. 2007a. Data Validation Summary Report Common Areas Sampling Event #20c – May/June 2001 Sunset North Supplemental Investigation. February.
- ERM. 2007b. Data Validation Summary Report Northeast Area Investigation, July-July 2007 (Dataset 46), BMI Common Areas (Eastside), Clark County, Nevada. October.
- Las Vegas Wash Coordination Committee. 2000. The Las Vegas Wash Comprehensive Adaptive Management Plan. <http://www.lvwash.org/resources/docs/lvwcamp.html>.
- Law Engineering Inc. 1993. Final Report of Phase I Environmental Condition Assessment, Titanium Metals Corporation (TIMET) - Henderson, Nevada.
- MWH. 2006. Data Validation Summary Report, 2004 Hydrogeologic Characterization (Dataset 27), BMI Common Areas (Eastside), Clark County, Nevada. May.
- Neptune and Company. 2009. Guided Interactive Statistical Decision Tools (GiSdT). [www.gisdt.org](http://www.gisdt.org).
- Nevada Division of Environmental Protection (NDEP). 2001. Record of Decision, Remediation of Soils and Sediments in the Upper and Lower Ponds at the BMI Complex. Henderson, Nevada. November 2.
- NDEP. 2006. Settlement Agreement and Administrative Order on Consent: BMI Common Areas, Phase 3 (AOC3).
- NDEP. 2008a. Supplemental Guidance for Assessing Data Usability for Environmental Investigations at the BMI Complex and Common Areas in Henderson, Nevada. Bureau of Corrective Actions, Special Projects Branch. October 22.
- NDEP. 2008b. Detection Limits and Data Reporting. Bureau of Corrective Actions, Special Projects Branch. December 3.

- NDEP. 2009a. Guidance for Evaluating Radionuclide Data for the BMI Plant Sites and Common Areas Projects. February 6.
- NDEP. 2009b. Technical Guidance for the Calculation of Asbestos-Related Risk in Soils for the Basic Management Incorporated (BMI) Complex and Common Areas. April.
- NDEP. 2009c. Supplemental Guidance on Data Validation. March 19.
- NDEP. 2009d. Supplemental Guidance on Data Validation. April 13.
- NDEP. 2009e. Guidance for Evaluating Secular Equilibrium at the BMI Complex and Common Areas. BMI Plant Sites and Common Areas Projects, Henderson, Nevada. February 6.
- NDEP. 2010. Workbook for the Calculation of Asbestos-Related Risk in Soils for the Basic Management Incorporated (BMI) Complex and Common Areas.
- NDEP. 2011. July 2011 Guidance on Qualifying Data due to Blank Contamination. BMI Plant Sites and Common Areas Projects, Henderson, Nevada.
- NDEP. 2013. User's Guide and Background Technical Document for Nevada Division of Environmental Protection (NDEP) Basic Comparison Levels (BCLs) for Human Health for the BMI Complex and Common Areas. April.
- NewFields Companies, LLC (NewFields). 2006. Statistical Methodology Report, BMI Common Areas (Eastside), Henderson, Nevada. August.
- Oak Ridge National Laboratory (ORNL). 2013. Risk Assessment Information System (RAIS) Toxicity Profiles. [http://rais.ornl.gov/tools/tox\\_profiles.html](http://rais.ornl.gov/tools/tox_profiles.html)
- Pacific Northwest National Laboratory (PNNL). 2009. Visual Sample Plan. <http://vsp.pnl.gov>.
- Scanlon, B.R., K.E. Keese, A.L. Flint, L.E. Flint, C.B. Gaye, W.M. Edmunds, and I. Simmers. 2006. Global synthesis of groundwater recharge in semiarid and arid regions. *Hydrological Processes* Hydrol. Process. 20(15):3335–3370.
- Southern Nevada Water Authority. 1996. Extent and Potential Use of the Shallow Aquifer and Wash Flow in Las Vegas Valley, Nevada.

- Umhoefer, P.J., L.S. Beard, and M.A. Lamb. eds. 2010. Miocene Tectonics of the Lake Mead Region, Central Basin and Range. Geological Society of America. Special Paper 463.
- U.S. Environmental Protection Agency (USEPA). 1985. Rapid Assessment of Exposure to Particulate Emissions From Surface Contamination Sites. EPA/600/8-85/002. Office of Health and Environmental Assessment. Washington, DC.
- USEPA. 1986. Measurement of Gaseous Emission Rates From Land Surfaces Using an Emission Isolation Flux Chamber, Users Guide. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada, EPA Contract No. 68-02-3889, Radian Corporation, February.
- USEPA. 1989. Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual (Part A). Interim Final. Office of Emergency and Remedial Response, Washington, DC. USEPA/540/1-89/002. December.
- USEPA. 1991a. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. Memorandum from D.R. Clay, Assistant Administrator, USEPA. OSWER Directive 9355.0-30, April.
- USEPA. 1991b. Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual. Supplemental Guidance ‘Standard Default Exposure Factors’. Office of Emergency and Remedial Response, Washington, DC. OSWER Directive 9285.3-03. March.
- USEPA. 1991c. Current Regulatory Issues in Risk Assessment and Risk Management. Executive Office of the President. Government Printing Office, Washington, DC. S/N 041 001 00354 1.
- USEPA. 1992a. Guidance for Data Usability in Risk Assessment. Part A. Office of Emergency and Remedial Response, Washington DC. Publication 9285.7-09A. PB92-963356. April.
- USEPA. 1992b. Guidelines for Exposure Assessment. Federal Register, 57(104):22888-22938. May 29.
- USEPA. 1992c. Supplemental Guidance to RAGS: Calculating the Concentration Term. Office of Emergency and Remedial Response, Washington, DC. Publication 9285.7-08I. May.
- USEPA. 1996. Soil Screening Guidance: Technical Background Document. Office of Emergency and Remedial Response, Washington, DC. USEPA/540/R-96/018. April.

- USEPA. 1997. Exposure Factors Handbook. Office of Research and Development, Washington DC. USEPA/600/P-95/002Fa-c. August.
- USEPA. 1999. National Functional Guidelines for Organic Data Review. EPA 540/R-99-008. OSWER 9240.1-05A-P. October.
- USEPA. 2000. Soil Screening Guidance for Radionuclides. Office of Radiation and Indoor Air, Washington, DC. USEPA/540-R-00-007 and USEPA/540-R-00-006.
- USEPA. 2002a. Guidance for Quality Assurance Project Plans. EPA QA/G-5. Office of Environmental Information, Washington, DC. December.
- USEPA. 2002b. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Solid Waste and Emergency Response, Washington, DC. OSWER 9355.4-24. December.
- USEPA. 2002c. Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. Office of Emergency and Remedial Response, Washington, DC. OSWER 9285.6-10. December.
- USEPA. 2002d. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance) EPA 530-f-02-052. November.
- USEPA. 2003a. Contract Laboratory Program Statement of Work for Organic Analysis: Multi-media, Multi-concentration. OLM04.3. Office of Emergency and Remedial Response. March.
- USEPA. 2003b. Technical Support Document for a Protocol to Assess Asbestos-Related Risk. Final Draft. Office of Solid Waste and Emergency Response, Washington, DC.
- USEPA. 2003c. Memorandum on Human Health Toxicity Values in Superfund Risk Assessments, from Michael B. Cook, Director, Office of Superfund Remediation and Technology Innovation to Superfund Remediation Policy Managers, Regions 1 - 10, dated December 5. OSWER Directive 9285.7-53.
- USEPA. 2004a. Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK). Office of Solid Waste and Emergency Response.

- USEPA. 2004b. Contract Laboratory Program Statement of Work for Organic Analysis: Multi-media, Multi-concentration. SOM01.0. Office of Emergency and Remedial Response. October.
- USEPA. 2004c. Contract Laboratory Program Statement of Work for Inorganic Analysis: Multi-media, Multi-concentration. ILM05.3. Office of Emergency and Remedial Response. March.
- USEPA. 2004d. National Functional Guidelines for Inorganic Data Review. EPA 540-R-04-004. OSWER 9240.1-45. October.
- USEPA. 2004e. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. Office of Emergency and Remedial Response, Washington, DC. EPA/540/R/99/005. July.
- USEPA. 2004f. Memorandum on Clarifying Cleanup Goals and Identification of New Assessment Tools for Evaluating Asbestos at Superfund Cleanups, from Michael B. Cook, Director, Office of Superfund Remediation and Technology Innovation to Superfund Remediation Policy Managers, Regions 1-10, August. OSWER Directive 9345.4-05.
- USEPA. 2005a. National Functional Guidelines for Chlorinated Dioxin/Furan Data Review. EPA 540-R-05-001. OSWER 9240.1-51. September.
- USEPA. 2005b. Guidelines for Carcinogen Risk Assessment. Risk Assessment Forum, Washington, DC. March.
- USEPA. 2006. Child-Specific Exposure Factors Handbook. Interim Report. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. EPA/600/R/06/096A. September.
- USEPA. 2008. National Functional Guidelines for Superfund Organic Methods Data Review. EPA 540-R-08-01. OSWER 9240.1-48. June.
- USEPA. 2009. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment). EPA-540-R-070-002. <http://www.epa.gov/oswer/riskassessment/ragsf/>.

USEPA. 2010. Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds. Risk Assessment Forum, Washington, DC. EPA/600/R-10/005.

USEPA. 2013. Integrated Risk Information System. USEPA on-line database:  
<http://www.epa.gov/iris/index.html>.

Western Regional Climate Center. 2008. Monthly average precipitation for Las Vegas. Desert Research Institute. <<http://www.wrcc.dri.edu/summary/Climsmnv.html>>.

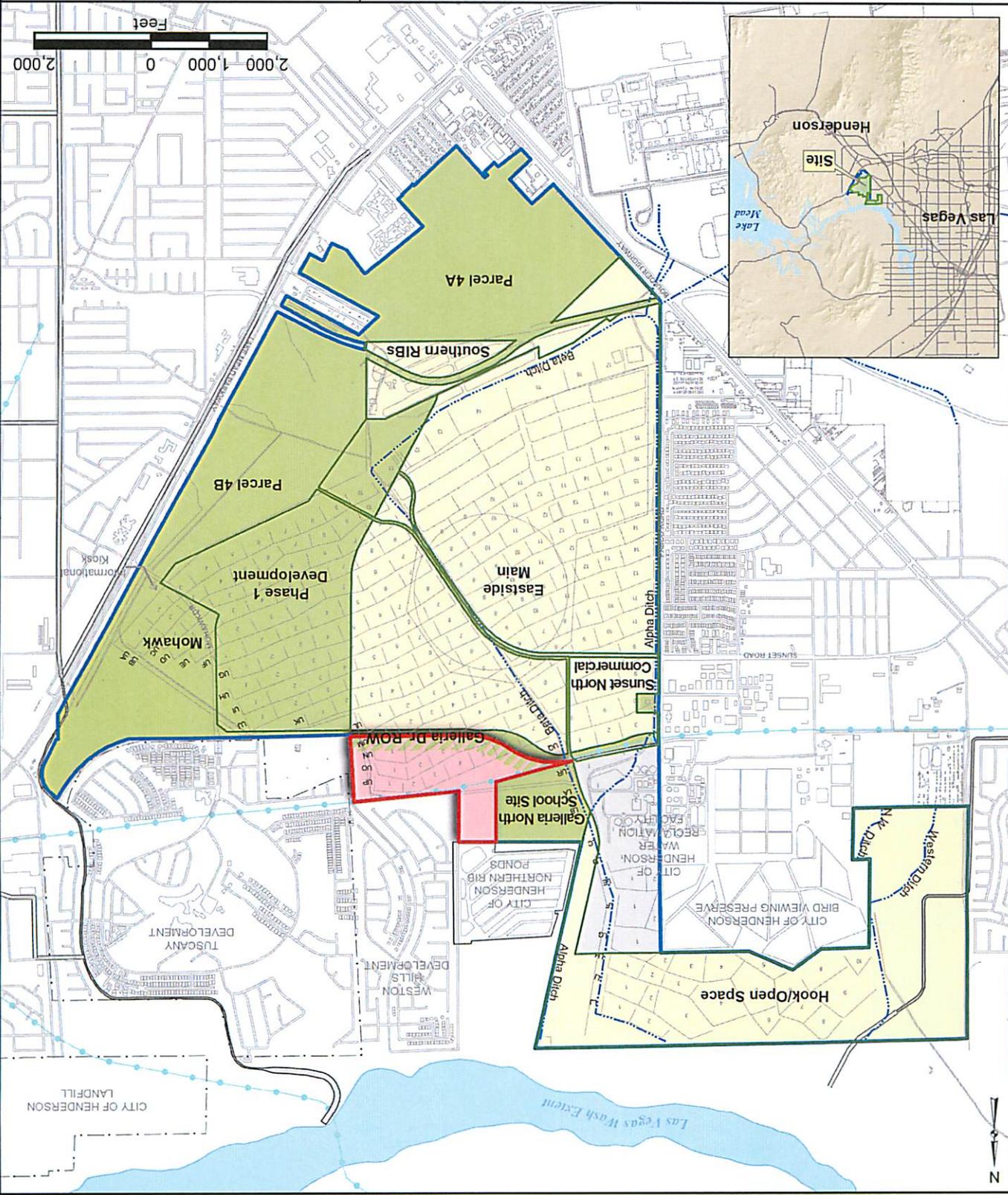
Weston. 1993. Site Conceptual Model, Stauffer/Pioneer/Montrose Site, Henderson, Nevada, September.

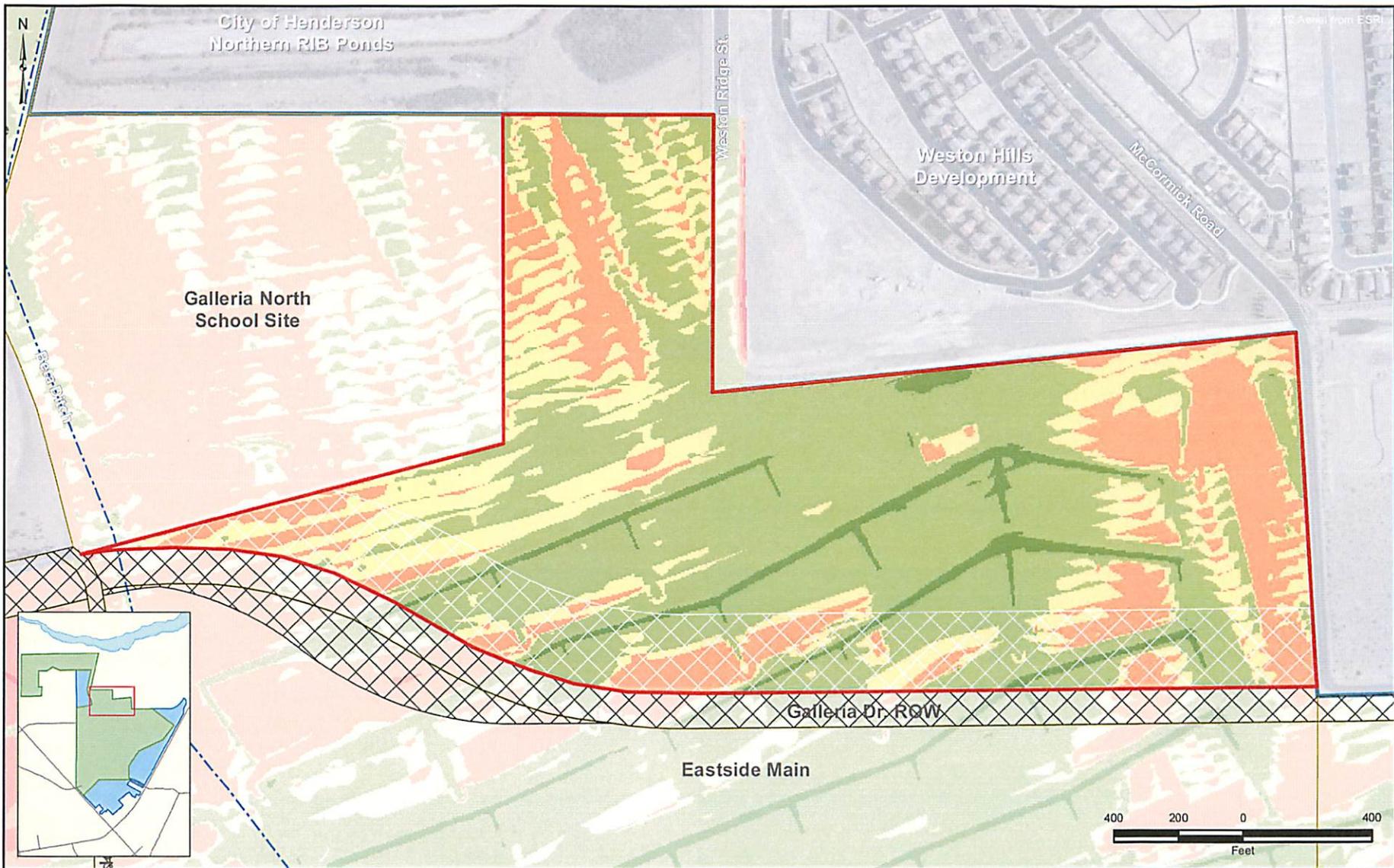
**FIGURES**

\*Not part of the Closure Plan for soils.

- Galleria North of ROW Sub-Area
- Eastside Sub-Areas
- NFA Areas
- CoH WRF\*

- Site AOC3 Boundary
- Ditches
- Flood Conveyance Channels
- Laterals





- Galleria North of ROW Sub-Area
- Site AOC3 Boundary
- Eastside Soil Sub-Areas
- Existing NFA Area
- Existing NFA Area Included in HHRA

- Development Cut/Fill Areas**
- |  |  |
|--|--|
| <span style="display: inline-block; width: 15px; height: 10px; background-color: red; margin-right: 5px;"></span> > 10 Ft Fill       | <span style="display: inline-block; width: 15px; height: 10px; background-color: lightgreen; margin-right: 5px;"></span> 0 to 5 Ft Cut |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: orange; margin-right: 5px;"></span> 5 to 10 Ft Fill | <span style="display: inline-block; width: 15px; height: 10px; background-color: green; margin-right: 5px;"></span> 5 to 10 Ft Cut     |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: yellow; margin-right: 5px;"></span> 0 to 5 Ft Fill  | <span style="display: inline-block; width: 15px; height: 10px; background-color: darkgreen; margin-right: 5px;"></span> > 10 Ft Cut    |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: white; margin-right: 5px;"></span> No Change        |  |

BMI Common Areas (Eastside)  
Clark County, Nevada

**FIGURE 2**

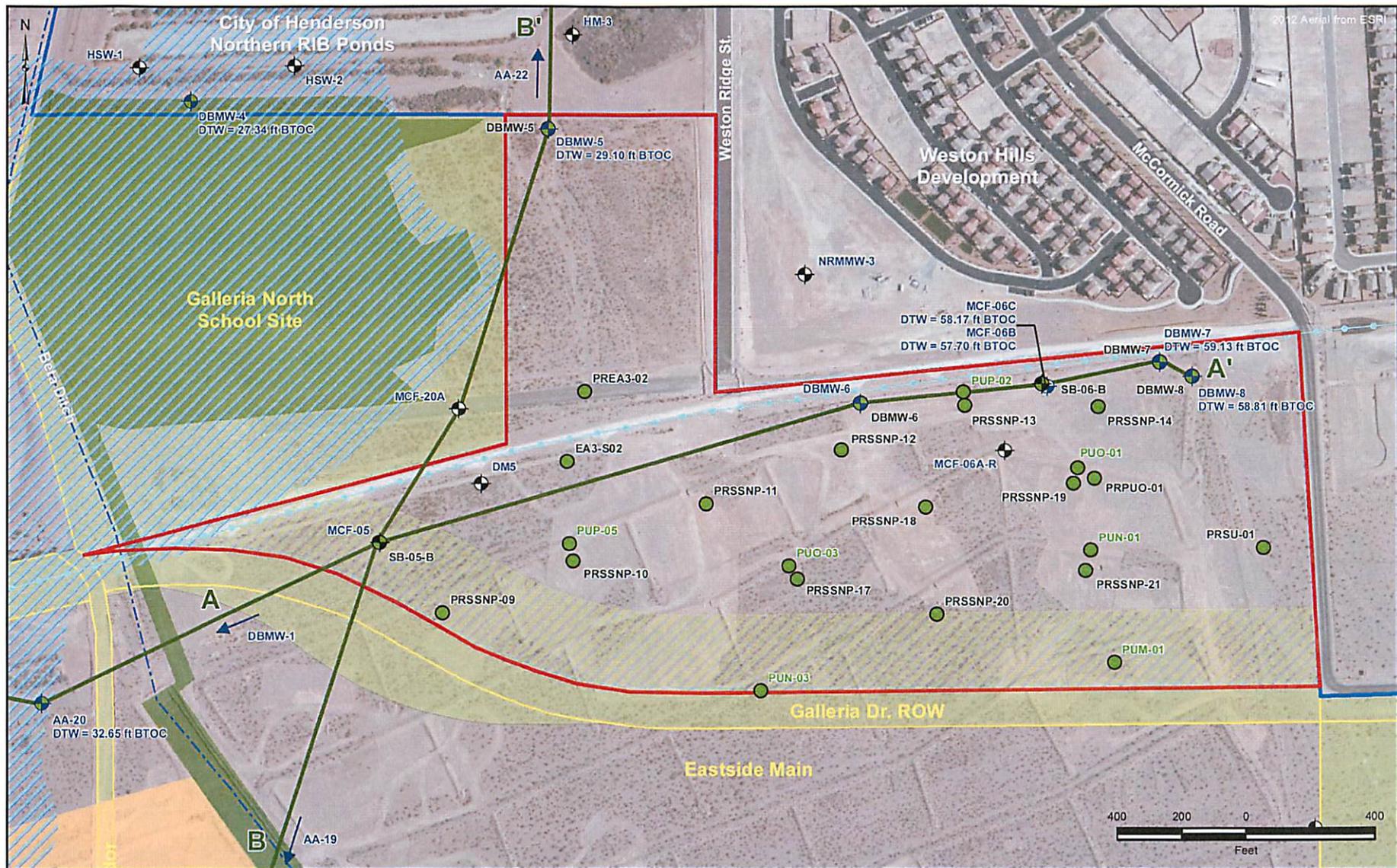
**REDEVELOPMENT  
GRADING PLAN**

Prepared by  
MKJ (ERM)

Date  
08/10/13

Job No. 0064276

FILE: GIS/ERC/GALLERIANORTH/FIGURES/2.8.12.MXD



- Galleria North of ROW Sub-Area
- Site AOC3 Boundary
- Eastside Soil Sub-Areas
- Existing NFA Area
- Existing NFA Area Included in HHRA

- Interim Remedial Measure Areas
- Approximate Historical Seep Area
- Tamarisk Removal Area
- Pittman Lateral

- Historical Soil Sample Location
- Monitoring Wells**
- ⊕ Alluvial Wells with Groundwater Data
- ⊕ Other Monitoring Wells

PRSSNP-17 - Discrete Sample  
 PUM-01 - Composite Sample

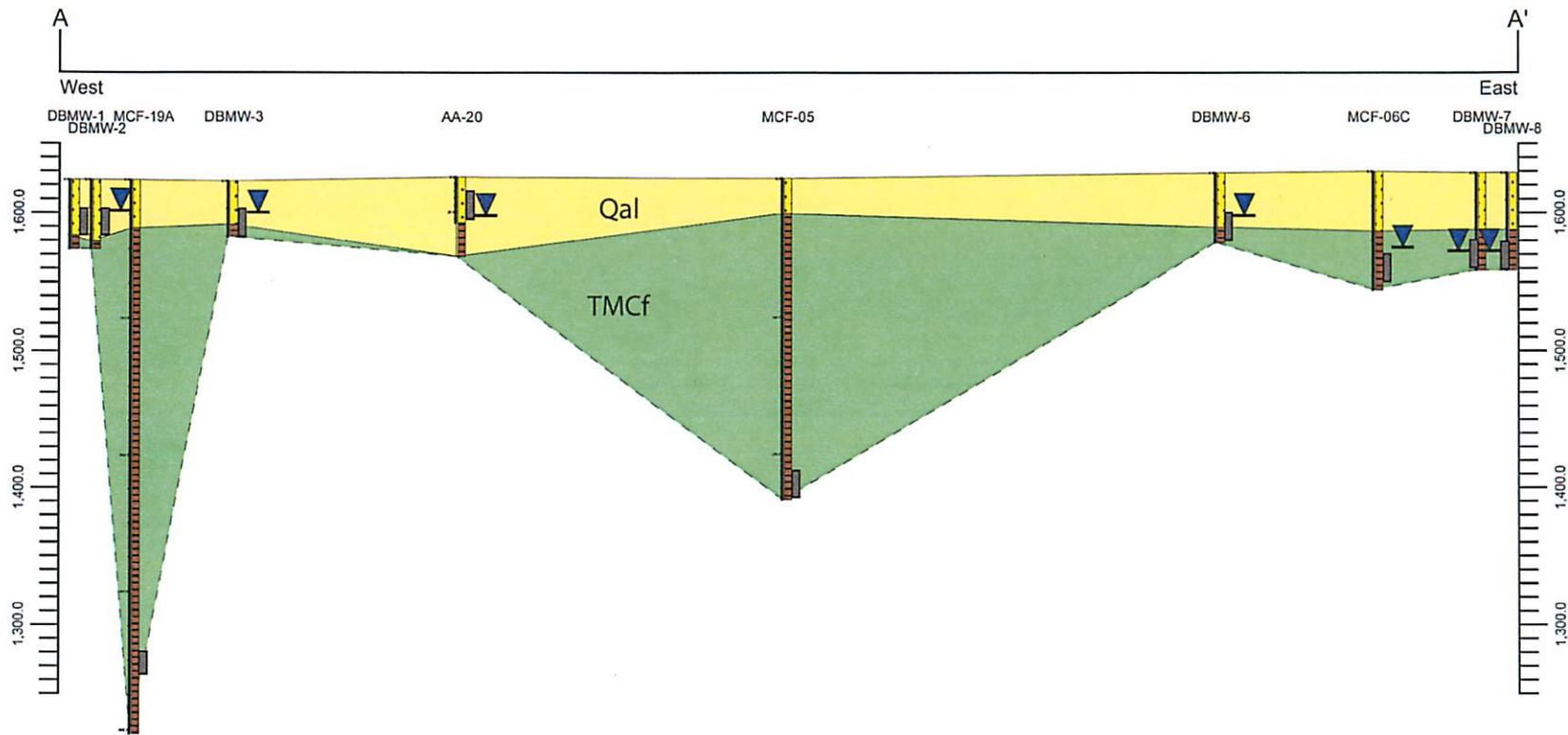
BMI Common Areas (Eastside)  
 Clark County, Nevada

FIGURE 3

**SITE PLAN WITH HISTORICAL  
 SOIL SAMPLE LOCATIONS  
 AND MONITORING WELLS**



# Cross-Section A-A'



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

BMI Common Areas (Eastside)  
Clark County, Nevada

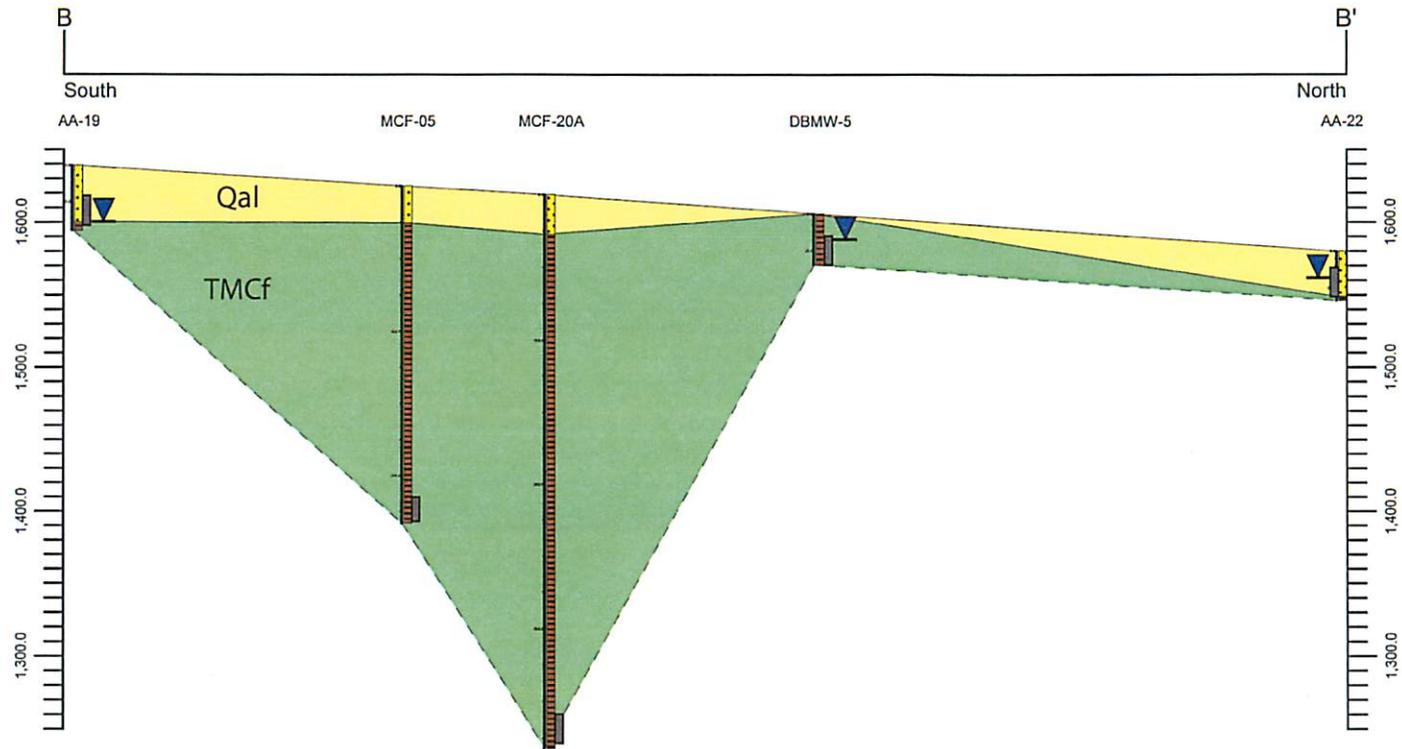
FIGURE 4

GALLERIA NORTH OF ROW  
SUB-AREA CROSS-SECTION A-A'

Basic Remediation  
COMPANY

Prepared by MKJ (ERM)	Date 06/10/13	JOB No. 0064276 FILE: GIS/BRC/GALLERIA/NORTH/ROW/FIGURE4.AI
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# Cross-Section B-B'



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

BMI Common Areas (Eastside)  
Clark County, Nevada

FIGURE 5

GALLERIA NORTH OF ROW  
SUB-AREA CROSS-SECTION B-B'

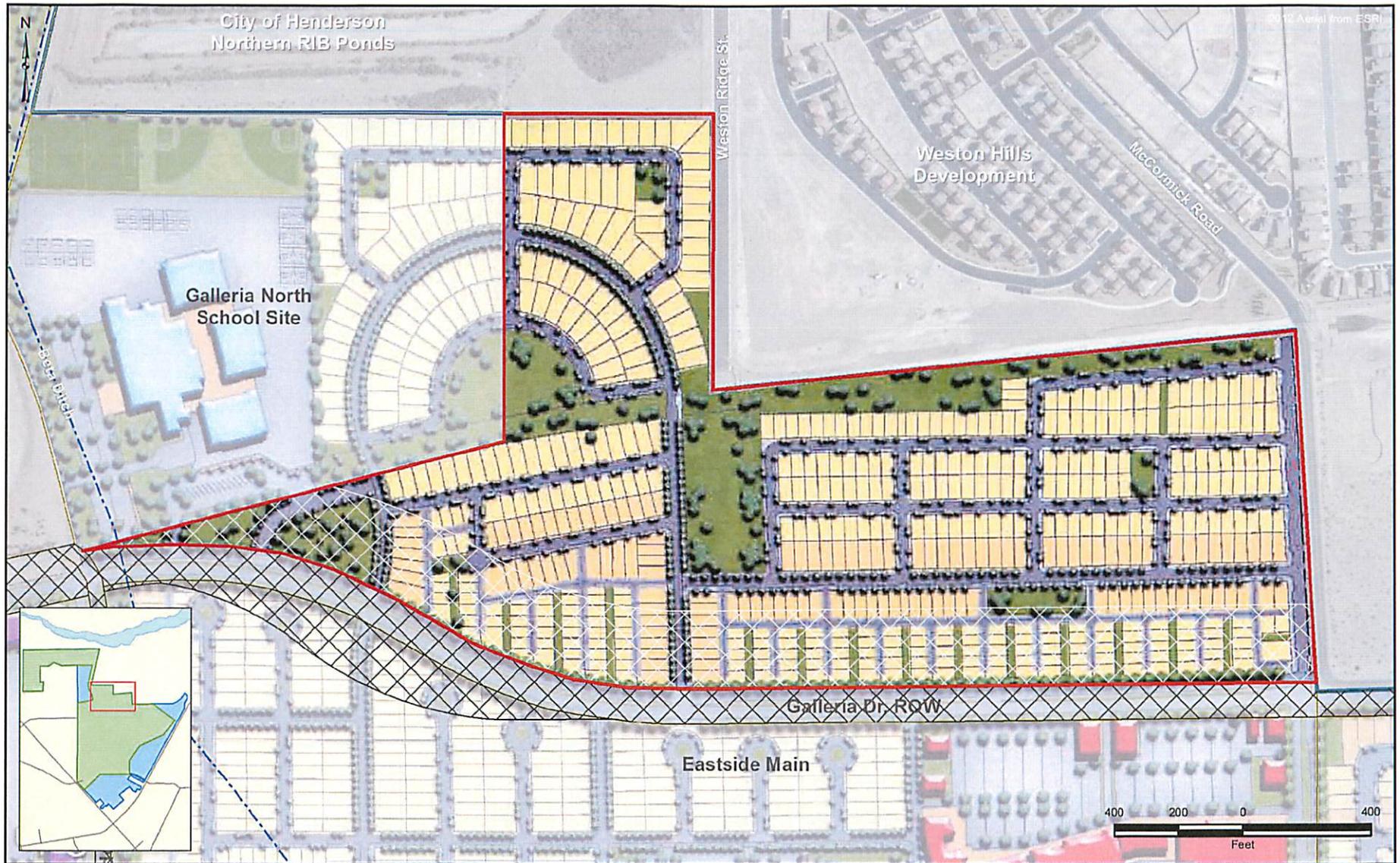


Prepared by  
MKJ (ERM)



Date  
06/10/13

JOB No. 0064276  
FILE: GIS\BRC\GALLERIA\NORTH OF ROW\FIGURE 5.A1



- Galleria North of ROW Sub-Area
- Site AOC3 Boundary
- Eastside Soil Sub-Areas
- Existing NFA Area
- Existing NFA Area Included in HHRA

**Current Development Plan**

- |  |   |
|--|---|
| <span style="display: inline-block; width: 20px; height: 10px; background-color: #8B4513; margin-right: 5px;"></span> High Density Residential   | <span style="display: inline-block; width: 20px; height: 10px; background-color: #ADD8E6; margin-right: 5px;"></span> Schools           |
| <span style="display: inline-block; width: 20px; height: 10px; background-color: #D2B48C; margin-right: 5px;"></span> Medium Density Residential | <span style="display: inline-block; width: 20px; height: 10px; background-color: #6A329F; margin-right: 5px;"></span> Retail/Commercial |
| <span style="display: inline-block; width: 20px; height: 10px; background-color: #FFD700; margin-right: 5px;"></span> Low Density Residential    | <span style="display: inline-block; width: 20px; height: 10px; background-color: #808080; margin-right: 5px;"></span> Parks & Trails    |
| <span style="display: inline-block; width: 20px; height: 10px; background-color: #FF0000; margin-right: 5px;"></span> Urban Core                 | <span style="display: inline-block; width: 20px; height: 10px; background-color: #A9A9A9; margin-right: 5px;"></span> Roads/Parking     |

BMI Common Areas (Eastside)  
Clark County, Nevada

FIGURE 6

**CURRENT  
DEVELOPMENT  
PLAN**

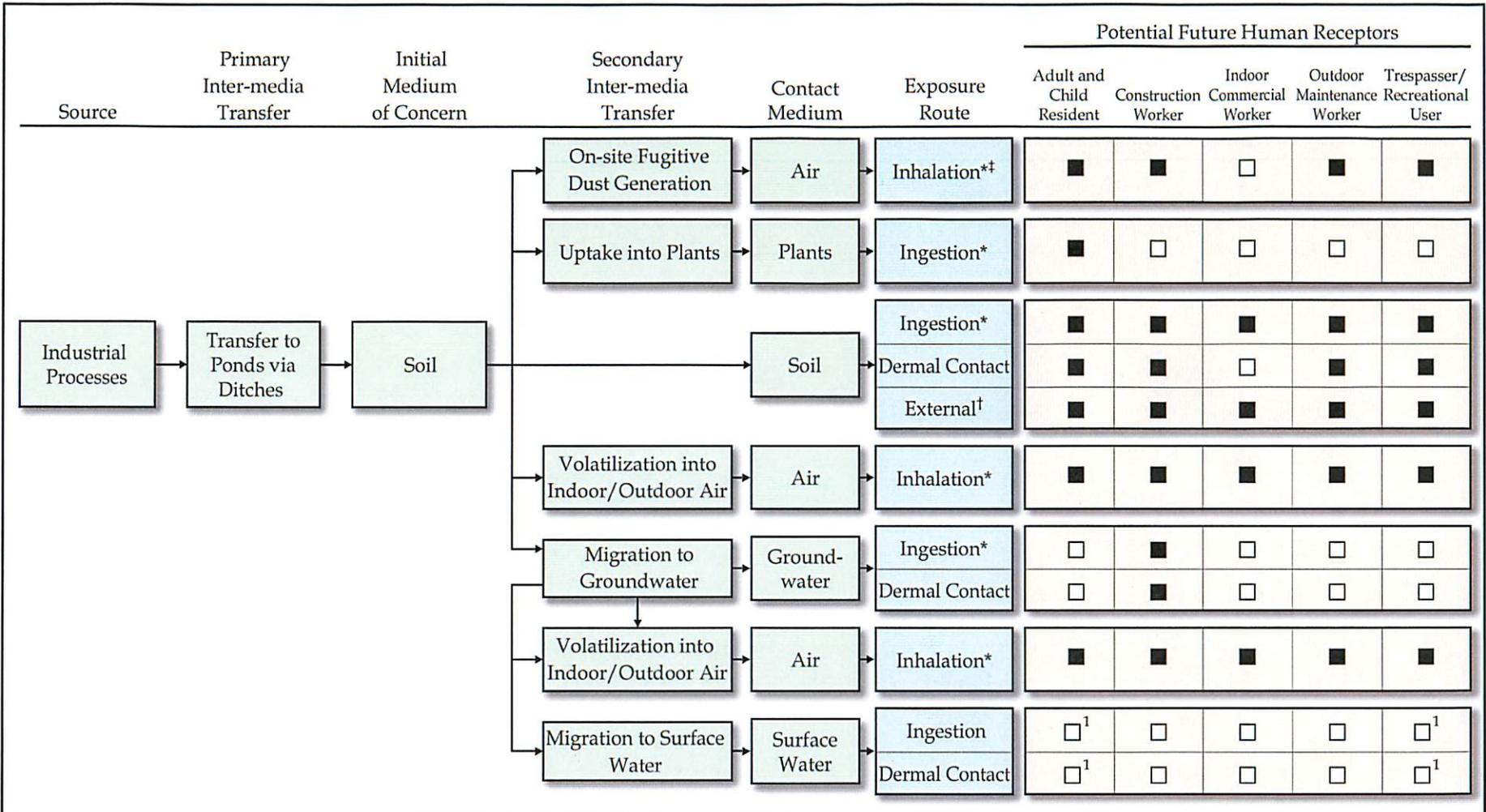


Prepared by  
MKJ (ERM)



Date  
09/10/13

Job No. 0054278  
FILE: GIS/BR/C/GALLERIA/NORTH/FRONT/FIGURES/6.12.MXD



□ - Incomplete or insignificant exposure pathway.

■ - Complete or potentially complete exposure pathway.

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

<sup>1</sup>Potentially complete exposure pathway following discharge to Las Vegas Wash and Lake Mead.

\*Includes radionuclide exposures.

†Only radionuclide exposures.

‡Includes asbestos exposures.

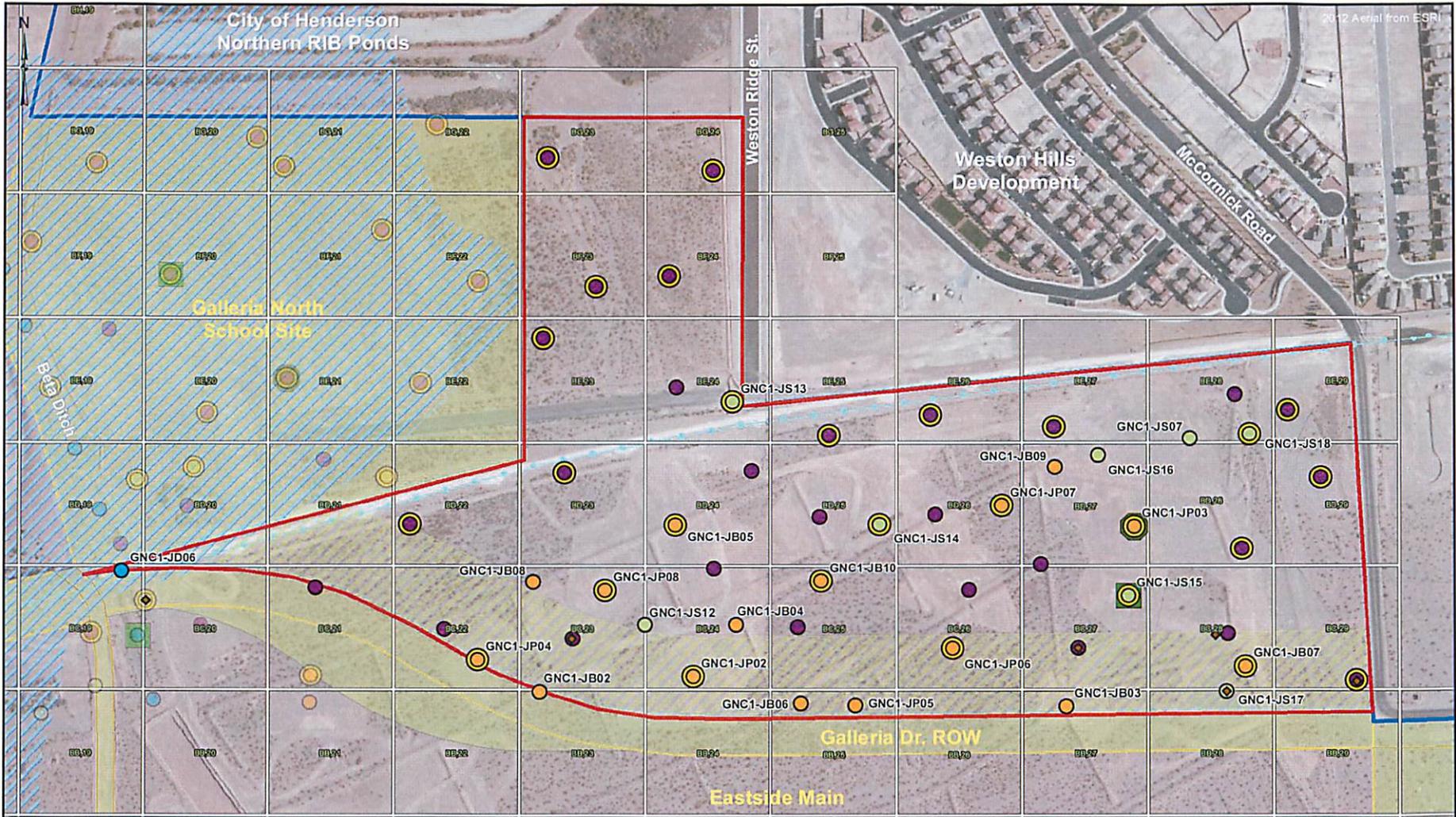
BMI Common Areas (Eastside)  
Clark County, Nevada

FIGURE 7

CONCEPTUAL SITE MODEL  
DIAGRAM FOR POTENTIAL  
HUMAN EXPOSURES

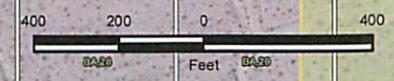


Prepared by: MKJ (ERM)  Date: 06/10/13  JOB No. 0054276  
FILE: GIS/BRC/GALLERIANORTHOFROW/FIGURE7.A1



- Eastside 3-Acre Random Sampling Grid (Grid ID = "XX,##")
- Galleria North of ROW Sub-Area
- Site AOC3 Boundary
- Eastside Soil Sub-Areas
- Existing NFA Area
- Existing NFA Area Included in HHRA
- Approximate Historical Seep Area

- Galleria North Sub-Area Soil Samples**
- Random Sample Location
  - Ditch Sample Location
  - Debris Sample Location
  - Other Biased Sample Locations (Ponds/Berms)
  - Surface Flux Sample Location
  - Deep Sample Location (to GW).
  - SPLP Sample Location (Subsurface)



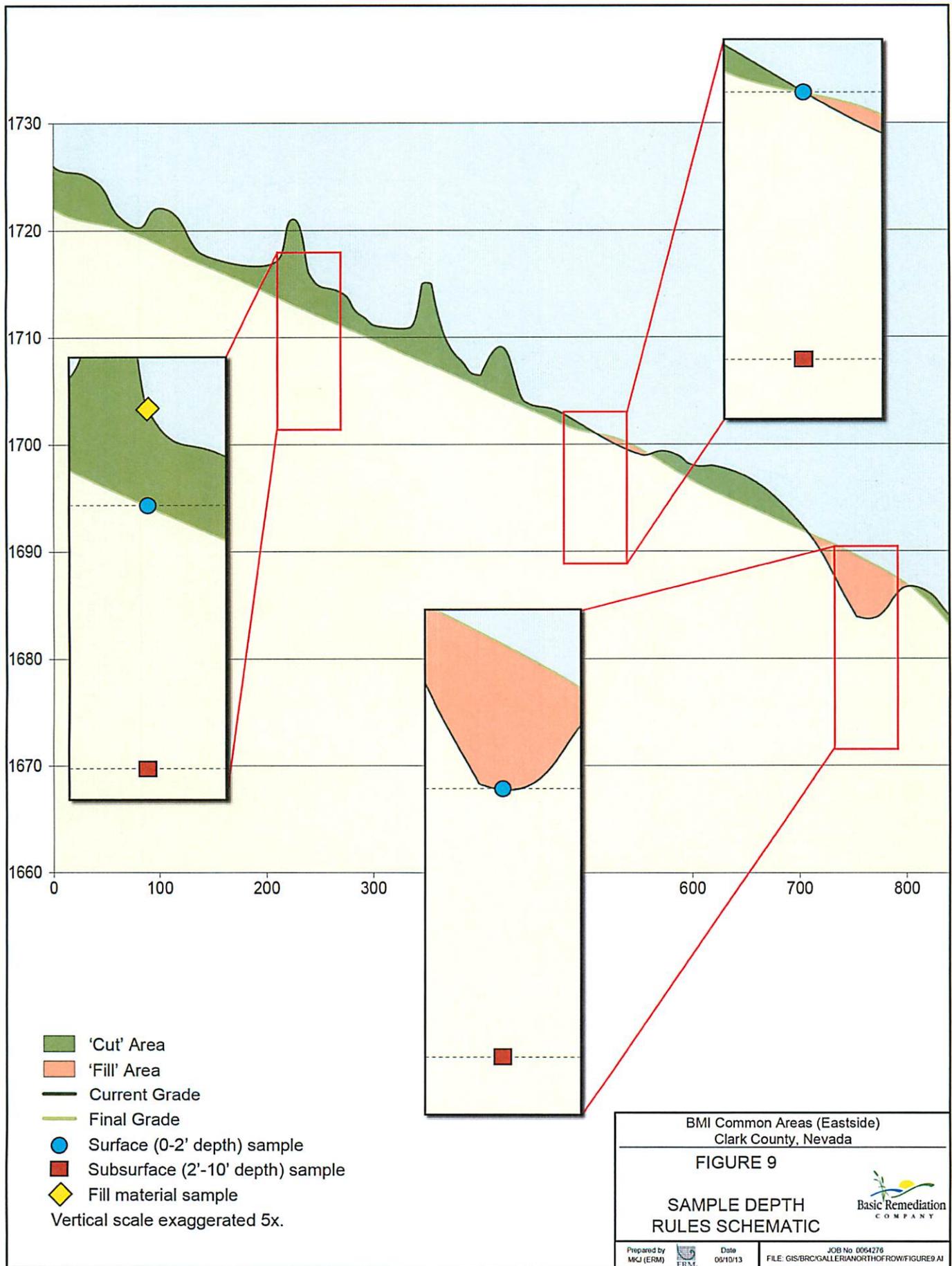
BMI Common Areas (Eastside)  
Clark County, Nevada

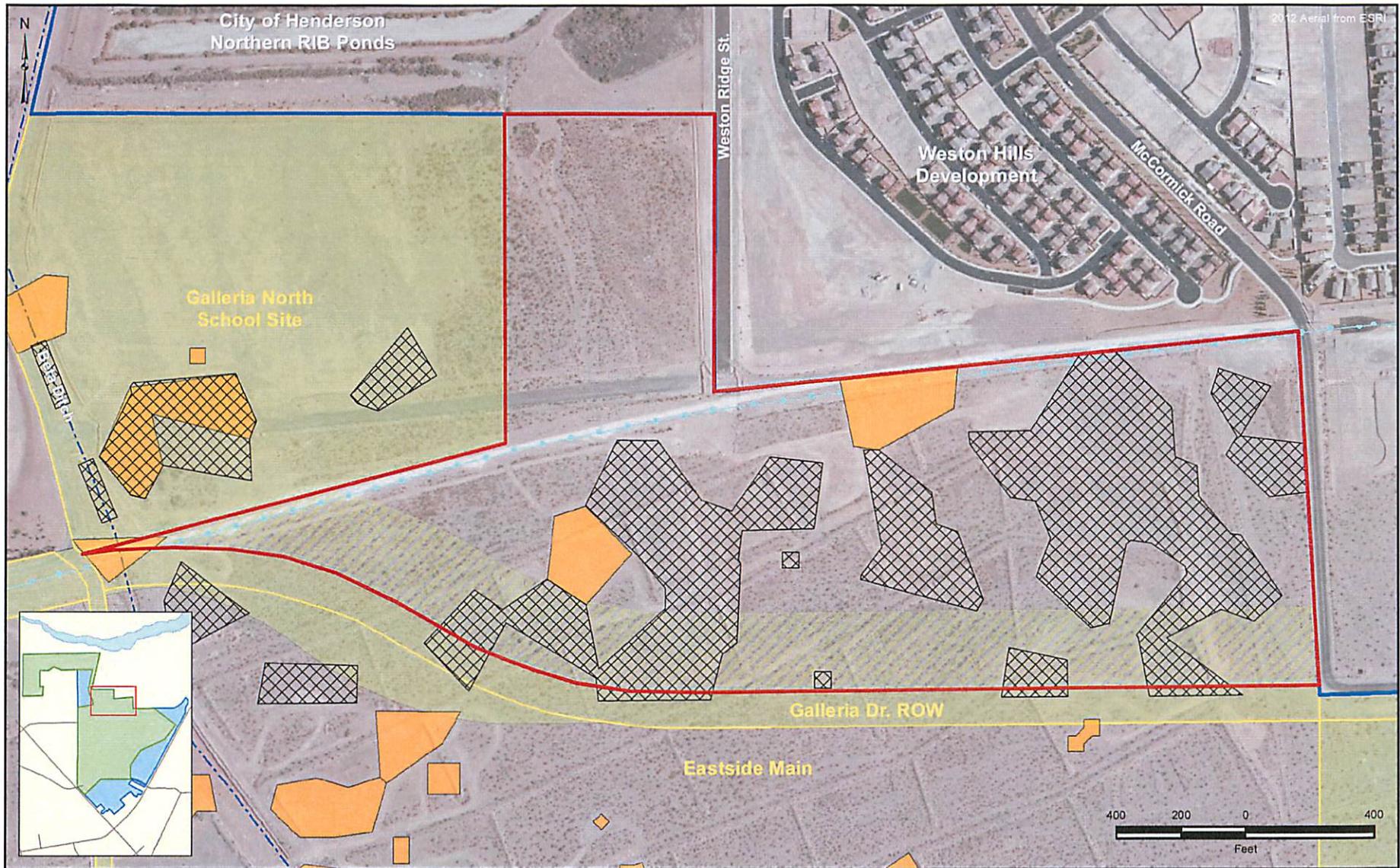
**FIGURE 8**

**INITIAL SOIL AND  
SOIL VAPOR FLUX  
SAMPLING LOCATIONS**



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





- Galleria North of ROW Sub-Area
- Site AOC3 Boundary
- Eastside Soil Sub-Areas
- Existing NFA Area
- Existing NFA Area Included in HHRA
- 2009 Remediation Areas
- 2010 Remediation Areas

BMI Common Areas (Eastside)  
Clark County, Nevada

**FIGURE 10**

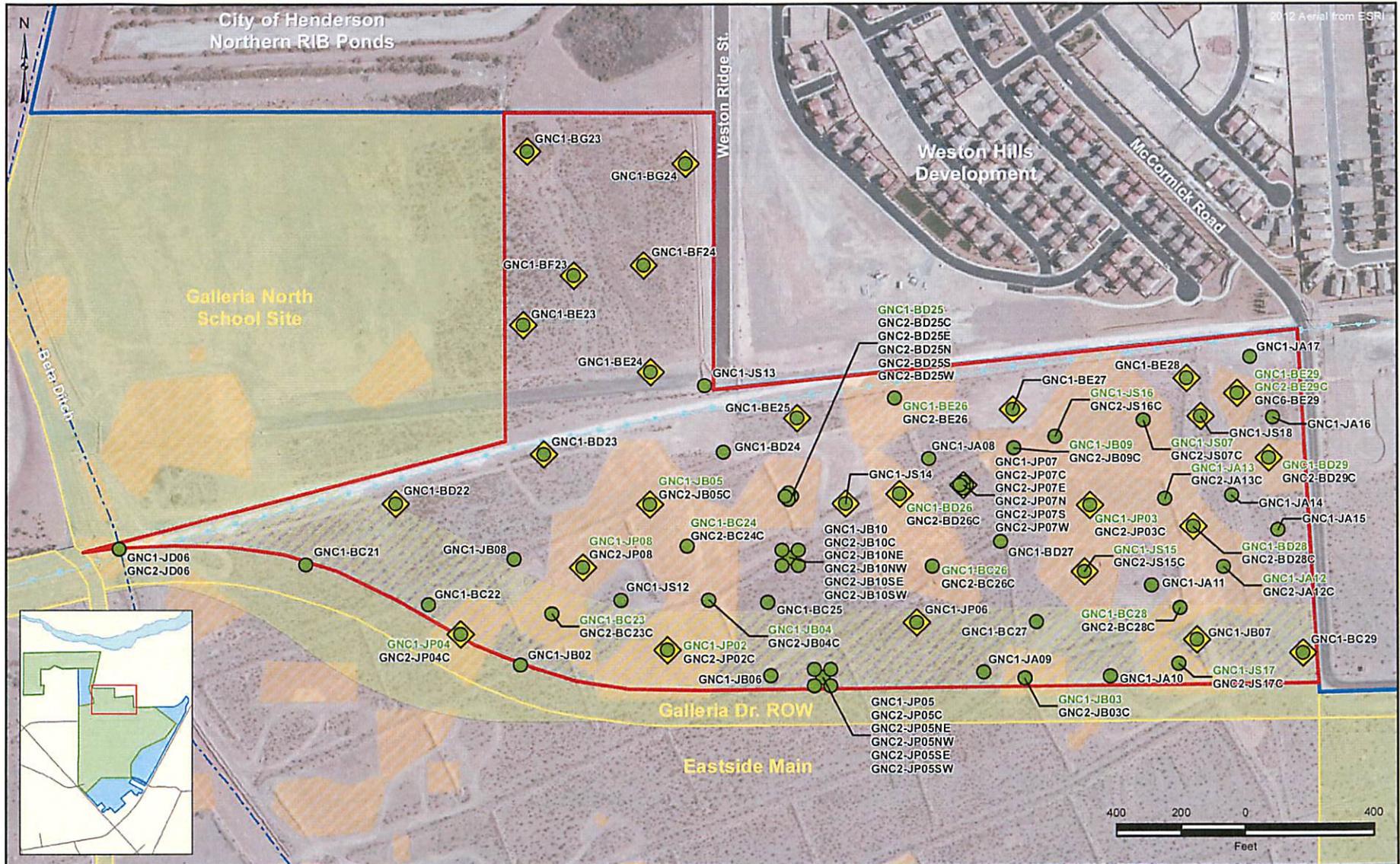
**GALLERIA NORTH OF ROW SUB-AREA SOIL REMEDIATION AREAS**

Prepared by  
MKJ (ERM)

Date  
06/10/13

FILE: GIS/BRC/GALLERIANORTHOFROWFIGURE10.MXD

JOB No. 0064276



- Galleria North of ROW Sub-Area
- Site AOC3 Boundary
- Eastside Soil Sub-Areas
- Existing NFA Area
- Existing NFA Area Included in HHRA
- Remediation Areas
- Soil Sample Location<sup>(1)</sup>
- ◆ Surface Flux Sample Location

GNC1-JD01 - Scraped Sample Location  
 GNC2-BD29C - Existing Sample Location

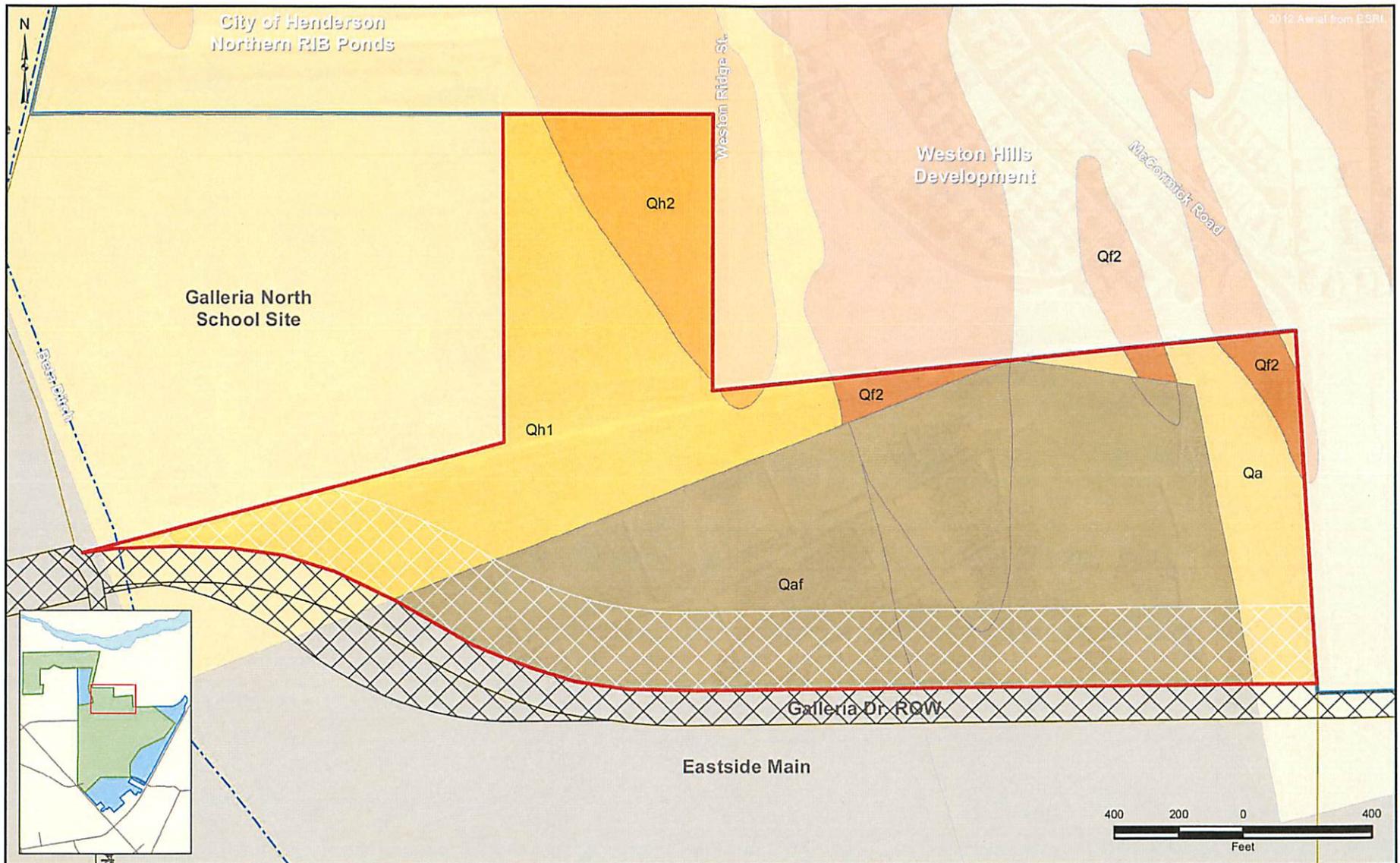
(1) Although soil removal would affect the concentrations of all analytes, confirmatory sampling only analyzed for the constituent suites that triggered the soil removal. Therefore, in the absence of post-scrape data, the pre-scrape data are used for all other analytes in the human health risk assessment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

BMI Common Areas (Eastside)  
 Clark County, Nevada

FIGURE 11

**FINAL SOIL AND  
 SOIL VAPOR FLUX  
 SAMPLING LOCATIONS**





- Galleria North of ROW Sub-Area
- Site AOC3 Boundary
- Eastside Soil Sub-Areas
- Existing NFA Area
- Existing NFA Area Included in HHRA

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

BMI Common Areas (Eastside)  
Clark County, Nevada

**FIGURE 12**

**GALLERIA NORTH OF ROW SUB-AREA LITHOLOGIES**

Prepared by MKJ (ERM) Date 06/10/13 JOB No. 0064278  
FILE: GIS/ERIC/GALLERIA/NORTH/ROW/FIGURES/2.6.12.MXD

Basic Remediation COMPANY

TABLES

**TABLE 3-1**  
**SAMPLE-SPECIFIC COLLECTION DEPTHS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 4)

Sample Location	Sample Type	Grading Plan	Sample Depth 1	Sample Depth 2	Sample Depth 3
<u>Initial Sampling Events</u>					
GNC1-BC21	Random	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-BC22	Random	Cut -1	0 (Fill/Surface)	11 (Subsurface)	--
GNC1-BC23	Random	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-BC24	Random	Cut -1	0 (Fill/Surface)	11 (Subsurface)	--
GNC1-BC25	Random	Cut -4	0 (Fill/Surface)	4 (Surface)	14 (Subsurface)
GNC1-BC26	Random	Cut -1	0 (Fill/Surface)	11 (Subsurface)	--
GNC1-BC27	Random	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-BC28	Random	Cut -1	0 (Fill/Surface)	11 (Subsurface)	--
GNC1-BC29	Random with Flux	Fill +3	0 (Surface)	10 (Subsurface)	--
GNC1-BD22	Random with Flux	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-BD23	Random with Flux	Cut -2	0 (Fill/Surface)	12 (Subsurface)	--
GNC1-BD24	Random	Cut -1	0 (Fill/Surface)	11 (Subsurface)	--
GNC1-BD25	Random	Cut -3	0 (Fill/Surface)	3 (Surface)	13 (Subsurface)
GNC1-BD26	Random with Flux	Cut -6	0 (Fill/Surface)	6 (Surface)	16 (Subsurface)
GNC1-BD27	Random	Cut -10	0 (Fill/Surface)	10 (Surface)	20 (Subsurface)
GNC1-BD28	Random with Flux	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-BD29	Random with Flux	Fill +1	0 (Surface)	10 (Subsurface)	--
GNC1-BE23	Random with Flux	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-BE24	Random with Flux	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-BE25	Random with Flux	Cut -2	0 (Fill/Surface)	12 (Subsurface)	--
GNC1-BE26	Random	Cut -4	0 (Fill/Surface)	4 (Surface)	14 (Subsurface)
GNC1-BE27	Random with Flux	Cut -2	0 (Fill/Surface)	12 (Subsurface)	--
GNC1-BE28	Random with Flux	Fill +1	0 (Surface)	10 (Subsurface)	--
GNC1-BE29	Random with Flux	Fill +3	0 (Surface)	10 (Subsurface)	--
GNC1-BF23	Random with Flux	Fill +2	0 (Surface)	10 (Subsurface)	--
GNC1-BF24	Random with Flux	Cut -1	0 (Fill/Surface)	11 (Subsurface)	--
GNC1-BG23	Random with Flux	Cut -1	0 (Fill/Surface)	11 (Subsurface)	--
GNC1-BG24	Random with Flux	Cut -1	0 (Fill/Surface)	11 (Subsurface)	--
GNC1-JB02	Berm	Cut -5	0 (Fill/Surface)	5 (Surface)	15 (Subsurface)
GNC1-JB03	Berm	Cut -7	0 (Fill/Surface)	7 (Surface)	17 (Subsurface)
GNC1-JB04	Berm	Cut -7	0 (Fill/Surface)	7 (Surface)	17 (Subsurface)
GNC1-JB05	Berm with Flux	Cut -7	0 (Fill/Surface)	7 (Surface)	17 (Subsurface)
GNC1-JB06	Berm	Cut -6	0 (Fill/Surface)	6 (Surface)	16 (Subsurface)
GNC1-JB07	Berm with Flux	Cut -8	0 (Fill/Surface)	8 (Surface)	18 (Subsurface)

**TABLE 3-1**  
**SAMPLE-SPECIFIC COLLECTION DEPTHS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 2 of 4)

Sample Location	Sample Type	Grading Plan	Sample Depth 1	Sample Depth 2	Sample Depth 3
GNC1-JB08	Berm	Cut -7	0 (Fill/Surface)	7 (Surface)	17 (Subsurface)
GNC1-JB09	Berm	Cut -9	0 (Fill/Surface)	9 (Surface)	19 (Subsurface)
GNC1-JB10	Berm	Cut -8	0 (Fill/Surface)	8 (Surface)	18 (Subsurface)
GNC1-JD06	Ditch	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-JP02	Ponds with Flux	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-JP03	Ponds with Flux	Cut -2	0 (Fill/Surface)	12 (Subsurface)	--
GNC1-JP04	Ponds with Flux	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-JP05	Ponds	Cut -1	0 (Fill/Surface)	11 (Subsurface)	--
GNC1-JP06	Ponds with Flux	Cut -3	0 (Fill/Surface)	3 (Surface)	13 (Subsurface)
GNC1-JP07	Ponds with Flux	Cut -4	0 (Fill/Surface)	4 (Surface)	14 (Subsurface)
GNC1-JP08	Ponds with Flux	Cut -2	0 (Fill/Surface)	12 (Subsurface)	--
GNC1-JS07	Debris	Fill +2	0 (Surface)	10 (Subsurface)	--
GNC1-JS12	Debris	Cut -1	0 (Fill/Surface)	11 (Subsurface)	--
GNC1-JS13	Debris	Cut -1	0 (Fill/Surface)	11 (Subsurface)	--
GNC1-JS14	Debris with Flux	Cut -3	0 (Fill/Surface)	3 (Surface)	13 (Subsurface)
GNC1-JS15	Debris with Flux	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-JS16	Debris	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-JS17	Debris	-- 0	0 (Surface)	10 (Subsurface)	--
GNC1-JS18	Debris with Flux	Fill +3	0 (Surface)	10 (Subsurface)	--
<u>Confirmation/Supplemental Sampling Events</u>					
GNC1-JA08	Supplemental	-- 0	0 (Surface)	--	--
GNC1-JA09	Supplemental	Cut -1	0 (Fill/Surface)	--	--
GNC1-JA10	Supplemental	Cut -1	0 (Fill/Surface)	--	--
GNC1-JA11	Supplemental	Fill +1	0 (Surface)	--	--
GNC1-JA12	Supplemental	-- 0	0 (Surface)	--	--
GNC1-JA13	Supplemental	Cut -1	0 (Fill/Surface)	--	--
GNC1-JA14	Supplemental	Cut -1	0 (Fill/Surface)	--	--
GNC1-JA15	Supplemental	Fill +1	0 (Surface)	--	--
GNC1-JA16	Supplemental	-- 0	0 (Surface)	--	--
GNC1-JA17	Supplemental	-- 0	0 (Surface)	--	--
GNC2-BC23C	Confirmation	--	0 (Surface)	--	--
GNC2-BC24C	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-BC26C	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-BC28C	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-BD25C	Supplemental	--	--	13 (Subsurface)	--

**TABLE 3-1**  
**SAMPLE-SPECIFIC COLLECTION DEPTHS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 3 of 4)

Sample Location	Sample Type	Grading Plan	Sample Depth 1	Sample Depth 2	Sample Depth 3
GNC2-BD25E	Supplemental	--	--	13 (Subsurface)	--
GNC2-BD25N	Supplemental	--	--	13 (Subsurface)	--
GNC2-BD25S	Supplemental	--	--	13 (Subsurface)	--
GNC2-BD25W	Supplemental	--	--	13 (Subsurface)	--
GNC2-BD26C	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-BD28C	Confirmation	--	0 (Surface)	--	--
GNC2-BD29C	Confirmation	--	0 (Surface)	--	--
GNC2-BE26	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-BE29C	Confirmation	--	0 (Surface)	--	--
GNC2-JA12C	Confirmation	--	0 (Surface)	--	--
GNC2-JA13C	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JB03C	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JB04C	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JB05C	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JB09C	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JB10C	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JB10NE	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JB10NW	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JB10SE	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JB10SW	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JD06	Confirmation	--	0 (Surface)	--	--
GNC2-JP02C	Confirmation	--	0 (Surface)	--	--
GNC2-JP03C	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JP04C	Confirmation	--	0 (Surface)	--	--
GNC2-JP05C	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JP05NE	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JP05NW	Confirmation	--	0 (Surface)	--	--
GNC2-JP05SE	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JP05SW	Confirmation	--	0 (Fill/Surface)	--	--
GNC2-JP07C	Supplemental	--	--	4 (Subsurface)	--
GNC2-JP07E	Supplemental	--	--	4 (Subsurface)	--
GNC2-JP07N	Supplemental	--	--	4 (Subsurface)	--
GNC2-JP07S	Supplemental	--	--	4 (Subsurface)	--
GNC2-JP07W	Supplemental	--	--	4 (Subsurface)	--
GNC2-JP08	Confirmation	--	0 (Fill/Surface)	--	--

**TABLE 3-1**  
**SAMPLE-SPECIFIC COLLECTION DEPTHS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 4 of 4)

Sample Location	Sample Type	Grading Plan	Sample Depth 1	Sample Depth 2	Sample Depth 3
GNC2-JS07C	Confirmation	--	0 (Surface)	--	--
GNC2-JS15C	Confirmation	--	0 (Surface)	--	--
GNC2-JS16C	Confirmation	--	0 (Surface)	--	--
GNC2-JS17C	Confirmation	--	0 (Surface)	--	--
GNC3-BD25C	Supplemental	--	--	7 (Subsurface)	10 (Subsurface)
GNC3-BD25E	Supplemental	--	--	7 (Subsurface)	10 (Subsurface)
GNC3-BD25N	Supplemental	--	--	7 (Subsurface)	10 (Subsurface)
GNC3-BD25S	Supplemental	--	--	7 (Subsurface)	10 (Subsurface)
GNC3-BD25W	Supplemental	--	--	7 (Subsurface)	10 (Subsurface)
GNC6-BE29	Confirmation	--	0 (Surface)	--	--

Note: Because sample collection will be over a two to three foot depth interval, sample locations with an anticipated cut depth less than three feet only sampled at the surface and one post-grade subsurface depth.

Yellow shaded location  (GNC1-JS15) indicates deep soil sample collected for physical parameter analyses.

Green shaded location  (GNC1-JP03) indicates subsurface soil sample also included synthetic precipitation leaching procedure (SPLP) sampling and analysis.

Depths are in feet bgs (current grade).

**TABLE 3-2**  
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 10)

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

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

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

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

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

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Parameter of Interest	Preparation Method	Analytical Method	Compound List	CAS Number	Sample Depth (from Table 3-1)		
					Depth 1	Depth 2/3	Deep
Radionuclides (continued)	HASL 300 (Total Dissolution)	HASL A-01-R	Thorium-228	7440-29-1	✓	✓	(d)
			Thorium-230	14274-82-9	✓	✓	(d)
			Thorium-232	14269-63-7	✓	✓	(d)
	HASL 300 (Total Dissolution)		Uranium-233/234	13966-29-5	✓	✓	(d)
			Uranium-235/236	15117-96-1	✓	✓	(d)
			Uranium-238	7440-61-1	✓	✓	(d)
Aldehydes	EPA 8315A	EPA 8315A	Acetaldehyde	75-07-0	✓	✓	(d)
			Chloroacetaldehyde	107-20-0	(e)	(e)	(d)
			Dichloroacetaldehyde	79-02-7	(e)	(e)	(d)
			Formaldehyde	50-00-0	✓	✓	(d)
			Trichloroacetaldehyde	75-87-6	(e)	(e)	(d)
Semivolatile Organic Compounds	EPA 3550B	EPA 8270C	1,2,4,5-Tetrachlorobenzene	95-94-3	✓	✓	(d)
			1,2-Diphenylhydrazine	122-66-7	✓	✓	(d)
			1,4-Dioxane	123-91-1	✓	✓	(d)
			2,2'/4,4'-Dichlorobenzil	21854-95-5	✓	✓	(d)
			2,4,5-Trichlorophenol	95-95-4	✓	✓	(d)
			2,4,6-Trichlorophenol	88-06-2	✓	✓	(d)
			2,4-Dichlorophenol	120-83-2	✓	✓	(d)
			2,4-Dimethylphenol	105-67-9	✓	✓	(d)
			2,4-Dinitrophenol	51-28-5	✓	✓	(d)
			2,4-Dinitrotoluene	121-14-2	✓	✓	(d)
			2,6-Dinitrotoluene	606-20-2	✓	✓	(d)
			2-Chloronaphthalene	91-58-7	✓	✓	(d)
			2-Chlorophenol	95-57-8	✓	✓	(d)
			2-Methylnaphthalene	91-57-6	✓	✓	(d)
			2-Nitroaniline	88-74-4	✓	✓	(d)
			2-Nitrophenol	88-75-5	✓	✓	(d)
			3,3-Dichlorobenzidine	91-94-1	✓	✓	(d)
			3-Nitroaniline	99-09-2	✓	✓	(d)
			4-Bromophenyl phenyl ether	101-55-3	✓	✓	(d)
			4-Chloro-3-methylphenol	59-50-7	✓	✓	(d)
			4-Chlorophenyl phenyl ether	7005-72-3	✓	✓	(d)
			4-Chlorothioanisole	123-09-1	✓	✓	(d)
			4-Nitroaniline	100-01-6	✓	✓	(d)
			4-Nitrophenol	100-02-7	✓	✓	(d)
			Acetophenone	98-86-2	✓	✓	(d)
Aniline	62-53-3	✓	✓	(d)			

**TABLE 3-2**  
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					Depth 1	Depth 2/3	Deep
Semivolatile Organic Compounds (continued)	EPA 3550B	EPA 8270C	Benzenethiol	108-98-5	✓	✓	(d)
			Benzoic acid	65-85-0	✓	✓	(d)
			Benzyl alcohol	100-51-6	✓	✓	(d)
			bis(2-Chloroethoxy)methane	111-91-1	✓	✓	(d)
			bis(2-Chloroethyl) ether	111-44-4	✓	✓	(d)
			bis(2-Chloroisopropyl) ether	108-60-1	✓	✓	(d)
			bis(2-Ethylhexyl) phthalate	117-81-7	✓	✓	(d)
			bis(p-Chlorophenyl) sulfone	80-07-9	✓	✓	(d)
			bis(p-Chlorophenyl)disulfide	1142-19-4	✓	✓	(d)
			Butylbenzyl phthalate	85-68-7	✓	✓	(d)
			Carbazole	86-74-8	✓	✓	(d)
			Dibenzofuran	132-64-9	✓	✓	(d)
			Dichloromethyl ether	542-88-1	✓	✓	(d)
			Diethyl phthalate	84-66-2	✓	✓	(d)
			Dimethyl phthalate	131-11-3	✓	✓	(d)
			Di-n-butyl phthalate	84-74-2	✓	✓	(d)
			Di-n-octyl phthalate	117-84-0	✓	✓	(d)
			Diphenyl disulfide	882-33-7	✓	✓	(d)
			Diphenyl sulfide	139-66-2	✓	✓	(d)
			Diphenyl sulfone	127-63-9	✓	✓	(d)
			Diphenylamine	122-39-4	✓	✓	(d)
			Fluoranthene	206-44-0	✓	✓	(d)
			Fluorene	86-73-7	✓	✓	(d)
			Hexachlorobenzene	118-74-1	✓	✓	(d)
			Hexachlorobutadiene	87-68-3	✓	✓	(d)
			Hexachlorocyclopentadiene	77-47-4	✓	✓	(d)
			Hexachloroethane	67-72-1	✓	✓	(d)
			Hydroxymethyl phthalimide	118-29-6	✓	✓	(d)
			Isophorone	78-59-1	✓	✓	(d)
			m,p-Cresols	65794-96-9	✓	✓	(d)
			Naphthalene	91-20-3	✓	✓	(d)
			Nitrobenzene	98-95-3	✓	✓	(d)
			N-nitrosodi-n-propylamine	621-64-7	✓	✓	(d)
o-Cresol	95-48-7	✓	✓	(d)			
Octachlorostyrene	29082-74-4	✓	✓	(d)			
p-Chloroaniline (4-Chloroaniline)	106-47-8	✓	✓	(d)			
p-Chlorobenzenethiol	106-54-7	✓	✓	(d)			

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Parameter of Interest	Preparation Method	Analytical Method	Compound List	CAS Number	Sample Depth (from Table 3-1)		
					Depth 1	Depth 2/3	Deep
Semivolatile Organic Compounds (continued)	EPA 3550B	EPA 8270C	Pentachlorobenzene	608-93-5	✓	✓	(d)
			Pentachlorophenol	87-86-5	✓	✓	(d)
			Phenol	108-95-2	✓	✓	(d)
			Phthalic acid	88-99-3	✓	✓	(d)
			Pyridine	110-86-1	✓	✓	(d)
			Tentatively Identified Compounds (TICs)		✓	✓	(d)
Volatile Organic Compounds	EPA 5030B/ EPA 5035	EPA 8260B	1,1,1,2-Tetrachloroethane	630-20-6	✓	✓	(d)
			1,1,1-Trichloroethane	71-55-6	✓	✓	(d)
			1,1,2,2-Tetrachloroethane	79-34-5	✓	✓	(d)
			1,1,2-Trichloroethane	79-00-5	✓	✓	(d)
			1,1-Dichloroethane	75-34-3	✓	✓	(d)
			1,1-Dichloroethene	75-35-4	✓	✓	(d)
			1,1-Dichloropropene	563-58-6	✓	✓	(d)
			1,2,3-Trichlorobenzene	87-61-6	✓	✓	(d)
			1,2,3-Trichloropropane	96-18-4	✓	✓	(d)
			1,2,4-Trichlorobenzene	120-82-1	✓	✓	(d)
			1,2,4-Trimethylbenzene	95-63-6	✓	✓	(d)
			1,2-Dichlorobenzene	95-50-1	✓	✓	(d)
			1,2-Dichloroethane	107-06-2	✓	✓	(d)
			1,2-Dichloroethene	540-59-0	✓	✓	(d)
			1,2-Dichloropropane	78-87-5	✓	✓	(d)
			1,3,5-Trichlorobenzene	108-70-3	✓	✓	(d)
			1,3,5-Trimethylbenzene	108-67-8	✓	✓	(d)
			1,3-Dichlorobenzene	541-73-1	✓	✓	(d)
			1,3-Dichloropropane	142-28-9	✓	✓	(d)
			1,4-Dichlorobenzene	106-46-7	✓	✓	(d)
			2,2-Dichloropropane	594-20-7	✓	✓	(d)
			2,2-Dimethylpentane	590-35-2	✓	✓	(d)
			2,2,3-Trimethylbutane	464-06-2	✓	✓	(d)
			2,3-Dimethylpentane	565-59-3	✓	✓	(d)
			2,4-Dimethylpentane	108-08-7	✓	✓	(d)
			2-Chlorotoluene	95-49-8	✓	✓	(d)
			2-Hexanone	591-78-6	✓	✓	(d)
			2-Methylhexane	591-76-4	✓	✓	(d)
			2-Nitropropane	79-46-9	✓	✓	(d)
			3,3-Dimethylpentane	562-49-2	✓	✓	(d)
3-Ethylpentane	617-78-7	✓	✓	(d)			

**TABLE 3-2**  
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 9 of 10)

Parameter of Interest	Preparation Method	Analytical Method	Compound List	CAS Number	Sample Depth (from Table 3-1)		
					Depth 1	Depth 2/3	Deep
Volatile Organic Compounds (continued)	EPA 5030B/ EPA 5035	EPA 8260B	3-Methylhexane	589-34-4	✓	✓	(d)
			4-Chlorotoluene	106-43-4	✓	✓	(d)
			4-Methyl-2-pentanone (MIBK)	108-10-1	✓	✓	(d)
			Acetone	67-64-1	✓	✓	(d)
			Acetonitrile	75-05-8	✓	✓	(d)
			Benzene	71-43-2	✓	✓	(d)
			Bromobenzene	108-86-1	✓	✓	(d)
			Bromodichloromethane	75-27-4	✓	✓	(d)
			Bromoform	75-25-2	✓	✓	(d)
			Bromomethane	74-83-9	✓	✓	(d)
			Carbon disulfide	75-15-0	✓	✓	(d)
			Carbon tetrachloride	56-23-5	✓	✓	(d)
			Chlorobenzene	108-90-7	✓	✓	(d)
			Chlorobromomethane	74-97-5	✓	✓	(d)
			Chloroethane	75-00-3	✓	✓	(d)
			Chloroform	67-66-3	✓	✓	(d)
			Chloromethane	74-87-3	✓	✓	(d)
			cis-1,2-Dichloroethene	156-59-2	✓	✓	(d)
			cis-1,3-Dichloropropene	10061-01-5	✓	✓	(d)
			Cymene (Isopropyltoluene)	99-87-6	✓	✓	(d)
			Dibromochloromethane	124-48-1	✓	✓	(d)
			Dibromochloropropane	96-12-8	✓	✓	(d)
			Dibromomethane	74-95-3	✓	✓	(d)
			Dichloromethane (Methylene chloride)	75-09-2	✓	✓	(d)
			Dimethyldisulfide	624-92-0	✓	✓	(d)
			Ethanol	64-17-5	✓	✓	(d)
			Ethylbenzene	100-41-4	✓	✓	(d)
			Freon-11 (Trichlorofluoromethane)	75-69-4	✓	✓	(d)
			Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane)	76-13-1	✓	✓	(d)
			Freon-12 (Dichlorodifluoromethane)	75-71-8	✓	✓	(d)
Heptane	142-82-5	✓	✓	(d)			
Isopropylbenzene	98-82-8	✓	✓	(d)			
m,p-Xylene	136777-61-2	✓	✓	(d)			
Methyl ethyl ketone (2-Butanone)	78-93-3	✓	✓	(d)			
Methyl iodide	74-88-4	✓	✓	(d)			
MTBE (Methyl tert-butyl ether)	1634-04-4	✓	✓	(d)			
n-Butylbenzene	104-51-8	✓	✓	(d)			

**TABLE 3-2**  
**SITE-RELATED CHEMICALS AND INITIAL SAMPLE ANALYSES AND DEPTHS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Parameter of Interest	Preparation Method	Analytical Method	Compound List	CAS Number	Sample Depth (from Table 3-1)		
					Depth 1	Depth 2/3	Deep
Volatile Organic Compounds (continued)	EPA 5030B/ EPA 5035	EPA 8260B	Nonanal	124-19-6	✓	✓	(d)
			n-Propylbenzene	103-65-1	✓	✓	(d)
			o-Xylene	95-47-6	✓	✓	(d)
			sec-Butylbenzene	135-98-8	✓	✓	(d)
			Styrene	100-42-5	✓	✓	(d)
			tert-Butylbenzene	98-06-6	✓	✓	(d)
			Tetrachloroethene	127-18-4	✓	✓	(d)
			Toluene	108-88-3	✓	✓	(d)
			trans-1,2-Dichloroethene	156-60-5	✓	✓	(d)
			trans-1,3-Dichloropropene	10061-02-6	✓	✓	(d)
			Trichloroethene	79-01-6	✓	✓	(d)
			Vinyl acetate	108-05-4	✓	✓	(d)
			Vinyl chloride	75-01-4	✓	✓	(d)
			Xylenes (total)	1330-20-7	✓	✓	(d)
			Tentatively Identified Compounds (TICs)		✓	✓	(d)
Flashpoint	NA	EPA 1010	Flammables	NA	(a)	(a)	(a)
Total Petroleum Hydrocarbons	EPA 3550 EPA 3550 EPA 1664A	EPA 8015	Diesel	64742-46-7	(a)	(a)	(a)
			Gasoline	8006-61-9	(a)	(a)	(a)
			Grease	68153-81-1	(a)	(a)	(a)
			Mineral Spirits	NA	(a)	(a)	(a)
White Phosphorus	EPA 7580M	EPA 7580M	White phosphorus	12185-10-3	(a)	(a)	(a)
Methyl Mercury	EPA 1630	EPA 1630	Methyl mercury	22967-92-6	(a)	(a)	(a)
Soil Physical Parameters	NA	ASTM D2937/ MOSA1Ch .13	Dry bulk density	NA	(d)	✓	✓
		ASTM D2435/ MOSA1Ch .18	Total porosity	NA	(d)	✓	✓
		ASTM D5084	Soil permeability/saturated hydraulic cond.	NA	(d)	✓	✓
		ASTM D854	Specific gravity of soils	NA	(d)	✓	✓
		SW846 Method 9081	Cation exchange capacity	NA	(d)	✓	✓
		ASTM D2216/D4643/D2974	Volumetric water content	NA	(d)	✓	✓
		ASTM D422	Grain size analysis by sieve and hydrometer	NA	(d)	✓	✓
EPA 415.1/ASTM 2947	Fractional organic carbon content	NA	(d)	✓	✓		

**Notes:**

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

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

NA = Not applicable.

a - Removed based on rationale provided in the text.

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

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

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

e - Removed based on Revisions to the Analyte List Technical Memorandum approved by NDEP on 10/16/2008.

**TABLE 3-3**  
**FINAL CONFIRMATION SOIL SAMPLE LOCATIONS AND ANALYSES**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 6)

Sample Location	Sample Depth	Sample Type	Scraped?	Asbestos	Aldehydes	Dioxins	Gen Chem	Metals	OCPs	PAHs	PCBs	Rads	SVOCs	VOCs
GNC1-BC21	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X
GNC1-BC22	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	11	Initial			X		X	X	X	X		X	X	X
<del>GNC1-BC23</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	10	Initial			X		X	X	X	X		X	X	X
GNC2-BC23C	0	Confirmation				X		X			X			
<del>GNC1-BC24</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	11	Initial			X		X	X	X	X		X	X	X
GNC2-BC24C	0	Confirmation				X		X			X			
GNC1-BC25	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	4	Initial			X		X	X	X	X		X	X	X
	14	Initial			X		X	X	X	X		X	X	X
<del>GNC1-BC26</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	11	Initial			X		X	X	X	X		X	X	X
GNC2-BC26C	0	Confirmation				X					X			
GNC1-BC27	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X
<del>GNC1-BC28</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	11	Initial			X		X	X	X	X		X	X	X
GNC2-BC28C	0	Confirmation				X					X			
GNC1-BC29	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X
GNC1-BD22	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X
GNC1-BD23	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	12	Initial			X		X	X	X	X		X	X	X
GNC1-BD24	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	11	Initial			X		X	X	X	X		X	X	X
<del>GNC1-BD25</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	3	Initial			X		X	X	X	X		X	X	X
	13	Initial			X		X	X	X	X		X	X	X
GNC2-BD25C	13	Supplemental						X				X		
GNC2-BD25E	13	Supplemental						X				X		
GNC2-BD25N	13	Supplemental						X				X		
GNC2-BD25S	13	Supplemental						X				X		
GNC2-BD25W	13	Supplemental						X				X		

**TABLE 3-3**  
**FINAL CONFIRMATION SOIL SAMPLE LOCATIONS AND ANALYSES**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Sample Location	Sample Depth	Sample Type	Scraped?	Asbestos	Aldehydes	Dioxins	Gen Chem	Metals	OCPs	PAHs	PCBs	Rads	SVOCs	VOCs
GNC3-BD25C	7	Supplemental						X						
	10	Supplemental						X						
GNC3-BD25E	7	Supplemental						X						
	10	Supplemental						X						
GNC3-BD25E	7	Supplemental						X						
	10	Supplemental						X						
GNC3-BD25E	7	Supplemental						X						
	10	Supplemental						X						
GNC3-BD25E	7	Supplemental						X						
	10	Supplemental						X						
<del>GNC1-BD26</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	6	Initial			X		X	X	X	X		X	X	X
	16	Initial			X		X	X	X	X		X	X	X
GNC2-BD26C	0	Confirmation				X					X			
GNC1-BD27	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X
	20	Initial			X		X	X	X	X		X	X	X
<del>GNC1-BD28</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	10	Initial			X		X	X	X	X		X	X	X
GNC2-BD28C	0	Confirmation				X					X			
<del>GNC1-BD29</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	10	Initial			X		X	X	X	X		X	X	X
GNC2-BD29C	0	Confirmation				X					X			
GNC1-BE23	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X
GNC1-BE24	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X
GNC1-BE25	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	12	Initial			X		X	X	X	X		X	X	X
<del>GNC1-BE26</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	4	Initial			X		X	X	X	X		X	X	X
	14	Initial			X		X	X	X	X		X	X	X
GNC2-BE26	0	Confirmation		X										
GNC1-BE27	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	12	Initial			X		X	X	X	X		X	X	X
GNC1-BE28	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X

**TABLE 3-3**  
**FINAL CONFIRMATION SOIL SAMPLE LOCATIONS AND ANALYSES**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 3 of 6)

Sample Location	Sample Depth	Sample Type	Scraped?	Asbestos	Aldehydes	Dioxins	Gen Chem	Metals	OCPs	PAHs	PCBs	Rads	SVOCs	VOCs
<del>GNC1-BE29</del>	0	Initial	Yes	X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X
<del>GNC2-BE29C</del>	0	Confirmation	Yes							X			X	
GNC6-BE29	0	Confirmation								X			X	
GNC1-BF23	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X
GNC1-BF24	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	11	Initial			X		X	X	X	X		X	X	X
GNC1-BG23	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	11	Initial			X		X	X	X	X		X	X	X
GNC1-BG24	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	11	Initial			X		X	X	X	X		X	X	X
GNC1-JA08	0	Supplemental				X		X						
GNC1-JA09	0	Supplemental				X								
GNC1-JA10	0	Supplemental				X		X				X		
GNC1-JA11	0	Supplemental				X								
<del>GNC1-JA12</del>	0	Supplemental	Yes			X								
GNC2-JA12C	0	Confirmation				X					X			
<del>GNC1-JA13</del>	0	Supplemental	Yes			X								
GNC2-JA13C	0	Confirmation				X					X			
GNC1-JA14	0	Supplemental				X								
GNC1-JA15	0	Supplemental				X								
GNC1-JA16	0	Supplemental								X				
GNC1-JA17	0	Supplemental								X				
GNC1-JB02	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	5	Initial			X		X	X	X	X		X	X	X
	15	Initial			X		X	X	X	X		X	X	X
<del>GNC1-JB03</del>	0	Initial	Yes	X	X	X	X	X	X	X	X	X	X	X
	7	Initial			X		X	X	X	X		X	X	X
	17	Initial			X		X	X	X	X		X	X	X
GNC2-JB03C	0	Confirmation				X		X			X			
<del>GNC1-JB04</del>	0	Initial	Yes	X	X	X	X	X	X	X	X	X	X	X
	7	Initial			X		X	X	X	X		X	X	X
	17	Initial			X		X	X	X	X		X	X	X
GNC2-JB04C	0	Confirmation				X		X			X			
<del>GNC1-JB05</del>	0	Initial	Yes	X	X	X	X	X	X	X	X	X	X	X
	7	Initial			X		X	X	X	X		X	X	X

**TABLE 3-3  
FINAL CONFIRMATION SOIL SAMPLE LOCATIONS AND ANALYSES  
HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA  
BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA  
(Page 4 of 6)**

Sample Location	Sample Depth	Sample Type	Scraped?	Asbestos	Aldehydes	Dioxins	Gen Chem	Metals	OCPs	PAHs	PCBs	Rads	SVOCs	VOCs
	17	Initial			X		X	X	X	X		X	X	X
GNC2-JB05C	0	Confirmation				X		X			X			
GNC1-JB06	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	6	Initial			X		X	X	X	X		X	X	X
	16	Initial			X		X	X	X	X		X	X	X
GNC1-JB07	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	8	Initial			X		X	X	X	X		X	X	X
	18	Initial			X		X	X	X	X		X	X	X
GNC1-JB08	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	7	Initial			X		X	X	X	X		X	X	X
	17	Initial			X		X	X	X	X		X	X	X
<del>GNC1-JB09</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	9	Initial			X		X	X	X	X		X	X	X
	19	Initial			X		X	X	X	X		X	X	X
GNC2-JB09C	0	Confirmation				X					X			
<del>GNC1-JB10</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	8	Initial			X		X	X	X	X		X	X	X
	18	Initial			X		X	X	X	X		X	X	X
GNC2-JB10C	0	Confirmation				X					X			
GNC2-JB10NE	0	Confirmation				X					X			
GNC2-JB10NW	0	Confirmation				X					X			
GNC2-JB10SE	0	Confirmation				X					X			
GNC2-JB10SW	0	Confirmation				X					X			
<del>GNC1-JD06</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	10	Initial			X		X	X	X	X		X	X	X
GNC2-JD06	0	Confirmation						X						
<del>GNC1-JP02</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	10	Initial			X		X	X	X	X		X	X	X
GNC2-JP02C	0	Confirmation				X		X			X			
<del>GNC1-JP03</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	12	Initial			X		X	X	X					X
GNC2-JP03C	0	Confirmation				X					X			
<del>GNC1-JP04</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	10	Initial			X		X	X	X	X		X	X	X
GNC2-JP04C	0	Confirmation				X		X			X			
<del>GNC1-JP05</del>	<del>0</del>	<del>Initial</del>	<del>Yes</del>	<del>X</del>										
	11	Initial			X		X	X	X	X		X	X	X

**TABLE 3-3**  
**FINAL CONFIRMATION SOIL SAMPLE LOCATIONS AND ANALYSES**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 5 of 6)

Sample Location	Sample Depth	Sample Type	Scraped?	Asbestos	Aldehydes	Dioxins	Gen Chem	Metals	OCPs	PAHs	PCBs	Rads	SVOCs	VOCs
GNC2-JP05C	0	Confirmation				X					X			
GNC2-JP05NE	0	Confirmation				X					X			
GNC2-JP05NW	0	Confirmation				X					X			
GNC2-JP05SE	0	Confirmation				X					X			
GNC2-JP05SW	0	Confirmation				X					X			
GNC1-JP06	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	3	Initial			X		X	X	X	X		X	X	X
	13	Initial			X		X	X	X	X		X	X	X
GNC1-JP07	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	4	Initial			X		X	X	X	X		X	X	X
	14	Initial			X		X	X	X	X		X	X	X
GNC2-JP07C	4	Supplemental						X				X		
GNC2-JP07E	4	Supplemental						X				X		
GNC2-JP07N	4	Supplemental						X				X		
GNC2-JP07S	4	Supplemental						X				X		
GNC2-JP07W	4	Supplemental						X				X		
GNC1-JP08	0	Initial	Yes	X	X	X	X	X	X	X	X	X	X	X
	12	Initial			X		X	X	X	X		X	X	X
GNC2-JP08	0	Confirmation		X										
GNC1-JS07	0	Initial	Yes	X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X
GNC2-JS07C	0	Confirmation				X					X			
GNC1-JS12	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	11	Initial			X		X	X	X	X		X	X	X
GNC1-JS13	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	11	Initial			X		X	X	X	X		X	X	X
GNC1-JS14	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	3	Initial			X		X	X	X	X		X	X	X
	13	Initial			X		X	X	X	X		X	X	X
GNC1-JS15	0	Initial	Yes	X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X
GNC2-JS15C	0	Confirmation				X					X			
GNC1-JS16	0	Initial	Yes	X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X
GNC2-JS16C	0	Confirmation				X					X			
GNC1-JS17	0	Initial	Yes	X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X

**TABLE 3-3**  
**FINAL CONFIRMATION SOIL SAMPLE LOCATIONS AND ANALYSES**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Sample Location	Sample Depth	Sample Type	Scraped?	Asbestos	Aldehydes	Dioxins	Gen Chem	Metals	OCPs	PAHs	PCBs	Rads	SVOCs	VOCs
GNC2-JS17C	0	Confirmation				X					X			
GNC1-JS18	0	Initial		X	X	X	X	X	X	X	X	X	X	X
	10	Initial			X		X	X	X	X		X	X	X



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



= Redevelopment grading plan adjusted to remove this sample location/depth from the HHRA dataset (that is, a lesser cut will be performed, such that this sample location/depth will be below the depth of potential exposure (10 ft bgs).

**TABLE 3-4**  
**FINAL HUMAN HEALTH RISK ASSESSMENT SOIL DATASET RESULTS SUMMARY**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 6)

Parameter of Interest	Compound List	Units	Total Count	Detect Freq.	Censored (Non-Detect) Data							Detected Data <sup>(1)</sup>							Residential Soil BCL	Count of Detects > BCL	LBCL (DAF 1)	Count of Detects > DAF 1	LBCL (DAF 20)	Count of Detects > DAF 20	Max. Bkgrnd <sup>(2)</sup>	Count of Detects > Bkgrnd
					Count	Min	Q1	Median	Mean	Q3	Max	Count	Min	Q1	Median	Mean	Q3	Max								
Asbestos <sup>(3)</sup>	Amphibole	Structures	58	0%	58	--	--	--	--	--	--	0	--	--	--	--	--	--	--	--	--	--	--	--	--	
	Chrysotile	Structures	58	2%	57	--	--	--	--	--	--	1	2	--	--	--	--	2	--	--	--	--	--	--	--	--
Aldehydes	Acetaldehyde	mg/kg	134	12%	118	0.301	0.31	0.31	0.33	0.32	1.04	16	0.357	0.46	0.52	0.52	0.6	0.695	13.9	0	--	--	--	--	--	--
	Formaldehyde	mg/kg	134	64%	48	0.201	0.21	0.21	0.24	0.24	0.546	86	0.207	0.25	0.3	0.32	0.36	0.613	12200	0	--	--	--	--	--	--
Dioxins/Furans	1,2,3,4,6,7,8-Heptachlorodibenzofuran <sup>(4)</sup>	pg/g	77	71%	22	0.15	0.36	0.95	0.91	1.3	2.3	55	2.5	15	61	62	89	210	--	--	--	--	--	--	--	--
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin <sup>(4)</sup>	pg/g	77	52%	37	0.074	0.21	0.28	0.53	0.59	3.1	40	2.8	6.2	8.4	11	13	31	--	--	--	--	--	--	--	--
	1,2,3,4,7,8,9-Heptachlorodibenzofuran <sup>(4)</sup>	pg/g	77	60%	31	0.13	0.22	0.55	0.7	0.99	2.5	46	2.9	12	32	30	41	69	--	--	--	--	--	--	--	--
	1,2,3,4,7,8-Hexachlorodibenzofuran <sup>(4)</sup>	pg/g	77	62%	29	0.087	0.28	0.64	0.79	1.2	2.4	48	2.6	13	34	33	45	87	--	--	--	--	--	--	--	--
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin <sup>(4)</sup>	pg/g	77	0%	77	0.045	0.084	0.37	1	1.5	5	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1,2,3,6,7,8-Hexachlorodibenzofuran <sup>(4)</sup>	pg/g	77	57%	33	0.057	0.22	0.42	0.65	0.85	2.5	44	4.1	9.4	25	25	30	66	--	--	--	--	--	--	--	--
	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin <sup>(4)</sup>	pg/g	77	23%	59	0.037	0.085	0.22	1.1	1.6	5	18	2.5	2.9	3.4	3.5	3.8	5.8	--	--	--	--	--	--	--	--
	1,2,3,7,8,9-Hexachlorodibenzofuran <sup>(4)</sup>	pg/g	77	36%	49	0.041	0.12	0.24	0.77	1	5	28	2.9	3.3	4.2	4.6	5.3	8.9	--	--	--	--	--	--	--	--
	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin <sup>(4)</sup>	pg/g	77	19%	62	0.032	0.083	0.25	1.1	1.6	5	15	2.6	2.9	3.2	3.5	4.1	5.1	--	--	--	--	--	--	--	--
	1,2,3,7,8-Pentachlorodibenzofuran <sup>(4)</sup>	pg/g	77	57%	33	0.054	0.2	0.35	0.54	0.74	2.3	44	2.7	8.4	20	21	30	51	--	--	--	--	--	--	--	--
	1,2,3,7,8-Pentachlorodibenzo-p-dioxin <sup>(4)</sup>	pg/g	77	8%	71	0.043	0.11	0.49	1.1	1.6	5	6	2.7	2.7	3.1	3.2	3.7	3.8	--	--	--	--	--	--	--	--
	2,3,4,6,7,8-Hexachlorodibenzofuran <sup>(4)</sup>	pg/g	77	44%	43	0.046	0.1	0.21	0.72	0.68	5	34	2.7	5.7	7.4	8	9.9	18	--	--	--	--	--	--	--	--
	2,3,4,7,8-Pentachlorodibenzofuran <sup>(4)</sup>	pg/g	77	52%	37	0.053	0.14	0.25	0.43	0.55	1.9	40	3	6.1	11	11	16	27	--	--	--	--	--	--	--	--
	2,3,7,8-Tetrachlorodibenzofuran <sup>(4)</sup>	pg/g	77	78%	17	0.09	0.15	0.24	0.25	0.37	0.45	60	0.53	1	7.2	8.9	14	66	--	--	--	--	--	--	--	--
	2,3,7,8-Tetrachlorodibenzo-p-dioxin <sup>(4)</sup>	pg/g	77	25%	58	0.031	0.062	0.12	0.25	0.31	1	19	0.52	0.57	0.64	0.7	0.76	1.3	--	--	--	--	--	--	--	--
Octachlorodibenzodioxin <sup>(4)</sup>	pg/g	77	45%	42	0.15	0.52	0.81	2.9	2.7	16	35	5.2	12	26	34	44	120	--	--	--	--	--	--	--	--	
Octachlorodibenzofuran <sup>(4)</sup>	pg/g	77	74%	20	0.34	0.82	1.5	2	3.2	4.7	57	5.2	43	160	190	300	760	--	--	--	--	--	--	--	--	
TCDD TEQ	pg/g	77	-- <sup>(4)</sup>	0	--	--	--	--	--	--	77	0.23	0.51	4.9	9.2	17	42.6	50	0	--	--	--	--	--	--	
General Chemistry/Ions	Ammonia (as N)	mg/kg	134	4%	128	0.79	0.8	0.81	1.7	0.84	6.5	6	0.96	0.97	1.3	2.3	3.8	6.6	--	--	--	--	--	--	--	--
	Bromide	mg/kg	134	32%	91	0.26	0.27	0.27	0.35	0.27	2.7	43	0.42	0.61	1.2	1.5	2.1	3.9	26600	0	95.6	0	1910	0	--	--
	Chlorate	mg/kg	134	17%	111	0.48	0.48	0.49	0.49	0.49	0.56	23	0.85	1.8	2.2	3	3.2	12.1	2350	0	1.13	20	22.6	0	--	--
	Chloride	mg/kg	134	100%	0	--	--	--	--	--	--	134	0.33	1.4	33	180	290	2070	--	--	--	--	--	--	--	--
	Cyanide, Total	mg/kg	134	34%	89	0.08	0.081	0.083	0.21	0.51	0.53	45	0.088	0.15	0.34	0.48	0.68	2.6	5.71	0	2	1	40	0	--	--
	Fluoride	mg/kg	134	74%	35	0.1	0.1	0.1	0.16	0.1	1.1	99	0.15	0.4	0.73	0.77	0.95	2.1	3670	0	--	--	--	--	--	--
	Nitrate	mg/kg	134	99%	1	0.053	--	0.053	0.053	--	0.053	133	0.15	2	4.7	17	15	202	100000	0	7	54	140	3	--	--
	Nitrite	mg/kg	134	17%	111	0.033	0.034	0.034	0.036	0.035	0.22	23	0.064	0.085	0.13	0.19	0.22	0.55	7820	0	--	--	--	--	--	--
	Orthophosphate as P	mg/kg	134	25%	100	0.51	0.52	0.52	2	5.1	6	34	0.66	1.8	2.4	2.8	4.1	6	--	--	--	--	--	--	--	--
	Perchlorate	mg/kg	133	87%	17	0.01	0.01	0.01	0.01	0.011	0.0112	116	0.0124	0.037	0.098	0.7	0.96	6.36	54.8	0	0.0185	108	0.371	36	--	--
	Sulfate	mg/kg	134	96%	5	5.2	5.3	5.3	5.4	5.6	5.7	129	2.6	9.9	56	630	430	18400	--	--	--	--	--	--	--	--
	Sulfide	mg/kg	134	1%	133	1.8	1.8	1.8	1.8	1.9	2.3	1	649	--	650	650	--	649	--	--	--	--	--	--	--	--
	Total Kjeldahl Nitrogen (TKN)	mg/kg	134	95%	7	50.8	51	52	52	52	52.1	127	22	72	120	180	230	1060	--	--	--	--	--	--	--	--
	Metals	Aluminum	mg/kg	149	100%	0	--	--	--	--	--	--	149	3700	8800	9800	9900	11000	14600	77200	0	75	149	1500	149	15300
Antimony		mg/kg	149	0%	149	0.225	0.32	0.32	0.67	0.33	2.6	0	--	--	--	--	--	--	31.3	--	0.3	--	6	--	0.5	--
Arsenic		mg/kg	149	100%	0	--	--	--	--	--	--	149	3.3	4.8	5.8	6	6.5	22	0.39	149	1	149	20	1	7.2	20
Barium		mg/kg	149	100%	0	--	--	--	--	--	--	149	30	340	420	430	500	1270	15300	0	82	147	1640	0	445	63
Beryllium		mg/kg	149	89%	17	0.3775	0.51	0.51	0.51	0.52	0.53	132	0.31	0.52	0.58	0.6	0.67	1.1	155	0	3	0	60	0	0.89	5
Boron		mg/kg	149	2%	146	2.99	17	17	20	17	82.5	3	18.3	18	27	26	33	33	15600	0	23.4	2	467	0	11.6	3
Cadmium		mg/kg	149	50%	74	0.081	0.1	0.26	0.2	0.26	0.5	75	0.08	0.11	0.13	0.15	0.17	0.37	77.7	0	0.4	0	8	0	0.1291	47
Calcium		mg/kg	149	100%	0	--	--	--	--	--	--	149	10000	20000	24000	32000	31000	215000	--	--	--	--	--	--	82800	9
Chromium		mg/kg	149	98%	3	6.37	6.4	16	13	16	15.925	146	2.6	12	15	15	19	42.9	100000	0	--	--	--	--	16.7	54
Chromium (VI)		mg/kg	149	43%	85	0.1	0.1	0.1	0.14	0.11	0.42	64	0.1	0.15	0.2	0.23	0.3	0.59	234	0	2	0	40	0	0.32	11
Cobalt		mg/kg	149	100%	0	--	--	--	--	--	--	149	1.9	7.6	8.6	8.6	9.5	14.4	23.4	0	0.495	149	9.9	25	16.3	0
Copper		mg/kg	149	99%	1	5	--	5	5	--	5	148	6	16	19	19	21	63.7	2910	0	45.8	1	915	0	25.9	9
Iron		mg/kg	149	100%	0	--	--	--	--	--	--	149	4010	14000	17000	16000	18000	24100	54800	0	7.56	149	151	149	19700	20
Lead		mg/kg	149	99%	1	2.5	--	2.5	2.5	--	2.5	148	3.3	12	15	20	24	74.3	400	0	--	--	--	--	35.1	18
Lithium		mg/kg	149	100%	0	--	--	--	--	--	--	149	8.3	15	17	18	19	76	156	0	21.9	15	438	0	26.5	9
Magnesium		mg/kg	149	100%	0	--	--	--	--	--	--	149	3400	8500	9800	11000	11000	48000	100000	0	973	149	19500	7	17500	8
Manganese	mg/kg	149	100%	0	--	--	--	--	--	--	149	102	440	520	540	610	1820	1820	0	1.3	149	26.1	149	863	3	

**TABLE 3-4**  
**FINAL HUMAN HEALTH RISK ASSESSMENT SOIL DATASET RESULTS SUMMARY**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Parameter of Interest	Compound List	Units	Total Count	Detect Freq.	Censored (Non-Detect) Data							Detected Data <sup>(1)</sup>							Residential Soil BCL	Count of Detects > BCL	LBCL (DAF 1)	Count of Detects > DAF 1	LBCL (DAF 20)	Count of Detects > DAF 20	Max. Bkgrnd <sup>(2)</sup>	Count of Detects > Bkgrnd
					Count	Min	Q1	Median	Mean	Q3	Max	Count	Min	Q1	Median	Mean	Q3	Max								
Polychlorinated Biphenyls	PCB 105 <sup>(4)</sup>	pg/g	70	50%	35	2	2	2	8	2.2	63	35	3.4	14	34	63	77	710	--	--	--	--	--	--	--	--
	PCB 114 <sup>(4)</sup>	pg/g	70	49%	36	2	2	2	2.1	2.1	2.3	34	2.2	9.7	20	22	30	63	--	--	--	--	--	--	--	--
	PCB 118 <sup>(4)</sup>	pg/g	70	61%	27	2	2	2	17	2.3	140	43	2.4	11	57	100	140	1100	--	--	--	--	--	--	--	--
	PCB 123 <sup>(4)</sup>	pg/g	70	1%	69	2	2	2.1	2.1	2.1	2.3	1	2.4	--	2.4	2.4	--	2.4	--	--	--	--	--	--	--	--
	PCB 126 <sup>(4)</sup>	pg/g	70	30%	49	2	2	2	2.1	2.1	2.3	21	2.1	2.9	4.8	4.9	5.6	17	--	--	--	--	--	--	--	--
	PCB 156 <sup>(4)</sup>	pg/g	70	41%	41	2	2	2.1	4.9	2.2	34	29	2.3	7.3	15	21	30	130	--	--	--	--	--	--	--	--
	PCB 157 <sup>(4)</sup>	pg/g	70	37%	44	2	2	2	2.1	2.1	2.3	26	2.1	3.3	4.2	6.1	7.1	32	--	--	--	--	--	--	--	--
	PCB 167 <sup>(4)</sup>	pg/g	70	34%	46	2	2	2.1	3	2.1	15	24	2.1	5.3	7	11	14	54	--	--	--	--	--	--	--	--
	PCB 169 <sup>(4)</sup>	pg/g	70	6%	66	2	2	2.1	2.1	2.1	2.3	4	2.1	2.2	2.3	2.3	2.3	2.3	--	--	--	--	--	--	--	--
	PCB 189 <sup>(4)</sup>	pg/g	70	31%	48	2	2	2	2.5	2.1	11	22	2.5	4.5	6.3	7.2	8.7	19	--	--	--	--	--	--	--	--
	PCB 209 <sup>(4)</sup>	pg/g	70	84%	11	2	2	2	2	2.1	2.3	59	23	70	460	990	1600	6200	--	--	--	--	--	--	--	--
	PCB 77 <sup>(4)</sup>	pg/g	70	0%	70	2	2	2.1	2.1	2.1	2.3	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCB 81 <sup>(4)</sup>	pg/g	70	0%	70	2	2	2.1	2.1	2.1	2.3	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Radionuclides	Radium-226	pCi/g	140	81%	27	--	--	--	--	--	--	113	0	0.75	1	1	1.3	2.84	0.0071	113	0.016	113	0.32	113	2.36	2
	Radium-228	pCi/g	140	89%	15	--	--	--	--	--	--	125	0.35	1	1.4	1.4	1.7	2.88	0.013	125	0.016	125	0.32	125	2.92	0
	Thorium-228	pCi/g	140	99%	1	--	--	--	--	--	--	139	0.00019	1.2	1.5	1.6	1.8	5.12	0.0078	139	0.0023	139	0.045	139	2.28	7
	Thorium-230	pCi/g	140	95%	7	--	--	--	--	--	--	133	0.416	0.96	1.2	1.2	1.4	3.1	3.2	0	0.00084	133	0.017	133	3.01	1
	Thorium-232	pCi/g	140	100%	0	--	--	--	--	--	--	140	0.545	1.3	1.5	1.5	1.7	4.61	2.8	2	0.0029	140	0.058	140	2.23	5
	Uranium-233/234	pCi/g	140	91%	12	--	--	--	--	--	--	128	0.273	0.79	1.0	1	1.2	2.21	4.2	0	--	--	--	--	2.84	0
	Uranium-235/236	pCi/g	140	11%	124	--	--	--	--	--	--	16	-0.0761	0.041	0.086	0.11	0.14	1	0.11	15	--	--	--	--	0.21	8
	Uranium-238	pCi/g	140	89%	16	--	--	--	--	--	--	124	0.301	0.73	0.9	0.95	1.1	2.31	0.46	120	--	--	--	--	2.37	0
Semivolatile Organic Compounds	1,2,4,5-Tetrachlorobenzene	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	18.3	--	--	--	--	--	--	--
	1,2-Diphenylhydrazine	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	0.608	--	--	--	--	--	--	--
	1,4-Dioxane	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	4.86	--	--	--	--	--	--	--
	2,2'-Dichlorobenzil	mg/kg	132	0%	132	0.11	0.11	0.11	0.12	0.12	0.136	0	--	--	--	--	--	--	23.5	--	0.0003	--	0.006	--	--	--
	2,4,5-Trichlorophenol	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	6110	--	14	--	280	--	--	--
	2,4,6-Trichlorophenol	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	44.2	--	0.008	--	0.16	--	--	--
	2,4-Dichlorophenol	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	183	--	0.05	--	1	--	--	--
	2,4-Dimethylphenol	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	1220	--	0.4	--	8	--	--	--
	2,4-Dinitrophenol	mg/kg	132	0%	132	0.127	0.13	0.13	0.13	0.13	0.156	0	--	--	--	--	--	--	122	--	0.01	--	0.2	--	--	--
	2,4-Dinitrotoluene	mg/kg	132	0%	132	0.0335	0.034	0.035	0.035	0.035	0.0412	0	--	--	--	--	--	--	1.57	--	0.00004	--	0.0008	--	--	--
	2,6-Dinitrotoluene	mg/kg	132	0%	132	0.0335	0.034	0.035	0.035	0.035	0.0412	0	--	--	--	--	--	--	61.1	--	0.00003	--	0.0006	--	--	--
	2-Chloronaphthalene	mg/kg	132	0%	132	0.0117	0.012	0.012	0.012	0.012	0.0144	0	--	--	--	--	--	--	82.6	--	--	--	--	--	--	--
	2-Chlorophenol	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	220	--	0.2	--	4	--	--	--
	2-Methylnaphthalene	mg/kg	132	1%	131	0.00669	0.0069	0.0069	0.007	0.007	0.00823	1	0.0109	--	0.011	0.011	--	0.0109	--	--	--	--	--	--	--	--
	2-Nitroaniline	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	183	--	--	--	--	--	--	--
	2-Nitrophenol	mg/kg	132	0%	132	0.0335	0.034	0.035	0.035	0.035	0.0412	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	3,3-Dichlorobenzidine	mg/kg	132	0%	132	0.1	0.1	0.1	0.1	0.11	0.123	0	--	--	--	--	--	--	1.08	--	0.0003	--	0.006	--	--	--
	3-Nitroaniline	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	4-Bromophenyl phenyl ether	mg/kg	132	0%	132	0.0335	0.034	0.035	0.035	0.035	0.0412	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	4-Chloro-3-methylphenol	mg/kg	132	0%	132	0.0335	0.034	0.035	0.035	0.035	0.0412	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	4-Chlorophenyl phenyl ether	mg/kg	132	0%	132	0.0335	0.034	0.035	0.035	0.035	0.0412	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	4-Chlorothioanisole	mg/kg	132	0%	132	0.11	0.11	0.11	0.12	0.12	0.136	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	4-Nitroaniline	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	4-Nitrophenol	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	--	489	--	--	--	--	--	--
	Acetophenone	mg/kg	132	0%	132	0.0335	0.034	0.035	0.035	0.035	0.0412	0	--	--	--	--	--	--	--	1740	--	--	--	--	--	--
	Aniline	mg/kg	132	0%	132	0.117	0.12	0.12	0.12	0.12	0.144	0	--	--	--	--	--	--	--	85.3	--	--	--	--	--	--
	Benzenethiol	mg/kg	132	0%	132	0.11	0.11	0.11	0.12	0.12	0.136	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzoic acid	mg/kg	132	0%	132	0.167	0.17	0.17	0.17	0.18	0.206	0	--	--	--	--	--	--	--	100000	--	20	--	400	--	--	
Benzyl alcohol	mg/kg	132	0%	132	0.1	0.1	0.1	0.1	0.11	0.123	0	--	--	--	--	--	--	--	30600	--	--	--	--	--	--	
bis(2-Chloroethoxy)methane	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
bis(2-Chloroethyl) ether	mg/kg	132	0%	132	0.0669	0.069	0.069	0.07	0.07	0.0823	0	--	--	--	--	--	--	--	0.244	--	0.00002	--	0.0004	--	--	



**TABLE 3-13**  
**SURFACE FLUX SAMPLE ANALYSES**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 3)

Compound	CAS Number	MDL ppbv	RL ppbv	MDL $\mu\text{g}/\text{m}^3$	RL $\mu\text{g}/\text{m}^3$
<b>List of Compounds for USEPA Method TO-15 Full Scan Mode Operation and MDLs</b>					
1,1,1,2-Tetrachloroethane	630-20-6	0.1	0.51	0.72	3.62
1,1,1-Trichloroethane	71-55-6	0.1	0.52	0.58	2.89
1,1,2,2-Tetrachloroethane	79-34-5	0.1	0.52	0.73	3.65
1,1,2-Trichloroethane	79-00-5	0.1	0.51	0.57	2.86
1,1-Dichloroethane	75-34-3	0.1	0.52	0.43	2.15
1,1-Dichloroethene	75-35-4	0.1	0.52	0.42	2.13
1,1-Dichloropropene	563-58-6	0.1	0.49	0.46	2.3
1,2,3-Trichloropropane	96-18-4	0.11	0.55	0.68	3.39
1,2,4-Trichlorobenzene	120-82-1	0.1	0.52	0.79	3.94
1,2,4-Trimethylbenzene	95-63-6	0.1	0.52	0.52	2.61
1,2-Dichlorobenzene	95-50-1	0.1	0.52	0.64	3.2
1,2-Dichloroethane	107-06-2	0.1	0.52	0.43	2.15
1,2-Dichloropropane	78-87-5	0.1	0.52	0.49	2.46
1,3,5-Trimethylbenzene	108-67-8	0.1	0.52	0.53	2.64
1,3-Dichlorobenzene	541-73-1	0.1	0.52	0.64	3.2
1,3-Dichloropropane	142-28-9	0.11	0.54	0.52	2.58
1,4-Dichlorobenzene	106-46-7	0.1	0.52	0.64	3.2
1,4-Dioxane	123-91-1	0.09	0.44	0.33	1.64
2,2-Dichloropropane	594-20-7	0.11	0.53	0.5	2.53
2-Hexanone	591-78-6	0.09	0.44	0.37	1.86
2-Methyl-1-propanol	78-83-1	0.23	1.13	0.84	4.21
4-Methyl-2-pentanone (MIBK)	108-10-1	0.09	0.46	0.38	1.95
Acetone	67-64-1	0.09	0.45	0.22	1.1
Acetonitrile	75-05-8	0.22	1.12	0.48	2.39
Benzene	71-43-2	0.1	0.52	0.34	1.7
Benzyl chloride	100-44-7	0.09	0.45	0.48	2.41
Bromodichloromethane	75-27-4	0.08	0.4	0.55	2.77
Bromoform	75-25-2	0.09	0.47	0.99	4.96
Bromomethane	74-83-9	0.1	0.51	0.41	2.04
Carbon disulfide	75-15-0	0.09	0.45	0.29	1.45
Carbon tetrachloride	56-23-5	0.1	0.52	0.67	3.38
Chlorobenzene	108-90-7	0.1	0.52	0.5	2.48

**TABLE 3-13**  
**SURFACE FLUX SAMPLE ANALYSES**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 2 of 3)

Compound	CAS Number	MDL ppbv	RL ppbv	MDL $\mu\text{g}/\text{m}^3$	RL $\mu\text{g}/\text{m}^3$
Chlorobromomethane	74-97-5	0.1	0.51	0.55	2.76
Chloroethane	75-00-3	0.1	0.51	0.28	1.39
Chloroform	67-66-3	0.1	0.52	0.52	2.59
Chloromethane	74-87-3	0.1	0.51	0.22	1.09
cis-1,2-Dichloroethene	156-59-2	0.1	0.52	0.42	2.11
cis-1,3-Dichloropropene	10061-01-5	0.1	0.52	0.48	2.41
Cymene (Isopropyltoluene)	99-87-6	0.11	0.55	0.62	3.12
Dibromochloromethane	124-48-1	0.09	0.44	0.77	3.87
Dibromochloropropane	96-12-8	0.22	1.1	2.2	10.98
Dibromomethane	74-95-3	0.11	0.55	0.97	4.84
Dichloromethane (Methylene chloride)	75-09-2	0.1	0.52	0.37	1.86
Ethanol	64-17-5	0.22	1.12	0.44	2.18
Ethylbenzene	100-41-4	0.1	0.52	0.46	2.33
Freon-11 (Trichlorofluoromethane)	75-69-4	0.1	0.51	0.59	2.95
Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane)	76-13-1	0.1	0.52	0.81	4.07
Freon-12 (Dichlorodifluoromethane)	75-71-8	0.1	0.51	0.52	2.61
Heptane	142-82-5	0.08	0.42	0.35	1.78
Hexachlorobutadiene	87-68-3	0.1	0.52	1.14	5.68
Isopropylbenzene	98-82-8	0.11	0.57	0.58	2.89
m & p-Xylenes	108-38-3	0.21	1.03	0.92	4.61
Methyl ethyl ketone (2-Butanone)	78-93-3	0.09	0.43	0.26	1.31
Methyl iodide	4227-95-6	0.19	0.94	1.13	5.67
MTBE (Methyl tert-butyl ether)	1634-04-4	0.08	0.39	0.29	1.45
Naphthalene	91-20-3	0.22	1.09	1.19	5.9
n-Butylbenzene	104-51-8	0.1	0.52	0.59	2.95
n-Propylbenzene	103-65-1	0.11	0.54	0.55	2.74
o-Xylene	95-47-6	0.1	0.52	0.46	2.31
sec-Butylbenzene	135-98-8	0.11	0.52	0.59	2.95
Styrene	100-42-5	0.1	0.52	0.45	2.26
tert-Butylbenzene	98-06-6	0.11	0.52	0.59	2.85
Tetrachloroethene	127-18-4	0.1	0.52	0.72	3.61
Toluene	108-88-3	0.1	0.52	0.4	2
trans-1,2-Dichloroethene	156-60-5	0.09	0.44	0.36	1.8

**TABLE 3-13**  
**SURFACE FLUX SAMPLE ANALYSES**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 3 of 3)

Compound	CAS Number	MDL ppbv	RL ppbv	MDL $\mu\text{g}/\text{m}^3$	RL $\mu\text{g}/\text{m}^3$
trans-1,3-Dichloropropene	10061-02-6	0.1	0.52	0.48	2.41
Trichloroethene	79-01-6	0.1	0.52	0.57	2.85
Vinyl acetate	108-05-4	0.09	0.43	0.31	1.56
Vinyl chloride	75-01-4	0.1	0.51	0.27	1.35
<b>List of Compounds for USEPA Method TO-15 Selective Ion Mode (SIM) Operation and MDLs</b>					
1,1,2,2-Tetrachloroethane	79-34-5	0.005	0.026	0.035	0.18
1,1,2-Trichloroethane	79-00-5	0.005	0.026	0.028	0.14
1,2,3-Trichloropropane	96-18-4	0.005	0.026	0.031	0.16
1,2-Dichlorobenzene	95-50-1	0.005	0.026	0.031	0.16
1,2-Dichloroethane	107-06-2	0.005	0.026	0.021	0.11
1,2-Dichloropropane	78-87-5	0.005	0.026	0.024	0.12
1,3-Dichlorobenzene	541-73-1	0.005	0.026	0.031	0.16
1,4-Dichlorobenzene	106-46-7	0.005	0.026	0.031	0.16
Benzene	71-43-2	0.005	0.026	0.016	0.085
Benzyl chloride	100-44-7	0.005	0.026	0.026	0.14
Bromodichloromethane	75-27-4	0.005	0.026	0.034	0.18
Carbon tetrachloride	56-23-5	0.005	0.026	0.032	0.17
Chloroform	67-66-3	0.005	0.026	0.025	0.13
Dibromochloromethane	124-48-1	0.005	0.026	0.043	0.23
Dibromochloropropane	96-12-8	0.01	0.026	0.098	0.26
Dichloromethane (Methylene chloride)	75-09-2	0.005	0.026	0.018	0.009
Hexachlorobutadiene	87-68-3	0.01	0.026	0.108	0.28
Naphthalene	91-20-3	0.01	0.026	0.534	0.14
Tetrachloroethene	127-18-4	0.005	0.026	0.035	0.18
Trichloroethene	79-01-6	0.005	0.026	0.027	0.14
Vinyl chloride	75-01-4	0.005	0.026	0.013	0.068

Note:

The actual reported MDL may vary based on Canister dilution or matrix interferences.

CAS - Chemical abstract system

MDL - Method detection limit

RL - Reporting limit

ppbv - Parts per billion by volume

$\mu\text{g}/\text{m}^3$  - microgram per cubic meter

**TABLE 3-14**  
**SOIL VAPOR FLUX SAMPLE RESULTS SUMMARY**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 3)

Parameter of Interest	Compound List	Units	Total Count	Detect Freq.	Censored (Non-Detect) Data							Detected Data <sup>(1)</sup>						
					Count	Min	Q1	Median	Mean	Q3	Max	Count	Min	Q1	Median	Mean	Q3	Max
Volatile Organic Compounds (Full Scan)	1,1,1,2-Tetrachloroethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.0154	0.015	0.016	0.017	0.016	0.0404	0	--	--	--	--	--	--
	1,1,1-Trichloroethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.0138	0.014	0.014	0.016	0.015	0.0369	0	--	--	--	--	--	--
	1,1,2,2-Tetrachloroethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.0177	0.018	0.018	0.02	0.018	0.0462	0	--	--	--	--	--	--
	1,1,2-Trichloroethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.0138	0.014	0.014	0.016	0.015	0.0369	0	--	--	--	--	--	--
	1,1-Dichloroethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.010	0.010	0.010	0.012	0.011	0.0269	0	--	--	--	--	--	--
	1,1-Dichloroethene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.01	0.010	0.010	0.011	0.010	0.0265	0	--	--	--	--	--	--
	1,1-Dichloropropene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.00962	0.0096	0.0096	0.011	0.01	0.0254	0	--	--	--	--	--	--
	1,2,3-Trichloropropane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	3%	28	0.0131	0.013	0.014	0.015	0.014	0.0342	1	0.0242	--	0.024	0.024	--	0.0242
	1,2,4-Trichlorobenzene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	14%	25	0.0381	0.039	0.04	0.044	0.04	0.101	4	0.0415	0.042	0.049	0.5	1.4	1.85
	1,2,4-Trimethylbenzene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	38%	18	0.0254	0.026	0.026	0.03	0.029	0.066	11	0.0273	0.042	0.065	0.18	0.46	0.57
	1,2-Dichlorobenzene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	7%	27	0.03	0.030	0.031	0.034	0.031	0.0796	2	0.0415	--	0.32	0.32	--	0.593
	1,2-Dichloroethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.010	0.011	0.011	0.012	0.011	0.0277	0	--	--	--	--	--	--
	1,2-Dichloropropane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	10%	26	0.0119	0.012	0.012	0.013	0.012	0.0177	3	0.181	0.18	1.6	1.4	2.5	2.49
	1,3,5-Trimethylbenzene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	17%	24	0.0262	0.027	0.027	0.03	0.027	0.0688	5	0.045	0.058	0.16	0.19	0.33	0.4
	1,3-Dichlorobenzene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	3%	28	0.031	0.031	0.032	0.035	0.032	0.0812	1	0.0369	--	0.037	0.037	--	0.0369
	1,3-Dichloropropane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.00962	0.0096	0.01	0.011	0.010	0.0254	0	--	--	--	--	--	--
	1,4-Dichlorobenzene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	3%	28	0.031	0.031	0.032	0.035	0.032	0.0812	1	0.0627	--	0.063	0.063	--	0.0627
	1,4-Dioxane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.00808	0.0081	0.0081	0.0089	0.0081	0.0212	0	--	--	--	--	--	--
	2,2-Dichloropropane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.010	0.011	0.011	0.012	0.011	0.0277	0	--	--	--	--	--	--
	2-Hexanone	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	59%	12	0.00885	0.0092	0.0092	0.011	0.012	0.0238	17	0.01	0.018	0.036	0.055	0.067	0.266
	2-Methyl-1-propanol	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.0185	0.019	0.019	0.021	0.019	0.0492	0	--	--	--	--	--	--
	4-Methyl-2-pentanone (MIBK)	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	17%	24	0.00962	0.0096	0.0096	0.011	0.0099	0.025	5	0.0181	0.023	0.029	0.077	0.16	0.259
	Acetone	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	55%	13	0.00538	0.0054	0.0058	0.044	0.031	0.288	16	0.0777	0.2	0.38	0.64	0.94	2.35
	Acetonitrile	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	28%	21	0.010	0.010	0.011	0.011	0.011	0.015	8	0.0162	0.018	0.13	0.17	0.27	0.567
	Benzene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	14%	25	0.00808	0.02	0.028	0.043	0.05	0.231	4	0.0523	0.053	0.26	0.49	1.2	1.4
	Benzyl chloride	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	3%	28	0.0235	0.024	0.024	0.026	0.024	0.0615	1	0.0865	--	0.087	0.087	--	0.0865
	Bromodichloromethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.0135	0.014	0.014	0.015	0.014	0.0354	0	--	--	--	--	--	--
	Bromoform	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.0242	0.025	0.025	0.027	0.025	0.0635	0	--	--	--	--	--	--
	Bromomethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.01	0.010	0.010	0.011	0.010	0.0265	0	--	--	--	--	--	--
	Carbon disulfide	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	38%	18	0.00692	0.0069	0.0073	0.0081	0.0073	0.0188	11	0.0112	0.019	0.054	0.18	0.19	1.13
	Carbon tetrachloride	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	3%	28	0.0162	0.016	0.017	0.018	0.017	0.0423	1	0.166	--	0.17	0.17	--	0.166
	Chlorobenzene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	7%	27	0.0119	0.012	0.012	0.013	0.012	0.0312	2	0.0138	--	0.017	0.017	--	0.0196
	Chlorobromomethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.0115	0.012	0.012	0.013	0.012	0.03	0	--	--	--	--	--	--
Chloroethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	24%	22	0.00692	0.0069	0.0069	0.0078	0.0073	0.0181	7	0.0142	0.033	0.076	0.14	0.26	0.301	
Chloroform	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	45%	16	0.0123	0.013	0.013	0.015	0.013	0.0331	13	0.0142	0.023	0.038	0.059	0.053	0.223	
Chloromethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	14%	25	0.00538	0.0054	0.0054	0.0059	0.0054	0.0138	4	0.00654	0.014	0.035	0.034	0.053	0.0592	

**TABLE 3-14**  
**SOIL VAPOR FLUX SAMPLE RESULTS SUMMARY**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 2 of 3)

Parameter of Interest	Compound List	Units	Total Count	Detect Freq.	Censored (Non-Detect) Data							Detected Data <sup>(1)</sup>						
					Count	Min	Q1	Median	Mean	Q3	Max	Count	Min	Q1	Median	Mean	Q3	Max
Volatile Organic Compounds (Full Scan)	cis-1,2-Dichloroethene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.010	0.010	0.010	0.012	0.011	0.0269	0	--	--	--	--	--	--
	cis-1,3-Dichloropropene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.0119	0.012	0.012	0.014	0.013	0.0319	0	--	--	--	--	--	--
	Cymene (Isopropyltoluene)	µg/m <sup>2</sup> .min <sup>-1</sup>	29	14%	25	0.025	0.026	0.026	0.028	0.026	0.066	4	0.0358	0.037	0.15	0.17	0.33	0.349
	Dibromochloromethane	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.0188	0.019	0.019	0.021	0.02	0.05	0	--	--	--	--	--	--
	Dibromochloropropane	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.116	0.12	0.12	0.13	0.12	0.307	0	--	--	--	--	--	--
	Dibromomethane	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.0158	0.016	0.016	0.018	0.016	0.0415	0	--	--	--	--	--	--
	Dichloromethane (Methylene chloride)	µg/m <sup>2</sup> .min <sup>-1</sup>	29	24%	22	0.00885	0.0092	0.0092	0.01	0.0093	0.0238	7	0.012	0.013	0.024	0.043	0.057	0.125
	Ethanol	µg/m <sup>2</sup> .min <sup>-1</sup>	29	38%	18	0.0115	0.012	0.012	0.013	0.012	0.0304	11	0.0142	0.11	0.45	1.3	3	6.16
	Ethylbenzene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	38%	18	0.0115	0.012	0.012	0.013	0.013	0.03	11	0.0131	0.015	0.024	0.06	0.046	0.312
	Freon-11 (Trichlorofluoromethane)	µg/m <sup>2</sup> .min <sup>-1</sup>	29	17%	24	0.0146	0.015	0.015	0.017	0.015	0.0385	5	0.0173	0.019	0.02	0.028	0.042	0.0488
	Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane)	µg/m <sup>2</sup> .min <sup>-1</sup>	29	7%	27	0.0196	0.020	0.020	0.022	0.020	0.0515	2	0.02	--	0.021	0.021	--	0.0223
	Freon-12 (Dichlorodifluoromethane)	µg/m <sup>2</sup> .min <sup>-1</sup>	29	31%	20	0.0131	0.013	0.014	0.014	0.014	0.0188	9	0.0158	0.028	0.047	0.05	0.064	0.103
	Heptane	µg/m <sup>2</sup> .min <sup>-1</sup>	29	45%	16	0.00846	0.0089	0.0089	0.0093	0.0089	0.013	13	0.00923	0.012	0.015	0.2	0.15	1.75
	Hexachlorobutadiene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	3%	28	0.055	0.056	0.056	0.062	0.057	0.145	1	1.37	--	1.4	1.4	--	1.37
	Isopropylbenzene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	34%	19	0.0119	0.012	0.012	0.014	0.017	0.0308	10	0.015	0.043	0.063	0.12	0.2	0.425
	m & p-Xylenes	µg/m <sup>2</sup> .min <sup>-1</sup>	29	52%	14	0.0227	0.023	0.023	0.029	0.032	0.0592	15	0.0235	0.042	0.076	0.23	0.17	1.92
	Methyl ethyl ketone (2-Butanone)	µg/m <sup>2</sup> .min <sup>-1</sup>	29	34%	19	0.00615	0.0065	0.0065	0.0081	0.0065	0.0204	10	0.0242	0.065	0.21	2.30	3.4	10.4
	Methyl iodide	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.03	0.030	0.030	0.034	0.031	0.0788	0	--	--	--	--	--	--
	MTBE (Methyl tert-butyl ether)	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.00692	0.0073	0.0073	0.008	0.0073	0.0185	0	--	--	--	--	--	--
	n-Butylbenzene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	10%	26	0.0254	0.026	0.026	0.029	0.026	0.067	3	0.0596	0.06	0.06	0.14	0.3	0.295
	n-Propylbenzene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	21%	23	0.010	0.011	0.011	0.012	0.011	0.0273	6	0.0146	0.02	0.048	0.055	0.089	0.113
	o-Xylene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	38%	18	0.0112	0.012	0.012	0.015	0.017	0.0292	11	0.0165	0.027	0.038	0.1	0.094	0.335
	sec-Butylbenzene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	7%	27	0.025	0.025	0.026	0.028	0.026	0.066	2	0.0265	--	0.088	0.088	--	0.149
	Styrene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	3%	28	0.0112	0.011	0.011	0.012	0.012	0.0288	1	0.0119	--	0.012	0.012	--	0.0119
	tert-Butylbenzene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	14%	25	0.0246	0.025	0.025	0.028	0.026	0.065	4	0.028	0.039	0.075	0.08	0.14	0.157
	Tetrachloroethene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.0173	0.018	0.018	0.019	0.018	0.0458	0	--	--	--	--	--	--
	Toluene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	55%	13	0.00962	0.01	0.01	0.019	0.022	0.070	16	0.025	0.043	0.065	0.45	0.22	3.03
	trans-1,2-Dichloroethene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.00846	0.0089	0.0089	0.0097	0.0089	0.023	0	--	--	--	--	--	--
	trans-1,3-Dichloropropene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.0119	0.012	0.012	0.013	0.012	0.0312	0	--	--	--	--	--	--
	Trichloroethene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.0138	0.014	0.014	0.016	0.014	0.0365	0	--	--	--	--	--	--
	Vinyl acetate	µg/m <sup>2</sup> .min <sup>-1</sup>	29	10%	26	0.00769	0.0077	0.0077	0.0081	0.0077	0.0112	3	0.0365	0.037	0.16	0.12	0.18	0.179
	Vinyl chloride	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.00654	0.0069	0.0069	0.0075	0.0069	0.0177	0	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	µg/m <sup>2</sup> .min <sup>-1</sup>	29	7%	27	0.00173	0.0018	0.0018	0.0019	0.0018	0.00373	2	0.00204	--	0.0025	0.0025	--	0.00304	
1,1,2-Trichloroethane	µg/m <sup>2</sup> .min <sup>-1</sup>	29	7%	27	0.00138	0.0014	0.0014	0.0016	0.0015	0.004	2	0.00185	--	0.0023	0.0023	--	0.00265	
1,2,3-Trichloropropane	µg/m <sup>2</sup> .min <sup>-1</sup>	29	0%	29	0.00119	0.0012	0.0012	0.0013	0.0013	0.00177	0	--	--	--	--	--	--	
1,2-Dichlorobenzene	µg/m <sup>2</sup> .min <sup>-1</sup>	29	17%	24	0.0015	0.0015	0.0015	0.0016	0.0016	0.00238	5	0.00173	0.0018	0.002	0.029	0.069	0.126	

**TABLE 3-14**  
**SOIL VAPOR FLUX SAMPLE RESULTS SUMMARY**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 3 of 3)

Parameter of Interest	Compound List	Units	Total Count	Detect Freq.	Censored (Non-Detect) Data						Detected Data <sup>(1)</sup>							
					Count	Min	Q1	Median	Mean	Q3	Max	Count	Min	Q1	Median	Mean	Q3	Max
Volatile Organic Compounds (SIM)	1,2-Dichloroethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	3%	28	0.00104	0.0011	0.0011	0.0011	0.0011	0.00154	1	0.00377	--	0.0038	0.0038	--	0.00377
	1,2-Dichloropropane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.00119	0.0012	0.0012	0.0013	0.0013	0.00177	0	--	--	--	--	--	--
	1,3-Dichlorobenzene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	10%	26	0.00154	0.0016	0.0016	0.0017	0.0016	0.00227	3	0.00219	0.0022	0.0025	0.005	0.01	0.0104
	1,4-Dichlorobenzene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	10%	26	0.00154	0.0016	0.0016	0.0019	0.0021	0.004	3	0.00235	0.0024	0.0028	0.0077	0.018	0.018
	Benzene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	69%	9	0.00554	0.0076	0.014	0.015	0.022	0.0242	20	0.00369	0.0057	0.012	0.092	0.038	1.43
	Benzyl chloride	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	3%	28	0.00096	0.001	0.001	0.001	0.001	0.00146	1	0.006	--	0.007	0.007	--	0.006
	Bromodichloromethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.00112	0.0012	0.0012	0.0012	0.0012	0.00169	0	--	--	--	--	--	--
	Carbon tetrachloride	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	97%	1	0.00162	--	0.0016	0.0016	--	0.00162	28	0.00381	0.0071	0.0094	0.027	0.017	0.432
	Chloroform	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	100%	0	--	--	--	--	--	--	29	0.00362	0.0083	0.032	0.058	0.062	0.445
	Dibromochloromethane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	7%	27	0.00158	0.0016	0.0016	0.0017	0.0017	0.00231	2	0.00204	--	0.012	0.012	--	0.0215
	Dibromochloropropane	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.00512	0.0053	0.0053	0.0055	0.0054	0.00762	0	--	--	--	--	--	--
	Dichloromethane (Methylene chloride)	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	62%	11	0.00089	0.00092	0.00092	0.00092	0.00092	0.00096	18	0.003	0.0052	0.0083	0.016	0.017	0.0943
	Hexachlorobutadiene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	3%	28	0.00277	0.0028	0.0029	0.0029	0.0029	0.00408	1	0.233	--	0.23	0.23	--	0.233
	Naphthalene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	17%	24	0.00277	0.0029	0.0029	0.003	0.0029	0.00415	5	0.008	0.0086	0.01	0.017	0.028	0.0298
	Tetrachloroethene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	31%	20	0.00177	0.0018	0.0023	0.0026	0.0029	0.00658	9	0.00196	0.0024	0.0038	0.0037	0.0043	0.00765
Trichloroethene	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	28%	21	0.00142	0.0014	0.0015	0.0021	0.0023	0.006	8	0.00188	0.0021	0.0027	0.0056	0.01	0.0173	
Vinyl chloride	µg/m <sup>2</sup> ,min <sup>-1</sup>	29	0%	29	0.00065	0.00069	0.00069	0.0007	0.00069	0.00096	0	--	--	--	--	--	--	

**Notes:**  
 Values for Q1, median, mean, and Q3 are rounded to 2 significant figures.  
 Max = Maximum  
 Min = Minimum  
 Q1 = 1st quartile (25th percentile)  
 Q3 = 3rd quartile (75th percentile)  
 (1) Range of detections include estimated values of detect results ("J" flagged values).  
 -- = Not applicable or no value has been established.

**TABLE 4-4**  
**METALS SAMPLES QUALIFIED DUE TO RECOVERIES OUTSIDE ACCEPTANCE CRITERIA**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 1)

Laboratory Data Package	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Chromium VI	Cobalt	Copper	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Strontium	Thallium	Tin	Titanium	Tungsten	Uranium	Vanadium	Zinc
F0A080516	-	+	+			+	+			+	+	+				+		+	+	+	+	+	+	+	+	+	+	+	+
F0H030409	-		+											+				+								-			-
F9A300184	-		+								+							+		+									-
F9B020113	-		+						+	+								+											+
F9B020113	-		+				+		+	+								+		+		+							+
F9B040141	-						+			+								+		+		+							+
F9B050269	-						+			+								+		+		+						-	+
F9B070176	-		+/-				+			+					-			+		+						-		+	+/-
F9B100109	-		-	+								+								+						-	+		+/-
F9B110228	-		+															+		+		+							
F9B120113	-	+				+	+			+	+					+	+	+		+						-		+	+
F9B130146	-					+	+	+		+	+		+					+		+								+	+
F9B140120	-					+	-				-							+		+						-		-	-
F9B180129	-					+	-				-							+		+						-		-	-
F9C030231	-					+	-	+		-	-									+						-		-	-
F9H140144	-	+	+/-			+				+	+							+		+		-			+	-	+	+	+

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

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

Chemical	Galleria North of ROW Sub-Area															
	Total Count	Detect Freq.	Censored (Non-Detect) Data							Detected Data <sup>(1)</sup>						
			Count	Min	Q1	Median	Mean	Q3	Max	Count	Min	Q1	Median	Mean	Q3	Max
Aluminum	149	100%	0	--	--	--	--	--	--	149	3700	8800	9800	9900	11000	14600
Antimony	149	0%	149	0.225	0.32	0.32	0.67	0.33	2.6	0	--	--	--	--	--	--
Arsenic	149	100%	0	--	--	--	--	--	--	149	3.3	4.8	5.8	6	6.5	22
Barium	149	100%	0	--	--	--	--	--	--	149	30	340	420	430	500	1270
Beryllium	149	89%	17	0.3775	0.51	0.51	0.51	0.52	0.53	132	0.31	0.52	0.58	0.6	0.67	1.1
Boron	149	2%	146	2.99	17	17	20	17	82.5	3	18.3	18	27	26	33	33
Cadmium	149	50%	74	0.081	0.1	0.26	0.2	0.26	0.5	75	0.08	0.11	0.13	0.15	0.17	0.37
Calcium	149	100%	0	--	--	--	--	--	--	149	10000	20000	24000	32000	31000	215000
Chromium	149	98%	3	6.37	6.4	16	13	16	15.925	146	2.6	12	15	15	19	42.9
Chromium (VI)	149	43%	85	0.1	0.1	0.1	0.14	0.11	0.42	64	0.1	0.15	0.2	0.23	0.3	0.59
Cobalt	149	100%	0	--	--	--	--	--	--	149	1.9	7.6	8.6	8.6	9.5	14.4
Copper	149	99%	1	5	--	5	5	--	5	148	6	16	19	19	21	63.7
Iron	149	100%	0	--	--	--	--	--	--	149	4010	14000	17000	16000	18000	24100
Lead	149	99%	1	2.5	--	2.5	2.5	--	2.5	148	3.3	12	15	20	24	74.3
Lithium	149	100%	0	--	--	--	--	--	--	149	8.3	15	17	18	19	76
Magnesium	149	100%	0	--	--	--	--	--	--	149	3400	8500	9800	11000	11000	48000
Manganese	149	100%	0	--	--	--	--	--	--	149	102	440	520	540	610	1820
Mercury	148	10%	133	0.005	0.034	0.034	0.028	0.035	0.0431	15	0.0056	0.0092	0.014	0.019	0.022	0.0529
Molybdenum	149	70%	44	0.47	0.47	0.78	1.4	2.5	2.6	105	0.5	0.6	0.69	0.81	0.87	2.6
Nickel	149	100%	0	--	--	--	--	--	--	149	6.7	14	16	16	18	24.1
Potassium	149	100%	0	--	--	--	--	--	--	149	820	1700	2100	2100	2400	5800
Selenium	149	5%	142	0.225	0.4	0.4	0.69	0.4	2.6	7	0.47	0.5	1	0.86	1.1	1.3
Silver	149	30%	104	0.041	0.11	0.11	0.21	0.11	1	45	0.049	0.11	0.12	0.12	0.13	0.2

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

Chemical	Galleria North of ROW Sub-Area															
	Total Count	Detect Freq.	Censored (Non-Detect) Data							Detected Data <sup>(1)</sup>						
			Count	Min	Q1	Median	Mean	Q3	Max	Count	Min	Q1	Median	Mean	Q3	Max
Sodium	149	100%	0	--	--	--	--	--	--	149	92.7	190	440	530	770	2700
Strontium	149	100%	0	--	--	--	--	--	--	149	120	200	270	430	360	6200
Thallium	149	1%	147	0.105	0.75	0.75	0.78	0.75	3.75	2	0.94	--	1.3	1.3	--	1.6
Tin	149	10%	134	0.5	0.75	0.75	0.81	0.75	3.75	15	0.79	0.85	1	1.1	1.4	1.7
Titanium	149	100%	0	--	--	--	--	--	--	149	129	440	610	600	740	1030
Tungsten	149	12%	131	0.185	1.3	1.3	1.4	1.3	6.25	18	1.3	1.5	1.9	2.2	2.2	8.5
Uranium	149	100%	0	--	--	--	--	--	--	149	0.53	0.78	0.92	1.3	1.2	9.5
Vanadium	149	100%	0	--	--	--	--	--	--	149	13.3	40	48	48	55	188
Zinc	149	98%	3	19.2	19	48	38	48	48	146	28	41	46	47	53	85.3
Radium-226	140	81%	27	--	--	--	--	--	--	113	0	0.75	1	1	1.3	2.84
Radium-228	140	89%	15	--	--	--	--	--	--	125	0.35	1	1.4	1.4	1.7	2.88
Thorium-228	140	99%	1	--	--	--	--	--	--	139	0.00019	1.2	1.5	1.6	1.8	5.12
Thorium-230	140	95%	7	--	--	--	--	--	--	133	0.416	0.96	1.2	1.2	1.4	3.1
Thorium-232	140	100%	0	--	--	--	--	--	--	140	0.545	1.3	1.5	1.5	1.7	4.61
Uranium-233/234	140	91%	12	--	--	--	--	--	--	128	0.273	0.79	1.0	1	1.2	2.21
Uranium-235/236	140	11%	124	--	--	--	--	--	--	16	-0.0761	0.041	0.086	0.11	0.14	1
Uranium-238	140	89%	16	--	--	--	--	--	--	124	0.301	0.73	0.9	0.95	1.1	2.31

Note: Background comparison t-tests were performed using one-half the detection limit for metals and using GISdT<sup>®</sup> (Neptune and Company 2009). The non-parametric Gehan, quantile and slippage tests make no adjustment for detection limits, since their algorithms account for non-detects through Gehan ranking.

Max = Maximum

Min = Minimum

Q1 = 1st quartile (25th percentile)

Q3 = 3rd quartile (75th percentile)

(1) Range of detections include estimated values of detect results between the detection limit and reporting limit. As such some minimum detected concentrations may be below the minimum reporting limit. In these cases the respective sample results are flagged in the dataset.

**BOLD with Highlight indicates Site concentrations are greater than background.**

WRS = Wilcoxon Rank Sum Test with the Gehan Modification.

N/A = Not applicable.

**TABLE 5-1**  
**BACKGROUND COMPARISON SUMMARY**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 3 of 6)

Chemical	Shallow Qal McCullough Background															
	Total Count	Detect Freq.	Censored (Non-Detect) Data							Detected Data <sup>(1)</sup>						
			Count	Min	Q1	Median	Mean	Q3	Max	Count	Min	Q1	Median	Mean	Q3	Max
Aluminum	95	100%	0	--	--	--	--	--	--	95	3740	6700	8400	9000	11000	15300
Antimony	95	45%	52	0.3298	0.33	0.33	0.33	0.33	0.3298	43	0.12	0.15	0.22	0.24	0.29	0.5
Arsenic	95	100%	0	--	--	--	--	--	--	95	2.5	3.4	4	4.2	5	7.2
Barium	95	100%	0	--	--	--	--	--	--	95	73	140	170	180	220	445
Beryllium	95	100%	0	--	--	--	--	--	--	95	0.16	0.46	0.57	0.59	0.73	0.89
Boron	95	36%	61	3.2	3.2	3.2	3.2	3.2	3.2	34	5.2	5.8	6.8	7.1	8.3	11.6
Cadmium	95	0%	95	0.1291	0.13	0.13	0.13	0.13	0.1291	0	--	--	--	--	--	--
Calcium	95	100%	0	--	--	--	--	--	--	95	9440	18000	25000	29000	37000	82800
Chromium	95	100%	0	--	--	--	--	--	--	95	2.6	6.8	9	9.1	11	16.7
Chromium (VI)	95	0%	95	0.25	0.25	0.26	0.26	0.26	0.32	0	--	--	--	--	--	--
Cobalt	95	100%	0	--	--	--	--	--	--	95	3.7	7.3	9	8.8	10	16.3
Copper	95	100%	0	--	--	--	--	--	--	95	10.2	15	18	18	20	25.9
Iron	95	100%	0	--	--	--	--	--	--	95	5410	11000	13000	13000	16000	19700
Lead	95	100%	0	--	--	--	--	--	--	95	3	6	7.2	8.2	9.3	35.1
Lithium	95	100%	0	--	--	--	--	--	--	95	7.5	11	13	14	17	26.5
Magnesium	95	100%	0	--	--	--	--	--	--	95	4690	8500	10000	10000	13000	17500
Manganese	95	100%	0	--	--	--	--	--	--	95	151	320	410	410	500	863
Mercury	95	77%	22	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	73	0.0084	0.012	0.018	0.023	0.028	0.11
Molybdenum	95	100%	0	--	--	--	--	--	--	95	0.3	0.41	0.49	0.55	0.61	2
Nickel	95	100%	0	--	--	--	--	--	--	95	7.9	14	16	16	19	30
Potassium	95	100%	0	--	--	--	--	--	--	95	625	1200	1600	1800	2200	3890
Selenium	95	35%	62	0.1579	0.16	0.16	0.16	0.16	0.1579	33	0.23	0.28	0.31	0.33	0.36	0.6
Silver	95	0%	95	0.2609	0.26	0.26	0.26	0.26	0.2609	0	--	--	--	--	--	--

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

Chemical	Shallow Qal McCullough Background															
	Total Count	Detect Freq.	Censored (Non-Detect) Data							Detected Data <sup>(1)</sup>						
			Count	Min	Q1	Median	Mean	Q3	Max	Count	Min	Q1	Median	Mean	Q3	Max
Sodium	95	100%	0	--	--	--	--	--	--	95	128	210	490	500	690	1320
Strontium	95	100%	0	--	--	--	--	--	--	95	75.5	140	190	230	270	808
Thallium	95	22%	74	0.5428	0.54	0.54	0.54	0.54	0.5428	21	1.1	1.2	1.4	1.4	1.7	1.8
Tin	95	100%	0	--	--	--	--	--	--	95	0.24	0.41	0.51	0.5	0.57	0.8
Titanium	95	100%	0	--	--	--	--	--	--	95	262	460	540	560	660	1010
Tungsten	95	0%	95	0.0175	0.018	0.018	0.018	0.018	0.0175	0	--	--	--	--	--	--
Uranium	94	100%	0	--	--	--	--	--	--	94	0.62	0.84	0.97	1	1.1	2.7
Vanadium	95	100%	0	--	--	--	--	--	--	95	20.2	34	38	39	45	59.1
Zinc	95	100%	0	--	--	--	--	--	--	95	15.4	30	38	38	43	121
Radium-226	95	96%	4	--	--	--	--	--	--	91	0.494	0.95	1.1	1.1	1.3	2.36
Radium-228	81	80%	16	--	--	--	--	--	--	65	0.946	1.6	1.9	1.9	2.2	2.92
Thorium-228	95	100%	0	--	--	--	--	--	--	95	1.15	1.5	1.8	1.7	1.9	2.28
Thorium-230	95	100%	0	--	--	--	--	--	--	95	0.73	1	1.2	1.3	1.5	3.01
Thorium-232	95	100%	0	--	--	--	--	--	--	95	1.22	1.4	1.7	1.7	1.9	2.23
Uranium-233/234	95	47%	50	--	--	--	--	--	--	45	0.63	0.9	1.1	1.2	1.2	2.84
Uranium-235/236	95	44%	53	--	--	--	--	--	--	42	0.0009	0.045	0.06	0.07	0.092	0.21
Uranium-238	95	100%	0	--	--	--	--	--	--	95	0.65	0.94	1.1	1.2	1.4	2.37

Note: Background comparison t-tests were performed using one-half the detection limit for metals and using GiSDT (Neptune and Company 2009). The non-parametric Gehan, quantile and slippage tests make no adjustment for detection limits, since their algorithms account for non-detects through Gehan ranking.

Max = Maximum

Min = Minimum

Q1 = 1st quartile (25th percentile)

Q3 = 3rd quartile (75th percentile)

(1) Range of detections include estimated values of detect results between the detection limit and reporting limit. As such some minimum detected concentrations may be below the minimum reporting limit. In these cases the respective sample results are flagged in the dataset.

**BOLD with Highlight indicates Site concentrations are greater than background.**

WRS = Wilcoxon Rank Sum Test with the Gehan Modification.

N/A = Not applicable.

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

Chemical	T Test <i>p</i>	Quantile Test <i>p</i>	Slippage Test <i>p</i>	WRS Test <i>p</i>	Greater than Background?	Units	Basis
Aluminum	3.1 E-3	6.1 E-1	1.0 E+0	1.0 E-3	YES	mg/kg	Multiple tests
Antimony	6.0 E-5	8.0 E-1	1.0 E+0	5.8 E-1	NO	mg/kg	Multiple tests; ND at Site
Arsenic	6.0 E-16	6.2 E-8	3.0 E-5	0.0 E+0	YES	mg/kg	Multiple tests
Barium	3.2 E-44	1.8 E-16	4.1 E-17	0.0 E+0	YES	mg/kg	Multiple tests
Beryllium	9.3 E-1	1.0 E+0	8.3 E-2	4.6 E-1	NO	mg/kg	Multiple tests
Boron	1.2 E-22	1.0 E+0	4.6 E-4	0.0 E+0	YES	mg/kg	Multiple tests
Cadmium	3.3 E-27	3.1 E-15	NA	2.3 E-3	YES	mg/kg	Multiple tests
Calcium	1.3 E-1	9.2 E-1	1.1 E-2	3.9 E-1	YES	mg/kg	Slippage test
Chromium	1.5 E-25	1.2 E-14	2.5 E-14	0.0 E+0	YES	mg/kg	Multiple tests
Chromium (VI)	1.4 E-1	1.8 E-16	NA	1.0 E+0	YES	mg/kg	Quantile test
Cobalt	7.4 E-1	9.8 E-1	1.0 E+0	8.0 E-1	NO	mg/kg	Multiple tests
Copper	2.2 E-2	9.8 E-2	1.1 E-2	3.5 E-2	YES	mg/kg	Multiple tests
Iron	6.5 E-11	1.5 E-7	3.0 E-5	1.7 E-10	YES	mg/kg	Multiple tests
Lead	9.0 E-20	7.6 E-12	9.1 E-5	0.0 E+0	YES	mg/kg	Multiple tests
Lithium	1.6 E-6	5.4 E-2	1.1 E-2	1.9 E-9	YES	mg/kg	Multiple tests
Magnesium	2.3 E-1	1.0 E+0	1.8 E-2	8.6 E-1	YES	mg/kg	Slippage test
Manganese	5.3 E-10	5.7 E-7	2.3 E-1	5.6 E-11	YES	mg/kg	Multiple tests
Mercury	9.7 E-1	1.0 E+0	1.0 E+0	2.7 E-9	YES	mg/kg	WRS test
Molybdenum	6.1 E-8	1.0 E-3	1.9 E-1	1.1 E-16	YES	mg/kg	Multiple tests
Nickel	8.4 E-1	8.7 E-1	1.0 E+0	8.4 E-1	NO	mg/kg	Multiple tests
Potassium	6.3 E-5	4.5 E-2	1.4 E-1	2.8 E-6	YES	mg/kg	Multiple tests
Selenium	1.2 E-9	1.0 E+0	9.9 E-2	0.0 E+0	YES	mg/kg	Multiple tests
Silver	9.9 E-1	2.9 E-9	NA	1.0 E+0	YES	mg/kg	Quantile test

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

Chemical	T Test <i>p</i>	Quantile Test <i>p</i>	Slippage Test <i>p</i>	WRS Test <i>p</i>	Greater than Background?	Units	Basis
Sodium	2.5 E-1	5.4 E-2	1.4 E-1	5.3 E-1	NO	mg/kg	Multiple tests
<b>Strontium</b>	1.2 E-3	6.8 E-2	3.0 E-2	2.2 E-7	YES	mg/kg	Multiple tests
Thallium	9.9 E-1	9.9 E-1	1.0 E+0	2.8 E-11	NO	mg/kg	Multiple tests; only (2 out of 149) detects at Site, both below max. background
<b>Tin</b>	7.9 E-1	1.0 E+0	8.0 E-4	0.0 E+0	YES	mg/kg	Multiple tests
<b>Titanium</b>	4.3 E-2	6.0 E-5	6.1 E-1	4.4 E-2	YES	mg/kg	Quantile test
<b>Tungsten</b>	6.8 E-26	5.4 E-9	NA	0.0 E+0	YES	mg/kg	Multiple tests
<b>Uranium</b>	1.2 E-2	3.5 E-2	1.9 E-2	7.3 E-1	YES	mg/kg	Multiple tests
<b>Vanadium</b>	1.5 E-8	2.6 E-7	5.8 E-6	2.9 E-10	YES	mg/kg	Multiple tests
<b>Zinc</b>	3.2 E-8	3.6 E-5	1.0 E+0	2.0 E-12	YES	mg/kg	Multiple tests
Radium-226	9.9 E-1	5.6 E-1	3.5 E-1	9.8 E-1	NO	pCi/g	Multiple tests
Radium-228	1.0 E+0	1.0 E+0	1.0 E+0	1.0 E+0	NO	pCi/g	Multiple tests
Thorium-228	1.0 E+0	1.0 E+0	2.5 E-2	1.0 E+0	NO	pCi/g	Multiple tests
Thorium-230	9.8 E-1	7.9 E-1	6.0 E-1	9.7 E-1	NO	pCi/g	Multiple tests
Thorium-232	1.0 E+0	1.0 E+0	7.3 E-2	1.0 E+0	NO	pCi/g	Multiple tests
Uranium-233/234	1.0 E+0	7.4 E-1	1.0 E+0	1.0 E+0	NO	pCi/g	Multiple tests
Uranium-235/236	2.2 E-3	4.6 E-5	1.7 E-4	2.5 E-2	NO	pCi/g	All other radionuclides are not greater than background and are in secular equilibrium; all results near noise level of instrument
Uranium-238	1.0 E+0	1.0 E+0	1.0 E+0	1.0 E+0	NO	pCi/g	Multiple tests

Note: Background comparison t-tests were performed using one-half the detection limit for metals and using GiSdT (Neptune and Company 2009). The non-parametric Gehan, quantile and slippage tests make no adjustment for detection limits, since their algorithms account for non-detects through Gehan ranking.

Max = Maximum

Min = Minimum

Q1 = 1st quartile (25th percentile)

Q3 = 3rd quartile (75th percentile)

(1) Range of detections include estimated values of detect results between the detection limit and reporting limit. As such some minimum detected concentrations may be below the minimum reporting limit. In these cases the respective sample results are flagged in the dataset.

**BOLD with Highlight indicates Site concentrations are greater than background.**

WRS = Wilcoxon Rank Sum Test with the Gehan Modification.

N/A = Not applicable.

**TABLE 5-5**  
**RESULTS OF COMPARISON TO RESIDENTIAL SOIL BCLs**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 8)

Chemical	Units	Number of Detects	Total Count	Detect Freq.	Max. Detect	Greater than Background?	Residential Soil BCL	1/10th Residential Soil BCL	Max. Detect Greater than 1/10th Residential BCL
<i>Aldehydes</i>									
Acetaldehyde	mg/kg	16	134	12%	0.695	--	13.9	1.39	NO
Formaldehyde	mg/kg	86	134	64%	0.613	--	12200	1220	NO
<i>Asbestos</i>									
Asbestos	Structures	1	58	2%	2	--	--	--	--
<i>Dioxins / Furans</i>									
1,2,3,4,6,7,8-Heptachlorodibenzofuran	mg/kg	55	77	71%	210	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	40	77	52%	31	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran	mg/kg	46	77	60%	69	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran	mg/kg	48	77	62%	87	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	0	77	0%	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran	mg/kg	44	77	57%	66	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	18	77	23%	5.8	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran	mg/kg	28	77	36%	8.9	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	15	77	19%	5.1	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran	mg/kg	44	77	57%	51	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	mg/kg	6	77	8%	3.8	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran	mg/kg	34	77	44%	18	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran	mg/kg	40	77	52%	27	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran	mg/kg	60	77	78%	66	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin	mg/kg	19	77	25%	1.3	--	--	--	--
Octachlorodibenzodioxin	mg/kg	35	77	45%	120	--	--	--	--
Octachlorodibenzofuran	mg/kg	57	77	74%	760	--	--	--	--
TCDD TEQ	ppt	77	77	--(4)	42.6	--	50	--	--
<i>General Chemistry/Ions</i>									
Ammonia (as N)	mg/kg	6	134	4%	6.6	--	--	--	--
Bromide	mg/kg	43	134	32%	3.9	--	26600	2660	NO
Chlorate	mg/kg	23	134	17%	12.1	--	2350	235	NO
Chloride	mg/kg	134	134	100%	2070	--	--	--	--
Cyanide, Total	mg/kg	45	134	34%	2.6	--	1220	122	NO
Fluoride	mg/kg	99	134	74%	2.1	--	3670	367	NO
Nitrate	mg/kg	133	134	99%	202	--	100000	10000	NO
Nitrite	mg/kg	23	134	17%	0.55	--	7820	782	NO
Orthophosphate as P	mg/kg	34	134	25%	6	--	--	--	--
Perchlorate	mg/kg	116	133	87%	6.36	--	54.8	5.48	YES
Sulfate	mg/kg	129	134	96%	18400	--	--	--	--
Sulfide	mg/kg	1	134	1%	649	--	--	--	--
Total Kjeldahl Nitrogen (TKN)	mg/kg	127	134	95%	1060	--	--	--	--

**TABLE 5-5**  
**RESULTS OF COMPARISON TO RESIDENTIAL SOIL BCLs**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 2 of 8)

Chemical	Units	Number of Detects	Total Count	Detect Freq.	Max. Detect	Greater than Background?	Residential Soil BCL	1/10th Residential Soil BCL	Max. Detect Greater than 1/10th Residential BCL
<i>Metals</i>									
Aluminum	mg/kg	149	149	100%	14600	YES	77200	7720	YES
Antimony	mg/kg	0	149	0%	--	NO	31.3	3.13	--
Arsenic	mg/kg	149	149	100%	22	YES	0.39	0.039	YES
Barium	mg/kg	149	149	100%	1270	YES	15300	1530	NO
Beryllium	mg/kg	132	149	89%	1.1	NO	155	15.5	--
Boron	mg/kg	3	149	2%	33	YES	15600	1560	NO
Cadmium	mg/kg	75	149	50%	0.37	YES	38.9	3.89	NO
Calcium	mg/kg	149	149	100%	215000	YES	--	--	--
Chromium	mg/kg	146	149	98%	42.9	YES	100000	10000	NO
Chromium (VI)	mg/kg	64	149	43%	0.59	YES	234	23.4	NO
Cobalt	mg/kg	149	149	100%	14.4	NO	23.4	2.34	--
Copper	mg/kg	148	149	99%	63.7	YES	2910	291	NO
Iron	mg/kg	149	149	100%	24100	YES	54800	5480	YES
Lead	mg/kg	148	149	99%	74.3	YES	400	--	--
Lithium	mg/kg	149	149	100%	76	YES	156	15.6	YES
Magnesium	mg/kg	149	149	100%	48000	YES	100000	10000	YES
Manganese	mg/kg	149	149	100%	1820	YES	1820	182	YES
Mercury	mg/kg	15	148	10%	0.0529	YES	23.5	2.35	NO
Molybdenum	mg/kg	105	149	70%	2.6	YES	391	39.1	NO
Nickel	mg/kg	149	149	100%	24.1	NO	1540	154	--
Potassium	mg/kg	149	149	100%	5800	YES	--	--	--
Selenium	mg/kg	7	149	5%	1.3	YES	391	39.1	NO
Silver	mg/kg	45	149	30%	0.2	YES	391	39.1	NO
Sodium	mg/kg	149	149	100%	2700	NO	--	--	--
Strontium	mg/kg	149	149	100%	6200	YES	46900	4690	YES
Thallium	mg/kg	2	149	1%	1.6	NO	5.48	0.548	--
Tin	mg/kg	15	149	10%	1.7	YES	46900	4690	NO
Titanium	mg/kg	149	149	100%	1030	YES	100000	10000	NO
Tungsten	mg/kg	18	149	12%	8.5	YES	587	58.7	NO
Uranium	mg/kg	149	149	100%	9.5	YES	234	23.4	NO
Vanadium	mg/kg	149	149	100%	188	YES	391	39.1	YES
Zinc	mg/kg	146	149	98%	85.3	YES	23500	2350	NO
<i>Organochlorine Pesticides</i>									
2,4-DDD	mg/kg	14	134	10%	0.0059	--	--	--	--
2,4-DDE	mg/kg	49	134	37%	0.033	--	--	--	--
4,4-DDD	mg/kg	7	134	5%	0.017	--	2.44	0.244	NO
4,4-DDE	mg/kg	57	133	43%	0.092	--	1.72	0.172	NO

**TABLE 5-5**  
**RESULTS OF COMPARISON TO RESIDENTIAL SOIL BCLs**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Units	Number of Detects	Total Count	Detect Freq.	Max. Detect	Greater than Background?	Residential Soil BCL	1/10th Residential Soil BCL	Max. Detect Greater than 1/10th Residential BCL
4,4-DDT	mg/kg	47	134	35%	0.045	--	1.72	0.172	NO
Aldrin	mg/kg	0	134	0%	--	--	0.0286	0.00286	--
alpha-BHC	mg/kg	4	134	3%	0.0029	--	21.1	2.11	NO
alpha-Chlordane	mg/kg	0	134	0%	--	--	--	--	--
beta-BHC	mg/kg	45	134	34%	0.027	--	4.22	0.422	NO
Chlordane	mg/kg	0	134	0%	--	--	1.62	0.162	--
delta-BHC	mg/kg	0	134	0%	--	--	21.1	2.11	--
Dieldrin	mg/kg	0	134	0%	--	--	0.0304	0.00304	--
Endosulfan I	mg/kg	0	134	0%	--	--	367	36.7	--
Endosulfan II	mg/kg	0	134	0%	--	--	367	36.7	--
Endosulfan sulfate	mg/kg	0	134	0%	--	--	--	--	--
Endrin	mg/kg	0	134	0%	--	--	18.3	1.83	--
Endrin aldehyde	mg/kg	2	134	1%	0.0026	--	--	--	--
Endrin ketone	mg/kg	0	134	0%	--	--	--	--	--
gamma-BHC (Lindane)	mg/kg	0	134	0%	--	--	0.703	0.0703	--
gamma-Chlordane	mg/kg	0	134	0%	--	--	--	--	--
Heptachlor	mg/kg	0	134	0%	--	--	0.108	0.0108	--
Heptachlor epoxide	mg/kg	0	134	0%	--	--	0.0534	0.00534	--
Methoxychlor	mg/kg	6	134	4%	0.013	--	306	30.6	NO
Toxaphene	mg/kg	0	134	0%	--	--	0.442	0.0442	--
<i>Polynuclear Aromatic Hydrocarbons</i>									
Acenaphthene	mg/kg	0	134	0%	--	--	509	50.9	--
Acenaphthylene	mg/kg	0	134	0%	--	--	147	14.7	--
Anthracene	mg/kg	4	134	3%	0.00451	--	2000	200	NO
Benzo(a)anthracene	mg/kg	10	134	7%	0.00457	--	0.621	0.0621	NO
Benzo(a)pyrene	mg/kg	20	134	15%	0.0121	--	0.0621	0.00621	YES
Benzo(b)fluoranthene	mg/kg	41	134	31%	0.0256	--	0.621	0.0621	NO
Benzo(g,h,i)perylene	mg/kg	17	134	13%	0.0163	--	2350	235	NO
Benzo(k)fluoranthene	mg/kg	7	134	5%	0.00548	--	6.21	0.621	NO
Chrysene	mg/kg	16	134	12%	0.0296	--	62.1	6.21	NO
Dibenzo(a,h)anthracene	mg/kg	11	134	8%	0.0181	--	0.0621	0.00621	YES
Indeno(1,2,3-cd)pyrene	mg/kg	9	134	7%	0.0061	--	0.621	0.0621	NO
Phenanthrene	mg/kg	10	134	7%	0.00545	--	24.5	2.45	NO
Pyrene	mg/kg	34	134	25%	0.00778	--	1890	189	NO
<i>Polychlorinated Biphenyls</i>									
PCB 105	mg/kg	35	70	50%	710	--	--	--	--
PCB 114	mg/kg	34	70	49%	63	--	--	--	--
PCB 118	mg/kg	43	70	61%	1100	--	--	--	--

**TABLE 5-5**  
**RESULTS OF COMPARISON TO RESIDENTIAL SOIL BCLs**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Units	Number of Detects	Total Count	Detect Freq.	Max. Detect	Greater than Background?	Residential Soil BCL	1/10th Residential Soil BCL	Max. Detect Greater than 1/10th Residential BCL
PCB 123	mg/kg	1	70	1%	2.4	--	--	--	--
PCB 126	mg/kg	21	70	30%	17	--	--	--	--
PCB 156	mg/kg	29	70	41%	130	--	--	--	--
PCB 157	mg/kg	26	70	37%	32	--	--	--	--
PCB 167	mg/kg	24	70	34%	54	--	--	--	--
PCB 169	mg/kg	4	70	6%	2.3	--	--	--	--
PCB 189	mg/kg	22	70	31%	19	--	--	--	--
PCB 209	mg/kg	59	70	84%	6200	--	--	--	--
PCB 77	mg/kg	0	70	0%	--	--	--	--	--
PCB 81	mg/kg	0	70	0%	--	--	--	--	--
<i>Radionuclides</i>									
Radium-226	pCi/g	113	140	81%	2.84	NO	0.0071	0.00071	--
Radium-228	pCi/g	125	140	89%	2.88	NO	0.013	0.0013	--
Thorium-228	pCi/g	139	140	99%	5.12	NO	0.0078	0.00078	--
Thorium-230	pCi/g	133	140	95%	3.1	NO	3.2	0.32	--
Thorium-232	pCi/g	140	140	100%	4.61	NO	2.8	0.28	--
Uranium-233/234	pCi/g	128	140	91%	2.21	NO	4.2	0.42	--
Uranium-235/236	pCi/g	16	140	11%	1	NO	0.11	0.011	--
Uranium-238	pCi/g	124	140	89%	2.31	NO	0.46	0.046	--
<i>Semi-Volatile Organic Compounds</i>									
1,2,4,5-Tetrachlorobenzene	mg/kg	0	132	0%	--	--	18.3	1.83	--
1,2-Diphenylhydrazine	mg/kg	0	132	0%	--	--	0.608	0.0608	--
1,4-Dioxane	mg/kg	0	132	0%	--	--	4.86	0.486	--
2,2'-Dichlorobenzil	mg/kg	0	132	0%	--	--	23.5	2.35	--
2,4,5-Trichlorophenol	mg/kg	0	132	0%	--	--	6110	611	--
2,4,6-Trichlorophenol	mg/kg	0	132	0%	--	--	44.2	4.42	--
2,4-Dichlorophenol	mg/kg	0	132	0%	--	--	183	18.3	--
2,4-Dimethylphenol	mg/kg	0	132	0%	--	--	1220	122	--
2,4-Dinitrophenol	mg/kg	0	132	0%	--	--	122	12.2	--
2,4-Dinitrotoluene	mg/kg	0	132	0%	--	--	1.57	0.157	--
2,6-Dinitrotoluene	mg/kg	0	132	0%	--	--	61.1	6.11	--
2-Chloronaphthalene	mg/kg	0	132	0%	--	--	82.6	8.26	--
2-Chlorophenol	mg/kg	0	132	0%	--	--	220	22	--
2-Methylnaphthalene	mg/kg	1	132	1%	0.0109	--	--	--	--
2-Nitroaniline	mg/kg	0	132	0%	--	--	183	18.3	--
2-Nitrophenol	mg/kg	0	132	0%	--	--	--	--	--
3,3-Dichlorobenzidine	mg/kg	0	132	0%	--	--	1.08	0.108	--
3-Nitroaniline	mg/kg	0	132	0%	--	--	--	--	--

**TABLE 5-5**  
**RESULTS OF COMPARISON TO RESIDENTIAL SOIL BCLs**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Units	Number of Detects	Total Count	Detect Freq.	Max. Detect	Greater than Background?	Residential Soil BCL	1/10th Residential Soil BCL	Max. Detect Greater than 1/10th Residential BCL
4-Bromophenyl phenyl ether	mg/kg	0	132	0%	--	--	--	--	--
4-Chloro-3-methylphenol	mg/kg	0	132	0%	--	--	--	--	--
4-Chlorophenyl phenyl ether	mg/kg	0	132	0%	--	--	--	--	--
4-Chlorothioanisole	mg/kg	0	132	0%	--	--	--	--	--
4-Nitroaniline	mg/kg	0	132	0%	--	--	--	--	--
4-Nitrophenol	mg/kg	0	132	0%	--	--	489	48.9	--
Acetophenone	mg/kg	0	132	0%	--	--	1740	174	--
Aniline	mg/kg	0	132	0%	--	--	85.3	8.53	--
Benzenethiol	mg/kg	0	132	0%	--	--	--	--	--
Benzoic acid	mg/kg	0	132	0%	--	--	100000	10000	--
Benzyl alcohol	mg/kg	0	132	0%	--	--	30600	3060	--
bis(2-Chloroethoxy)methane	mg/kg	0	132	0%	--	--	--	--	--
bis(2-Chloroethyl) ether	mg/kg	0	132	0%	--	--	0.244	0.0244	--
bis(2-Chloroisopropyl) ether	mg/kg	0	132	0%	--	--	3.37	0.337	--
bis(2-Ethylhexyl) phthalate	mg/kg	1	132	1%	0.0747	--	34.7	3.47	NO
bis(p-Chlorophenyl) sulfone	mg/kg	0	132	0%	--	--	--	--	--
bis(p-Chlorophenyl)disulfide	mg/kg	0	132	0%	--	--	--	--	--
Butylbenzyl phthalate	mg/kg	0	132	0%	--	--	240	24	--
Carbazole	mg/kg	1	132	1%	0.011	--	24.3	2.43	NO
Dibenzofuran	mg/kg	0	132	0%	--	--	156	15.6	--
Dichloromethyl ether	mg/kg	0	132	0%	--	--	0.000242	0.000242	--
Diethyl phthalate	mg/kg	1	132	1%	0.138	--	48900	4890	NO
Dimethyl phthalate	mg/kg	0	132	0%	--	--	100000	10000	--
Di-n-butyl phthalate	mg/kg	0	132	0%	--	--	6110	611	--
Di-n-octyl phthalate	mg/kg	0	132	0%	--	--	--	--	--
Diphenyl disulfide	mg/kg	0	132	0%	--	--	--	--	--
Diphenyl sulfide	mg/kg	0	132	0%	--	--	--	--	--
Diphenyl sulfone	mg/kg	0	132	0%	--	--	183	18.3	--
Diphenylamine	mg/kg	0	132	0%	--	--	1530	153	--
Fluoranthene	mg/kg	2	132	2%	0.0117	--	2290	229	NO
Fluorene	mg/kg	0	132	0%	--	--	671	67.1	--
Hexachlorobenzene	mg/kg	0	132	0%	--	--	0.304	0.0304	--
Hexachlorobutadiene	mg/kg	0	132	0%	--	--	6.24	0.624	--
Hexachlorocyclopentadiene	mg/kg	0	132	0%	--	--	366	36.6	--
Hexachloroethane	mg/kg	0	132	0%	--	--	34.7	3.47	--
Hydroxymethyl phthalimide	mg/kg	0	132	0%	--	--	--	--	--
Isophorone	mg/kg	0	132	0%	--	--	512	51.2	--
m,p-Cresols	mg/kg	0	132	0%	--	--	306	30.6	--

**TABLE 5-5**  
**RESULTS OF COMPARISON TO RESIDENTIAL SOIL BCLs**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Units	Number of Detects	Total Count	Detect Freq.	Max. Detect	Greater than Background?	Residential Soil BCL	1/10th Residential Soil BCL	Max. Detect Greater than 1/10th Residential BCL
Naphthalene	mg/kg	1	132	1%	0.0114	--	3.1	0.31	NO
Nitrobenzene	mg/kg	0	132	0%	--	--	2.69	0.269	--
N-nitrosodi-n-propylamine	mg/kg	0	132	0%	--	--	0.0695	0.00695	--
o-Cresol	mg/kg	0	132	0%	--	--	3060	306	--
Octachlorostyrene	mg/kg	0	132	0%	--	--	--	--	--
p-Chloroaniline	mg/kg	0	132	0%	--	--	2.43	0.243	--
p-Chlorobenzenethiol	mg/kg	0	132	0%	--	--	--	--	--
Pentachlorobenzene	mg/kg	0	132	0%	--	--	48.9	4.89	--
Pentachlorophenol	mg/kg	0	132	0%	--	--	0.894	0.0894	--
Phenol	mg/kg	0	132	0%	--	--	18300	1830	--
Phthalic acid	mg/kg	0	132	0%	--	--	100000	10000	--
Pyridine	mg/kg	0	132	0%	--	--	60.5	6.05	--
<i>Volatile Organic Compounds</i>									
1,1,1,2-Tetrachloroethane	mg/kg	0	134	0%	--	--	3.69	0.369	--
1,1,1-Trichloroethane	mg/kg	0	134	0%	--	--	1390	139	--
1,1,2,2-Tetrachloroethane	mg/kg	0	134	0%	--	--	0.472	0.0472	--
1,1,2-Trichloroethane	mg/kg	0	134	0%	--	--	1.05	0.105	--
1,1-Dichloroethane	mg/kg	0	134	0%	--	--	4.19	0.419	--
1,1-Dichloroethene	mg/kg	0	134	0%	--	--	285	28.5	--
1,1-Dichloropropene	mg/kg	0	134	0%	--	--	--	--	--
1,2,3-Trichlorobenzene	mg/kg	0	134	0%	--	--	--	--	--
1,2,3-Trichloropropane	mg/kg	0	134	0%	--	--	0.0213	0.00213	--
1,2,4-Trichlorobenzene	mg/kg	0	134	0%	--	--	22.1	2.21	--
1,2,4-Trimethylbenzene	mg/kg	15	134	11%	0.0014	--	144	14.4	NO
1,2-Dichlorobenzene	mg/kg	12	134	9%	0.00022	--	373	37.3	NO
1,2-Dichloroethane	mg/kg	0	134	0%	--	--	0.433	0.0433	--
1,2-Dichloroethene	mg/kg	0	134	0%	--	--	--	--	--
1,2-Dichloropropane	mg/kg	0	134	0%	--	--	0.82	0.082	--
1,3,5-Trichlorobenzene	mg/kg	0	134	0%	--	--	--	--	--
1,3,5-Trimethylbenzene	mg/kg	9	134	7%	0.00014	--	57.9	5.79	NO
1,3-Dichlorobenzene	mg/kg	12	134	9%	0.00022	--	214	21.4	NO
1,3-Dichloropropane	mg/kg	0	134	0%	--	--	15.2	1.52	--
1,4-Dichlorobenzene	mg/kg	12	134	9%	0.00031	--	2.59	0.259	NO
2,2,3-Trimethylbutane	mg/kg	0	134	0%	--	--	--	--	--
2,2-Dichloropropane	mg/kg	0	134	0%	--	--	--	--	--
2,2-Dimethylpentane	mg/kg	0	134	0%	--	--	--	--	--
2,3-Dimethylpentane	mg/kg	0	134	0%	--	--	--	--	--
2,4-Dimethylpentane	mg/kg	0	134	0%	--	--	--	--	--

**TABLE 5-5**  
**RESULTS OF COMPARISON TO RESIDENTIAL SOIL BCLs**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Units	Number of Detects	Total Count	Detect Freq.	Max. Detect	Greater than Background?	Residential Soil BCL	1/10th Residential Soil BCL	Max. Detect Greater than 1/10th Residential BCL
2-Chlorotoluene	mg/kg	0	134	0%	--	--	248	24.8	--
2-Hexanone	mg/kg	0	134	0%	--	--	460	46	--
2-Methylhexane	mg/kg	0	134	0%	--	--	--	--	--
2-Nitropropane	mg/kg	0	134	0%	--	--	0.011	0.0011	--
3,3-Dimethylpentane	mg/kg	0	134	0%	--	--	--	--	--
3-Ethylpentane	mg/kg	0	134	0%	--	--	--	--	--
3-Methylhexane	mg/kg	0	134	0%	--	--	--	--	--
4-Chlorotoluene	mg/kg	0	134	0%	--	--	--	--	--
4-Methyl-2-pentanone (MIBK)	mg/kg	0	134	0%	--	--	5800	580	--
Acetone	mg/kg	4	134	3%	0.02	--	60000	6000	NO
Acetonitrile	mg/kg	0	134	0%	--	--	1470	147	--
Benzene	mg/kg	9	134	7%	0.00021	--	0.81	0.081	NO
Bromobenzene	mg/kg	1	134	1%	0.00023	--	243	24.3	NO
Bromodichloromethane	mg/kg	0	134	0%	--	--	0.648	0.0648	--
Bromoform	mg/kg	0	134	0%	--	--	61.6	6.16	--
Bromomethane	mg/kg	0	134	0%	--	--	8.7	0.87	--
Carbon disulfide	mg/kg	0	134	0%	--	--	721	72.1	--
Carbon tetrachloride	mg/kg	0	134	0%	--	--	0.735	0.0735	--
Chlorobenzene	mg/kg	0	134	0%	--	--	273	27.3	--
Chlorobromomethane	mg/kg	0	134	0%	--	--	--	--	--
Chloroethane	mg/kg	0	134	0%	--	--	221	22.1	--
Chloroform	mg/kg	0	134	0%	--	--	0.306	0.0306	--
Chloromethane	mg/kg	3	134	2%	0.00031	--	1.6	0.16	NO
cis-1,2-Dichloroethene	mg/kg	0	134	0%	--	--	148	14.8	--
cis-1,3-Dichloropropene	mg/kg	0	134	0%	--	--	--	--	--
Cymene (Isopropyltoluene)	mg/kg	0	134	0%	--	--	389	38.9	--
Dibromochloromethane	mg/kg	0	134	0%	--	--	1.12	0.112	--
Dibromochloropropane	mg/kg	0	134	0%	--	--	0.0104	0.00104	--
Dibromomethane	mg/kg	0	134	0%	--	--	43.4	4.34	--
Dichloromethane (Methylene chloride)	mg/kg	37	134	28%	0.019	--	11	1.1	NO
Dimethyldisulfide	mg/kg	0	134	0%	--	--	--	--	--
Ethanol	mg/kg	1	134	1%	1.9	--	10000	1000	NO
Ethylbenzene	mg/kg	16	134	12%	0.00021	--	3.79	0.379	NO
Freon-11 (Trichlorofluoromethane)	mg/kg	0	134	0%	--	--	883	88.3	--
Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane)	mg/kg	0	134	0%	--	--	5550	555	--
Freon-12 (Dichlorodifluoromethane)	mg/kg	0	134	0%	--	--	218	21.8	--
Heptane	mg/kg	0	134	0%	--	--	220	22	--
Isopropylbenzene	mg/kg	7	134	5%	0.00013	--	371	37.1	NO

**TABLE 5-5**  
**RESULTS OF COMPARISON TO RESIDENTIAL SOIL BCLs**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Units	Number of Detects	Total Count	Detect Freq.	Max. Detect	Greater than Background?	Residential Soil BCL	1/10th Residential Soil BCL	Max. Detect Greater than 1/10th Residential BCL
m,p-Xylene	mg/kg	14	134	10%	0.00032	--	214	21.4	NO
Methyl ethyl ketone (2-Butanone)	mg/kg	1	134	1%	0.0024	--	32100	3210	NO
Methyl iodide	mg/kg	0	134	0%	--	--	360	36	--
MTBE (Methyl tert-butyl ether)	mg/kg	0	134	0%	--	--	39.2	3.92	--
n-Butylbenzene	mg/kg	0	134	0%	--	--	237	23.7	--
Nonanal	mg/kg	8	134	6%	0.0061	--	--	--	--
n-Propylbenzene	mg/kg	16	134	12%	0.00017	--	237	23.7	NO
o-Xylene	mg/kg	7	134	5%	0.00013	--	282	28.2	NO
sec-Butylbenzene	mg/kg	8	134	6%	0.00015	--	223	22.3	NO
Styrene	mg/kg	1	134	1%	0.00018	--	1730	173	NO
tert-Butylbenzene	mg/kg	7	134	5%	0.00013	--	393	39.3	NO
Tetrachloroethene	mg/kg	0	134	0%	--	--	0.624	0.0624	--
Toluene	mg/kg	0	134	0%	--	--	521	52.1	--
trans-1,2-Dichloroethene	mg/kg	0	134	0%	--	--	122	12.2	--
trans-1,3-Dichloropropene	mg/kg	1	134	1%	0.00015	--	--	--	--
Trichloroethene	mg/kg	0	134	0%	--	--	1.06	0.106	--
Vinyl acetate	mg/kg	0	134	0%	--	--	988	98.8	--
Vinyl chloride	mg/kg	0	134	0%	--	--	0.349	0.0349	--
Xylenes (total)	mg/kg	12	134	9%	0.0004	--	214	21.4	NO

mg/kg - milligrams per kilogram

pCi/g - picoCuries per gram

ppt - parts per trillion

-- - Not available or not applicable

Chemical with at least one detection was compared to it's respective BCL.

Dioxin/furans and PCB congeners are evaluated as TCDD TEQs. These constituents, as well as lead, are evaluated using a separate process (see text).

Highlight indicates metals exceeding background and other inorganic/organic chemicals exceeding 1/10th residential BCLs.

**TABLE 5-6**  
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPCs)**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 9)

Chemical	Units	Number of Detects	Total Count	Detect Freq.	Min ND	Max ND	Min Detect	Max Detect	Mean	Standard Deviation	Greater than Background?	PBT(1) or Class A Carcinogen?	COPC?	Rationale
<i>Aldehydes</i>														
Acetaldehyde	mg/kg	16	134	12%	0.301	1.04	0.357	0.695	0.21	0.13	--	No	No	(5)(13)
Formaldehyde	mg/kg	86	134	64%	0.201	0.546	0.207	0.613	0.25	0.12	--	No	No	(5)(13)
<i>Asbestos</i>														
Asbestos	Structures	1	58	2%	--	--	2	2	--	--	--	Yes	Yes	(1)
<i>Dioxins / Furans</i>														
1,2,3,4,6,7,8-Heptachlorodibenzofuran	pg/g	55	77	71%	0.15	2.3	2.5	210	44	50	--	Yes	No	(1)(3)
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	pg/g	40	77	52%	0.074	3.1	2.8	31	5.7	7.2	--	Yes	No	(1)(3)
1,2,3,4,7,8,9-Heptachlorodibenzofuran	pg/g	46	77	60%	0.13	2.5	2.9	69	18	20	--	Yes	No	(1)(3)
1,2,3,4,7,8-Hexachlorodibenzofuran	pg/g	48	77	62%	0.087	2.4	2.6	87	21	24	--	Yes	No	(1)(3)
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	pg/g	0	77	0%	0.045	5	--	--	0.52	0.7	--	Yes	No	(1)(3)
1,2,3,6,7,8-Hexachlorodibenzofuran	pg/g	44	77	57%	0.057	2.5	4.1	66	14	17	--	Yes	No	(1)(3)
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	pg/g	18	77	23%	0.037	5	2.5	5.8	1.2	1.5	--	Yes	No	(1)(3)
1,2,3,7,8,9-Hexachlorodibenzofuran	pg/g	28	77	36%	0.041	5	2.9	8.9	1.9	2.3	--	Yes	No	(1)(3)
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	pg/g	15	77	19%	0.032	5	2.6	5.1	1.1	1.4	--	Yes	No	(1)(3)
1,2,3,7,8-Pentachlorodibenzofuran	pg/g	44	77	57%	0.054	2.3	2.7	51	12	14	--	Yes	No	(1)(3)
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	pg/g	6	77	8%	0.043	5	2.7	3.8	0.76	1	--	Yes	No	(1)(3)
2,3,4,6,7,8-Hexachlorodibenzofuran	pg/g	34	77	44%	0.046	5	2.7	18	3.7	4.5	--	Yes	No	(1)(3)
2,3,4,7,8-Pentachlorodibenzofuran	pg/g	40	77	52%	0.053	1.9	3	27	6	7.1	--	Yes	No	(1)(3)
2,3,7,8-Tetrachlorodibenzofuran	pg/g	60	77	78%	0.09	0.45	0.53	66	6.9	9.7	--	Yes	No	(1)(3)
2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/g	19	77	25%	0.031	1	0.52	1.3	0.27	0.29	--	Yes	No	(1)(3)
Octachlorodibenzodioxin	pg/g	35	77	45%	0.15	16	5.2	120	16	26	--	Yes	No	(1)(3)
Octachlorodibenzofuran	pg/g	57	77	74%	0.34	4.7	5.2	760	140	180	--	Yes	No	(1)(3)
TCDD TEQ	pg/g	77	77	--	--	--	0.23	42.6	9.2	10	--	Yes	No	(1)(3)
<i>General Chemistry/Ions</i>														
Ammonia (as N)	mg/kg	6	134	4%	0.79	6.5	0.96	6.6	0.92	1	--	No	No	(4)(15)
Bromide	mg/kg	43	134	32%	0.26	2.7	0.42	3.9	0.6	0.84	--	No	No	(5)(13)
Chlorate	mg/kg	23	134	17%	0.48	0.56	0.85	12.1	0.72	1.5	--	No	No	(5)(13)
Chloride	mg/kg	134	134	100%	--	--	0.33	2070	180	290	--	No	No	(9)
Cyanide, Total	mg/kg	45	134	34%	0.08	0.53	0.088	2.6	0.23	0.33	--	No	No	(5)(13)
Fluoride	mg/kg	99	134	74%	0.1	1.1	0.15	2.1	0.59	0.49	--	No	No	(5)(13)
Nitrate	mg/kg	133	134	99%	0.053	0.053	0.15	202	17	34	--	No	No	(5)(13)
Nitrite	mg/kg	23	134	17%	0.033	0.22	0.064	0.55	0.048	0.089	--	No	No	(5)(13)
Orthophosphate as P	mg/kg	34	134	25%	0.51	6	0.66	6	1.5	1.4	--	No	No	(9)
Perchlorate	mg/kg	116	133	87%	0.01	0.0112	0.0124	6.36	0.61	1.1	--	No	Yes	(5)(14)

**TABLE 5-6**  
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPCs)**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 2 of 9)

Chemical	Units	Number of Detects	Total Count	Detect Freq.	Min ND	Max ND	Min Detect	Max Detect	Mean	Standard Deviation	Greater than Background?	PBT(1) or Class A Carcinogen?	COPC?	Rationale
Sulfate	mg/kg	129	134	96%	5.2	5.7	2.6	18400	610	2100	--	No	No	(9)
Sulfide	mg/kg	1	134	1%	1.8	2.3	649	649	5.8	56	--	No	No	(4)(9)
Total Kjeldahl Nitrogen (TKN)	mg/kg	127	134	95%	50.8	52.1	22	1060	170	160	--	No	No	(9)
<i>Metals</i>														
Aluminum	mg/kg	149	149	100%	--	--	3700	14600	9900	2000	YES	No	Yes	(8)(14)
Antimony	mg/kg	0	149	0%	0.225	2.6	--	--	0.33	0.41	NO	No	No	(2)(6)(13)
Arsenic	mg/kg	149	149	100%	--	--	3.3	22	6	2.2	YES	Yes	Yes	(1)(8)(14)
Barium	mg/kg	149	149	100%	--	--	30	1270	430	160	YES	No	No	(8)(14)
Beryllium	mg/kg	132	149	89%	0.3775	0.53	0.31	1.1	0.56	0.16	NO	No	No	(6)(13)
Boron	mg/kg	3	149	2%	2.99	82.5	18.3	33	10	6.4	YES	No	No	(4)(8)(13)
Cadmium	mg/kg	75	149	50%	0.081	0.5	0.08	0.37	0.12	0.056	YES	No	No	(8)(13)
Calcium	mg/kg	149	149	100%	--	--	10000	215000	32000	30000	YES	No	No	(8)(12)(15)
Chromium	mg/kg	146	149	98%	6.37	15.925	2.6	42.9	15	5.2	YES	No	No	(8)(13)
Chromium (VI)	mg/kg	64	149	43%	0.1	0.42	0.1	0.59	0.14	0.11	YES	Yes	No	(8)(13)
Cobalt	mg/kg	149	149	100%	--	--	1.9	14.4	8.6	1.8	NO	No	No	(6)(14)
Copper	mg/kg	148	149	99%	5	5	6	63.7	19	5.4	YES	No	No	(8)(13)
Iron	mg/kg	149	149	100%	--	--	4010	24100	16000	3500	YES	No	No	(8)(12)
Lead	mg/kg	148	149	99%	2.5	2.5	3.3	74.3	20	13	YES	Yes	No	(11)
Lithium	mg/kg	149	149	100%	--	--	8.3	76	18	9.9	YES	No	Yes	(8)(14)
Magnesium	mg/kg	149	149	100%	--	--	3400	48000	11000	4600	YES	No	No	(8)(12)(15)
Manganese	mg/kg	149	149	100%	--	--	102	1820	540	180	YES	No	Yes	(8)(14)
Mercury	mg/kg	15	148	10%	0.005	0.0431	0.0056	0.0529	0.015	0.007	YES	No	No	(8)(13)
Molybdenum	mg/kg	105	149	70%	0.47	2.6	0.5	2.6	0.78	0.41	YES	No	No	(8)(13)
Nickel	mg/kg	149	149	100%	--	--	6.7	24.1	16	3.1	NO	No	No	(6)(13)
Potassium	mg/kg	149	149	100%	--	--	820	5800	2100	720	YES	No	No	(8)(12)(15)
Selenium	mg/kg	7	149	5%	0.225	2.6	0.47	1.3	0.37	0.37	YES	No	No	(4)(8)(13)
Silver	mg/kg	45	149	30%	0.041	1	0.049	0.2	0.11	0.11	YES	No	No	(8)(13)
Sodium	mg/kg	149	149	100%	--	--	92.7	2700	530	400	NO	No	No	(6)(12)(15)
Strontium	mg/kg	149	149	100%	--	--	120	6200	430	770	YES	No	Yes	(8)(14)
Thallium	mg/kg	2	149	1%	0.105	3.75	0.94	1.6	0.4	0.23	NO	No	No	(6)(14)
Tin	mg/kg	15	149	10%	0.5	3.75	0.79	1.7	0.48	0.3	YES	No	No	(8)(13)
Titanium	mg/kg	149	149	100%	--	--	129	1030	600	190	YES	No	No	(8)(13)
Tungsten	mg/kg	18	149	12%	0.185	6.25	1.3	8.5	0.86	0.82	YES	No	No	(8)(13)
Uranium	mg/kg	149	149	100%	--	--	0.53	9.5	1.3	1.2	YES	No	No	(8)(13)

**TABLE 5-6**  
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPCs)**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Units	Number of Detects	Total Count	Detect Freq.	Min ND	Max ND	Min Detect	Max Detect	Mean	Standard Deviation	Greater than Background?	PBT(1) or Class A Carcinogen?	COPC?	Rationale	
Vanadium	mg/kg	149	149	100%	--	--	13.3	188	48	16	YES	No	Yes	(8)(14)	
Zinc	mg/kg	146	149	98%	19.2	48	28	85.3	47	10	YES	No	No	(8)(13)	
<i>Organochlorine Pesticides</i>															
2,4-DDD	mg/kg	14	134	10%	0.00031	0.00039	0.0017	0.0059	0.0005	0.0011	--	Yes	No	(1)(5)(13)	
2,4-DDE	mg/kg	49	134	37%	0.0002	0.00026	0.002	0.033	0.0036	0.0069	--	Yes	No	(1)(5)(13)	
4,4-DDD	mg/kg	7	134	5%	0.00009	0.00011	0.0025	0.017	0.00046	0.0021	--	Yes	No	(1)(5)(13)	
4,4-DDE	mg/kg	57	133	43%	0.00019	0.00025	0.0018	0.092	0.0084	0.017	--	Yes	No	(1)(5)(13)	
4,4-DDT	mg/kg	47	134	35%	0.0002	0.00026	0.0018	0.045	0.0037	0.0079	--	Yes	No	(1)(5)(13)	
Aldrin	mg/kg	0	134	0%	0.000096	0.00012	--	--	0.000049	0.0000015	--	Yes	No	(2)	
alpha-BHC	mg/kg	4	134	3%	0.00029	0.00036	0.0019	0.0029	0.00022	0.00039	--	No	No	(4)(13)	
alpha-Chlordane	mg/kg	0	134	0%	0.00021	0.00027	--	--	0.00011	0.0000038	--	Yes	No	(2)	
beta-BHC	mg/kg	45	134	34%	0.00019	0.00024	0.0018	0.027	0.0019	0.004	--	No	No	(5)(13)	
Chlordane	mg/kg	0	134	0%	0.0024	0.003	--	--	0.0012	0.00004	--	Yes	No	(2)	
delta-BHC	mg/kg	0	134	0%	0.00017	0.00022	--	--	0.000087	0.0000034	--	No	No	(2)	
Dieldrin	mg/kg	0	134	0%	0.000092	0.00012	--	--	0.000047	0.0000016	--	Yes	No	(2)	
Endosulfan I	mg/kg	0	134	0%	0.00011	0.00014	--	--	0.000055	0.0000017	--	No	No	(2)	
Endosulfan II	mg/kg	0	134	0%	0.000094	0.00012	--	--	0.000048	0.0000016	--	No	No	(2)	
Endosulfan sulfate	mg/kg	0	134	0%	0.00026	0.00034	--	--	0.00014	0.0000044	--	No	No	(2)	
Endrin	mg/kg	0	134	0%	0.000084	0.00011	--	--	0.000043	0.0000015	--	No	No	(2)	
Endrin aldehyde	mg/kg	2	134	1%	0.00018	0.00023	0.0024	0.0026	0.00013	0.00029	--	No	No	(4)(13)	
Endrin ketone	mg/kg	0	134	0%	0.00016	0.00021	--	--	0.000086	0.0000027	--	No	No	(2)	
gamma-BHC (Lindane)	mg/kg	0	134	0%	0.00012	0.00016	--	--	0.000065	0.0000021	--	No	No	(2)	
gamma-Chlordane	mg/kg	0	134	0%	0.000084	0.00011	--	--	0.000043	0.0000015	--	Yes	No	(2)	
Heptachlor	mg/kg	0	134	0%	0.00017	0.00022	--	--	0.00009	0.000003	--	No	No	(2)	
Heptachlor epoxide	mg/kg	0	134	0%	0.00013	0.00017	--	--	0.000068	0.0000032	--	No	No	(2)	
Methoxychlor	mg/kg	6	134	4%	0.00032	0.00041	0.0027	0.013	0.00045	0.0016	--	No	No	(4)(13)	
Toxaphene	mg/kg	0	134	0%	0.0059	0.0075	--	--	0.003	0.0001	--	Yes	No	(2)	
<i>Polynuclear Aromatic Hydrocarbons</i>															
Acenaphthene	mg/kg	0	134	0%	0.00167	0.00206	--	--	0.00087	0.000023	--	No	No	(2)	
Acenaphthylene	mg/kg	0	134	0%	0.00167	0.00206	--	--	0.00087	0.000023	--	No	No	(2)	
Anthracene	mg/kg	4	134	3%	0.00167	0.00206	0.00177	0.00451	0.00092	0.00035	--	No	No	(4)(13)	
Benzo(a)anthracene	mg/kg	10	134	7%	0.00167	0.00206	0.00183	0.00457	0.001	0.0006	--	No	Yes	(5)(13)(10)	
Benzo(a)pyrene	mg/kg	20	134	15%	0.00167	0.00206	0.0018	0.0121	0.0012	0.0013	--	Yes	Yes	(5)(14)	
Benzo(b)fluoranthene	mg/kg	41	134	31%	0.00167	0.00206	0.00183	0.0256	0.0033	0.0056	--	No	Yes	(5)(13)(10)	
Benzo(g,h,i)perylene	mg/kg	17	134	13%	0.00167	0.00206	0.00176	0.0163	0.0013	0.0017	--	No	No	(5)(13)	

**TABLE 5-6**  
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPCs)**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Units	Number of Detects	Total Count	Detect Freq.	Min ND	Max ND	Min Detect	Max Detect	Mean	Standard Deviation	Greater than Background?	PBT(1) or Class A Carcinogen?	COPC?	Rationale
Benzo(k)fluoranthene	mg/kg	7	134	5%	0.00167	0.00206	0.00186	0.00548	0.00097	0.00051	--	No	Yes	(5)(13)(10)
Chrysene	mg/kg	16	134	12%	0.00167	0.00206	0.00179	0.0296	0.0014	0.0026	--	No	Yes	(5)(13)(10)
Dibenzo(a,h)anthracene	mg/kg	11	134	8%	0.00167	0.00206	0.00181	0.0181	0.0019	0.0039	--	No	Yes	(5)(14)
Indeno(1,2,3-cd)pyrene	mg/kg	9	134	7%	0.00167	0.00206	0.00179	0.0061	0.001	0.00066	--	No	Yes	(5)(13)(10)
Phenanthrene	mg/kg	10	134	7%	0.00167	0.00206	0.00169	0.00545	0.00099	0.0005	--	No	No	(5)(13)
Pyrene	mg/kg	34	134	25%	0.00167	0.00206	0.00181	0.00778	0.0016	0.0015	--	No	No	(5)(13)
<i>Polychlorinated Biphenyls</i>														
PCB 105	pg/g	35	70	50%	2	63	3.4	710	34	88	--	Yes	No	(1)(3)
PCB 114	pg/g	34	70	49%	2	2.3	2.2	63	11	15	--	Yes	No	(1)(3)
PCB 118	pg/g	43	70	61%	2	140	2.4	1100	67	140	--	Yes	No	(1)(3)
PCB 123	pg/g	1	70	1%	2	2.3	2.4	2.4	1.1	0.17	--	Yes	No	(1)(3)
PCB 126	pg/g	21	70	30%	2	2.3	2.1	17	2.2	2.5	--	Yes	No	(1)(3)
PCB 156	pg/g	29	70	41%	2	34	2.3	130	10	18	--	Yes	No	(1)(3)
PCB 157	pg/g	26	70	37%	2	2.3	2.1	32	2.9	4.2	--	Yes	No	(1)(3)
PCB 167	pg/g	24	70	34%	2	15	2.1	54	4.6	7.6	--	Yes	No	(1)(3)
PCB 169	pg/g	4	70	6%	2	2.3	2.1	2.3	1.1	0.29	--	Yes	No	(1)(3)
PCB 189	pg/g	22	70	31%	2	11	2.5	19	3.1	3.6	--	Yes	No	(1)(3)
PCB 209	pg/g	59	70	84%	2	2.3	23	6200	830	1100	--	Yes	No	(1)(3)
PCB 77	pg/g	0	70	0%	2	2.3	--	--	1	0.035	--	Yes	No	(1)(3)
PCB 81	pg/g	0	70	0%	2	2.3	--	--	1	0.035	--	Yes	No	(1)(3)
<i>Radionuclides</i>														
Radium-226	pCi/g	113	140	81%	--	--	0	2.84	1	0.44	NO	Yes	No	(1)(6)
Radium-228	pCi/g	125	140	89%	--	--	0.35	2.88	1.4	0.48	NO	Yes	No	(1)(6)
Thorium-228	pCi/g	139	140	99%	--	--	0.00019	5.12	1.6	0.52	NO	Yes	No	(1)(6)
Thorium-230	pCi/g	133	140	95%	--	--	0.416	3.1	1.2	0.39	NO	Yes	No	(1)(6)
Thorium-232	pCi/g	140	140	100%	--	--	0.545	4.61	1.5	0.46	NO	Yes	No	(1)(6)
Uranium-233/234	pCi/g	128	140	91%	--	--	0.273	2.21	1	0.35	NO	Yes	No	(1)(6)
Uranium-235/236	pCi/g	16	140	11%	--	--	-0.0761	1	0.11	0.14	NO	Yes	No	(1)(6)
Uranium-238	pCi/g	124	140	89%	--	--	0.301	2.31	0.95	0.31	NO	Yes	No	(1)(6)
<i>Semi-Volatile Organic Compounds</i>														
1,2,4,5-Tetrachlorobenzene	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
1,2-Diphenylhydrazine	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
1,4-Dioxane	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
2,2'-Dichlorobenzil	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
2,4,5-Trichlorophenol	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)

**TABLE 5-6**  
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPCs)**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 5 of 9)

Chemical	Units	Number of Detects	Total Count	Detect Freq.	Min ND	Max ND	Min Detect	Max Detect	Mean	Standard Deviation	Greater than Background?	PBT(1) or Class A Carcinogen?	COPC?	Rationale
2,4,6-Trichlorophenol	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
2,4-Dichlorophenol	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
2,4-Dimethylphenol	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
2,4-Dinitrophenol	mg/kg	0	132	0%	0.127	0.156	--	--	0.066	0.0017	--	No	No	(2)
2,4-Dinitrotoluene	mg/kg	0	132	0%	0.0335	0.0412	--	--	0.017	0.00046	--	No	No	(2)
2,6-Dinitrotoluene	mg/kg	0	132	0%	0.0335	0.0412	--	--	0.017	0.00046	--	No	No	(2)
2-Chloronaphthalene	mg/kg	0	132	0%	0.0117	0.0144	--	--	0.0061	0.00016	--	No	No	(2)
2-Chlorophenol	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
2-Methylnaphthalene	mg/kg	1	132	1%	0.00669	0.00823	0.0109	0.0109	0.0035	0.00065	--	No	No	(4)(13)
2-Nitroaniline	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
2-Nitrophenol	mg/kg	0	132	0%	0.0335	0.0412	--	--	0.017	0.00046	--	No	No	(2)
3,3-Dichlorobenzidine	mg/kg	0	132	0%	0.1	0.123	--	--	0.052	0.0014	--	No	No	(2)
3-Nitroaniline	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
4-Bromophenyl phenyl ether	mg/kg	0	132	0%	0.0335	0.0412	--	--	0.017	0.00046	--	No	No	(2)
4-Chloro-3-methylphenol	mg/kg	0	132	0%	0.0335	0.0412	--	--	0.017	0.00046	--	No	No	(2)
4-Chlorophenyl phenyl ether	mg/kg	0	132	0%	0.0335	0.0412	--	--	0.017	0.00046	--	No	No	(2)
4-Chlorothioanisole	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
4-Nitroaniline	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
4-Nitrophenol	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Acetophenone	mg/kg	0	132	0%	0.0335	0.0412	--	--	0.017	0.00046	--	No	No	(2)
Aniline	mg/kg	0	132	0%	0.117	0.144	--	--	0.061	0.0016	--	No	No	(2)
Benzenethiol	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
Benzoic acid	mg/kg	0	132	0%	0.167	0.206	--	--	0.087	0.0023	--	No	No	(2)
Benzyl alcohol	mg/kg	0	132	0%	0.1	0.123	--	--	0.052	0.0014	--	No	No	(2)
bis(2-Chloroethoxy)methane	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	Yes	No	(2)
bis(2-Chloroethyl) ether	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
bis(2-Chloroisopropyl) ether	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
bis(2-Ethylhexyl) phthalate	mg/kg	1	132	1%	0.0669	0.0823	0.0747	0.0747	0.035	0.0036	--	No	No	(4)(13)
bis(p-Chlorophenyl) sulfone	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
bis(p-Chlorophenyl)disulfide	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
Butylbenzyl phthalate	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Carbazole	mg/kg	1	132	1%	0.01	0.0123	0.011	0.011	0.0053	0.00052	--	No	No	(4)(13)
Dibenzofuran	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Dichloromethyl ether	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
Diethyl phthalate	mg/kg	1	132	1%	0.0669	0.0823	0.138	0.138	0.036	0.009	--	No	No	(4)(13)

**TABLE 5-6**  
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPCs)**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Units	Number of Detects	Total Count	Detect Freq.	Min ND	Max ND	Min Detect	Max Detect	Mean	Standard Deviation	Greater than Background?	PBT(1) or Class A Carcinogen?	COPC?	Rationale
Dimethyl phthalate	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Di-n-butyl phthalate	mg/kg	0	132	0%	0.0335	0.0412	--	--	0.017	0.00046	--	No	No	(2)
Di-n-octyl phthalate	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Diphenyl disulfide	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
Diphenyl sulfide	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
Diphenyl sulfone	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
Diphenylamine	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Fluoranthene	mg/kg	2	132	2%	0.01	0.0123	0.0107	0.0117	0.0053	0.00075	--	No	No	(4)(13)
Fluorene	mg/kg	0	132	0%	0.01	0.0123	--	--	0.0052	0.00014	--	No	No	(2)
Hexachlorobenzene	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	Yes	No	(2)
Hexachlorobutadiene	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Hexachlorocyclopentadiene	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Hexachloroethane	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Hydroxymethyl phthalimide	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
Isophorone	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
m,p-Cresols	mg/kg	0	132	0%	0.134	0.165	--	--	0.07	0.0018	--	No	No	(2)
Naphthalene	mg/kg	1	132	1%	0.01	0.0123	0.0114	0.0114	0.0053	0.00055	--	No	No	(4)(13)
Nitrobenzene	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
N-nitrosodi-n-propylamine	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	Yes	No	(2)
o-Cresol	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Octachlorostyrene	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
p-Chloroaniline	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
p-Chlorobenzenethiol	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
Pentachlorobenzene	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Pentachlorophenol	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Phenol	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
Phthalic acid	mg/kg	0	132	0%	0.11	0.136	--	--	0.058	0.0015	--	No	No	(2)
Pyridine	mg/kg	0	132	0%	0.0669	0.0823	--	--	0.035	0.00091	--	No	No	(2)
<i>Volatile Organic Compounds</i>														
1,1,1,2-Tetrachloroethane	mg/kg	0	134	0%	0.00018	0.00023	--	--	0.000092	0.0000036	--	No	No	(2)
1,1,1-Trichloroethane	mg/kg	0	134	0%	0.00011	0.00014	--	--	0.000055	0.0000017	--	No	No	(2)
1,1,2,2-Tetrachloroethane	mg/kg	0	134	0%	0.000079	0.0001	--	--	0.000041	0.0000013	--	No	No	(2)
1,1,2-Trichloroethane	mg/kg	0	134	0%	0.000068	0.000087	--	--	0.000035	0.0000012	--	No	No	(2)
1,1-Dichloroethane	mg/kg	0	134	0%	0.000071	0.00009	--	--	0.000037	0.0000012	--	No	No	(2)
1,1-Dichloroethene	mg/kg	0	134	0%	0.00012	0.00016	--	--	0.000062	0.0000031	--	No	No	(2)

**TABLE 5-6**  
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPCs)**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Units	Number of Detects	Total Count	Detect Freq.	Min ND	Max ND	Min Detect	Max Detect	Mean	Standard Deviation	Greater than Background?	PBT(1) or Class A Carcinogen?	COPC?	Rationale
1,1-Dichloropropene	mg/kg	0	134	0%	0.000088	0.00011	--	--	0.000045	0.0000014	--	No	No	(2)
1,2,3-Trichlorobenzene	mg/kg	0	134	0%	0.00039	0.0005	--	--	0.0002	0.0000067	--	No	No	(2)
1,2,3-Trichloropropane	mg/kg	0	134	0%	0.00025	0.00032	--	--	0.00013	0.0000043	--	No	No	(2)
1,2,4-Trichlorobenzene	mg/kg	0	134	0%	0.00033	0.00046	--	--	0.00017	0.0000077	--	No	No	(2)
1,2,4-Trimethylbenzene	mg/kg	15	134	11%	0.00013	0.00074	0.00039	0.0014	0.00029	0.00021	--	No	No	(4)(13)
1,2-Dichlorobenzene	mg/kg	12	134	9%	0.00012	0.00017	0.00014	0.00022	0.000074	0.000036	--	No	No	(4)(13)
1,2-Dichloroethane	mg/kg	0	134	0%	0.000067	0.000085	--	--	0.000034	0.0000011	--	No	No	(2)
1,2-Dichloroethene	mg/kg	0	134	0%	0.00011	0.00014	--	--	0.000056	0.0000022	--	No	No	(2)
1,2-Dichloropropane	mg/kg	0	134	0%	0.00011	0.00014	--	--	0.000057	0.0000028	--	No	No	(2)
1,3,5-Trichlorobenzene	mg/kg	0	134	0%	0.00037	0.00048	--	--	0.00019	0.0000066	--	No	No	(2)
1,3,5-Trimethylbenzene	mg/kg	9	134	7%	0.000098	0.00016	0.00011	0.00014	0.000056	0.000019	--	No	No	(5)(13)
1,3-Dichlorobenzene	mg/kg	12	134	9%	0.00013	0.00019	0.00015	0.00022	0.000079	0.000031	--	No	No	(4)(13)
1,3-Dichloropropane	mg/kg	0	134	0%	0.000052	0.000066	--	--	0.000027	8.9E-07	--	No	No	(2)
1,4-Dichlorobenzene	mg/kg	12	134	9%	0.00014	0.00025	0.00016	0.00031	0.000086	0.000044	--	No	No	(4)(13)
2,2,3-Trimethylbutane	mg/kg	0	134	0%	0.00021	0.00027	--	--	0.00011	0.0000038	--	No	No	(2)
2,2-Dichloropropane	mg/kg	0	134	0%	0.00023	0.0003	--	--	0.00012	0.000004	--	No	No	(2)
2,2-Dimethylpentane	mg/kg	0	134	0%	0.00028	0.00036	--	--	0.00014	0.0000053	--	No	No	(2)
2,3-Dimethylpentane	mg/kg	0	134	0%	0.00023	0.00029	--	--	0.00012	0.000004	--	No	No	(2)
2,4-Dimethylpentane	mg/kg	0	134	0%	0.0002	0.00025	--	--	0.0001	0.0000032	--	No	No	(2)
2-Chlorotoluene	mg/kg	0	134	0%	0.00025	0.00032	--	--	0.00013	0.0000047	--	No	No	(2)
2-Hexanone	mg/kg	0	134	0%	0.00024	0.00031	--	--	0.00012	0.0000046	--	No	No	(2)
2-Methylhexane	mg/kg	0	134	0%	0.00021	0.00026	--	--	0.00011	0.0000032	--	No	No	(2)
2-Nitropropane	mg/kg	0	134	0%	0.00061	0.00078	--	--	0.00031	0.00001	--	No	No	(2)
3,3-Dimethylpentane	mg/kg	0	134	0%	0.00021	0.00026	--	--	0.00011	0.0000032	--	No	No	(2)
3-Ethylpentane	mg/kg	0	134	0%	0.00021	0.00027	--	--	0.00011	0.0000038	--	No	No	(2)
3-Methylhexane	mg/kg	0	134	0%	0.00014	0.00018	--	--	0.000073	0.0000033	--	No	No	(2)
4-Chlorotoluene	mg/kg	0	134	0%	0.00017	0.00022	--	--	0.00009	0.0000032	--	No	No	(2)
4-Methyl-2-pentanone (MIBK)	mg/kg	0	134	0%	0.00029	0.00037	--	--	0.00015	0.0000049	--	No	No	(2)
Acetone	mg/kg	4	134	3%	0.0017	0.021	0.013	0.02	0.0052	0.0035	--	No	No	(4)(13)
Acetonitrile	mg/kg	0	134	0%	0.0055	0.007	--	--	0.0028	0.000095	--	No	No	(2)
Benzene	mg/kg	9	134	7%	0.000088	0.00011	0.00015	0.00021	0.000055	0.000036	--	Yes	No	(5)(13)
Bromobenzene	mg/kg	1	134	1%	0.00012	0.00016	0.00023	0.00023	0.000064	0.000015	--	No	No	(4)(13)
Bromodichloromethane	mg/kg	0	134	0%	0.00022	0.00028	--	--	0.00011	0.0000037	--	No	No	(2)
Bromoform	mg/kg	0	134	0%	0.00006	0.000076	--	--	0.000031	0.000001	--	No	No	(2)
Bromomethane	mg/kg	0	134	0%	0.00013	0.00017	--	--	0.000067	0.0000033	--	No	No	(2)

**TABLE 5-6**  
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPCs)**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 8 of 9)

Chemical	Units	Number of Detects	Total Count	Detect Freq.	Min ND	Max ND	Min Detect	Max Detect	Mean	Standard Deviation	Greater than Background?	PBT(1) or Class A Carcinogen?	COPC?	Rationale
Carbon disulfide	mg/kg	0	134	0%	0.00012	0.00016	--	--	0.000063	0.0000034	--	No	No	(2)
Carbon tetrachloride	mg/kg	0	134	0%	0.00021	0.00026	--	--	0.00011	0.0000038	--	No	No	(2)
Chlorobenzene	mg/kg	0	134	0%	0.00011	0.00014	--	--	0.000056	0.0000022	--	No	No	(2)
Chlorobromomethane	mg/kg	0	134	0%	0.00023	0.00029	--	--	0.00012	0.0000041	--	No	No	(2)
Chloroethane	mg/kg	0	134	0%	0.00047	0.0006	--	--	0.00024	0.0000081	--	No	No	(2)
Chloroform	mg/kg	0	134	0%	0.0001	0.00033	--	--	0.000052	0.000011	--	No	No	(2)
Chloromethane	mg/kg	3	134	2%	0.00027	0.00035	0.00028	0.00031	0.00014	0.000023	--	No	No	(4)(13)
cis-1,2-Dichloroethene	mg/kg	0	134	0%	0.000055	0.00007	--	--	0.000028	9.5E-07	--	No	No	(2)
cis-1,3-Dichloropropene	mg/kg	0	134	0%	0.0001	0.00013	--	--	0.000051	0.0000026	--	No	No	(2)
Cymene (Isopropyltoluene)	mg/kg	0	134	0%	0.00013	0.00016	--	--	0.000065	0.0000018	--	No	No	(2)
Dibromochloromethane	mg/kg	0	134	0%	0.00012	0.00015	--	--	0.000061	0.0000025	--	No	No	(2)
Dibromochloropropane	mg/kg	0	134	0%	0.00021	0.00027	--	--	0.00011	0.0000035	--	No	No	(2)
Dibromomethane	mg/kg	0	134	0%	0.00017	0.00021	--	--	0.000086	0.0000031	--	No	No	(2)
Dichloromethane (Methylene chloride)	mg/kg	37	134	28%	0.0007	0.014	0.0014	0.019	0.0046	0.0052	--	No	No	(5)(13)
Dimethyldisulfide	mg/kg	0	134	0%	0.00018	0.00023	--	--	0.000091	0.0000033	--	No	No	(2)
Ethanol	mg/kg	1	134	1%	0.048	0.061	1.9	1.9	0.039	0.16	--	No	No	(4)(13)
Ethylbenzene	mg/kg	16	134	12%	0.000059	0.00019	0.00016	0.00021	0.00005	0.00005	--	No	No	(5)(13)
Freon-11 (Trichlorofluoromethane)	mg/kg	0	134	0%	0.00022	0.00028	--	--	0.00011	0.0000043	--	No	No	(2)
Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane)	mg/kg	0	134	0%	0.00015	0.00019	--	--	0.000076	0.0000026	--	No	No	(2)
Freon-12 (Dichlorodifluoromethane)	mg/kg	0	134	0%	0.00029	0.00037	--	--	0.00015	0.0000049	--	No	No	(2)
Heptane	mg/kg	0	134	0%	0.00016	0.00021	--	--	0.000086	0.0000027	--	No	No	(2)
Isopropylbenzene	mg/kg	7	134	5%	0.0001	0.00013	0.00011	0.00013	0.000058	0.000014	--	No	No	(5)(13)
m,p-Xylene	mg/kg	14	134	10%	0.00017	0.00026	0.00024	0.00032	0.00011	0.000056	--	No	No	(5)(13)
Methyl ethyl ketone (2-Butanone)	mg/kg	1	134	1%	0.00088	0.0011	0.0024	0.0024	0.00047	0.00017	--	No	No	(4)(13)
Methyl iodide	mg/kg	0	134	0%	0.00013	0.00016	--	--	0.000065	0.0000018	--	No	No	(2)
MTBE (Methyl tert-butyl ether)	mg/kg	0	134	0%	0.00009	0.00011	--	--	0.000046	0.0000014	--	No	No	(2)
n-Butylbenzene	mg/kg	0	134	0%	0.00018	0.00023	--	--	0.000094	0.0000037	--	No	No	(2)
Nonanal	mg/kg	8	134	6%	0.00047	0.0006	0.00049	0.0061	0.00033	0.00054	--	No	No	(5)(15)
n-Propylbenzene	mg/kg	16	134	12%	0.00011	0.00014	0.00013	0.00017	0.000067	0.000031	--	No	No	(5)(13)
o-Xylene	mg/kg	7	134	5%	0.000077	0.00015	0.000087	0.00013	0.000044	0.000017	--	No	No	(5)(13)
sec-Butylbenzene	mg/kg	8	134	6%	0.00011	0.00014	0.00011	0.00015	0.00006	0.000018	--	No	No	(5)(13)
Styrene	mg/kg	1	134	1%	0.00018	0.00027	0.00018	0.00018	0.000099	0.000014	--	No	No	(4)(13)
tert-Butylbenzene	mg/kg	7	134	5%	0.0001	0.00013	0.00012	0.00013	0.000055	0.000017	--	No	No	(5)(13)
Tetrachloroethene	mg/kg	0	134	0%	0.000088	0.00011	--	--	0.000045	0.0000014	--	No	No	(2)
Toluene	mg/kg	0	134	0%	0.00033	0.00044	--	--	0.00017	0.0000074	--	No	No	(2)

**TABLE 5-6**  
**SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPCs)**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Units	Number of Detects	Total Count	Detect Freq.	Min ND	Max ND	Min Detect	Max Detect	Mean	Standard Deviation	Greater than Background?	PBT(1) or Class A Carcinogen?	COPC?	Rationale
trans-1,2-Dichloroethene	mg/kg	0	134	0%	0.000091	0.00012	--	--	0.000047	0.0000016	--	No	No	(2)
trans-1,3-Dichloropropene	mg/kg	1	134	1%	0.0001	0.00013	0.00015	0.00015	0.000052	0.0000089	--	No	No	(4)(13)
Trichloroethene	mg/kg	0	134	0%	0.00011	0.00013	--	--	0.000055	0.0000012	--	No	No	(2)
Vinyl acetate	mg/kg	0	134	0%	0.00024	0.00031	--	--	0.00013	0.0000043	--	No	No	(2)
Vinyl chloride	mg/kg	0	134	0%	0.00011	0.00014	--	--	0.000059	0.0000026	--	No	No	(2)
Xylenes (total)	mg/kg	12	134	9%	0.00023	0.0003	0.00025	0.0004	0.00014	0.000063	--	No	No	(5)(13)

mg/kg - milligrams per kilogram

pCi/g - picoCuries per gram

ppt - parts per trillion

-- - Not available or not applicable.

ND - Not detected.

Highlight indicates selected as COPC.

(1) Persistent, Bioaccumulative, and Toxic (PBT) Program.

(2) Not detected.

(3) Dioxin and PCB congeners are not evaluated separately. Dioxin and PCB congeners are evaluated as TCDD TEQs. The maximum TCDD TEQ was less than the 50 ppt residential BCL (see text).

(4) Chemical detected in less than 5 percent of the samples and is not a PBT or Class A carcinogen.

(5) Chemical detected in greater than 5 percent of samples.

(6) Chemical concentrations are equivalent to background.

(7) Chemical detected in less than 5 percent of the samples, but is a PBT or Class A carcinogen.

(8) Based on statistical tests, Site concentrations are elevated compared to background.

(9) No toxicity criteria or applicable surrogate criteria are available.

(10) At least one carcinogenic polynuclear aromatic hydrocarbon (PAH) is a COPC, therefore all detected carcinogenic PAHs are COPCs.

(11) Lead was not selected as a COPC because the maximum concentration is below 400 mg/kg.

(12) USEPA (1989) states that "Chemicals that are (1) essential human nutrients, (2) present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and (3) toxic only at very high doses (i.e., much higher than those that could be associated with contact at the site) need not be considered further in the quantitative risk assessment. Examples of such chemicals are iron, magnesium, calcium, potassium, and sodium."

(13) Maximum detected site concentration below one-tenth residential BCL.

(14) Maximum detected site concentration greater than one-tenth residential BCL.

(15) Chemical has no BCL.

**TABLE 6-1**  
**EXPOSURE POINT CONCENTRATIONS IN SOIL**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 2)

Chemical	Units	Number of Detects	Total Count	Detect Freq.	Min ND	Max ND	Min Detect	Max Detect	Mean	Standard Deviation
<i>Inorganics</i>										
Aluminum	mg/kg	149	149	100%	--	--	3700	14600	9900	2000
Arsenic	mg/kg	149	149	100%	--	--	3.3	22	6	2.2
Lithium	mg/kg	149	149	100%	--	--	8.3	76	18	9.9
Manganese	mg/kg	149	149	100%	--	--	102	1820	540	180
Perchlorate	mg/kg	116	133	87%	0.01	0.0112	0.0124	6.36	0.61	1.1
Strontium	mg/kg	149	149	100%	--	--	120	6200	430	770
Vanadium	mg/kg	149	149	100%	--	--	13.3	188	48	16
<i>Polynuclear Aromatic Hydrocarbons</i>										
Benzo(a)anthracene	mg/kg	10	134	7%	0.00167	0.00206	0.00183	0.00457	0.001	0.0006
Benzo(a)pyrene	mg/kg	20	134	15%	0.00167	0.00206	0.0018	0.0121	0.0012	0.0013
Benzo(b)fluoranthene	mg/kg	41	134	31%	0.00167	0.00206	0.00183	0.0256	0.0033	0.0056
Benzo(k)fluoranthene	mg/kg	7	134	5%	0.00167	0.00206	0.00186	0.00548	0.00097	0.00051
Chrysene	mg/kg	16	134	12%	0.00167	0.00206	0.00179	0.0296	0.0014	0.0026
Dibenzo(a,h)anthracene	mg/kg	11	134	8%	0.00167	0.00206	0.00181	0.0181	0.0019	0.0039
Indeno(1,2,3-cd)pyrene	mg/kg	9	134	7%	0.00167	0.00206	0.00179	0.0061	0.001	0.00066

(1) The EPC is either the maximum of the All, Fill, Surface, All-Fill or Surface/Fill 95 UCLs unless it exceeds the maximum detection concentration, then it is the maximum detected concentration.

EPC - Exposure point concentration.

UCL - Upper Confidence Limit

NA - Not applicable.

**TABLE 6-1**  
**EXPOSURE POINT CONCENTRATIONS IN SOIL**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Units	95%UCL All	95%UCL Fill	95%UCL Surface	95%UCL All - Fill	95%UCL Surface/Fill	EPC <sup>1</sup>
<i>Inorganics</i>							
Aluminum	mg/kg	10150	11830	10010	9621	10740	11830
Arsenic	mg/kg	6.4	6.2	5.5	6.6	5.7	6.6
Lithium	mg/kg	20.2	17.7	16.3	21.8	16.7	21.8
Manganese	mg/kg	567	736	572	522	633	736
Perchlorate	mg/kg	0.80	0.45	0.48	1.0	0.38	1.0
Strontium	mg/kg	585	235	254	685	240	685
Vanadium	mg/kg	50.7	54.5	50.2	50.3	51.5	54.5
<i>Polynuclear Aromatic Hydrocarbons</i>							
Benzo(a)anthracene	mg/kg	0.0011	0.0013	0.0014	0.0011	0.0013	0.0014
Benzo(a)pyrene	mg/kg	0.0015	0.0024	0.0018	0.0014	0.0018	0.0024
Benzo(b)fluoranthene	mg/kg	0.0043	0.0069	0.0058	0.0037	0.0056	0.0069
Benzo(k)fluoranthene	mg/kg	0.0011	0.0014	0.0010	0.00098	0.0012	0.0014
Chrysene	mg/kg	0.0021	0.0042	0.0015	0.0012	0.0027	0.0042
Dibenzo(a,h)anthracene	mg/kg	0.0025	0.0051	0.0039	0.0023	0.0036	0.0051
Indeno(1,2,3-cd)pyrene	mg/kg	0.0012	0.0017	0.0011	0.0010	0.0013	0.0017

(1) The EPC is either the maximum of the All, Fill, Surface, All-Fill or Surface/Fill 95 UCLs unless it exceeds the maximum detection concentration, then it is the maximum detected concentration.

EPC - Exposure point concentration.

UCL - Upper Confidence Limit

NA - Not applicable.

**TABLE 6-2**  
**ASBESTOS RESULTS AND ANALYTICAL SENSITIVITIES**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 2)

Sample ID	Depth (ft bgs)	Sample Type	Sample Date	Analytical Sensitivity (10 <sup>6</sup> s/gPM <sub>10</sub> )	Concentration		Number of			
					Protocol Structures <sup>(1)</sup>		Protocol Structures <sup>(2)</sup>			
					Chrysotile (10 <sup>6</sup> s/gPM <sub>10</sub> )	Amphibole (10 <sup>6</sup> s/gPM <sub>10</sub> )	Chrysotile		Amphibole	
		Total	Long	Total	Long					
GNC1-BC21	0	NORM	01/26/09	2.963	< 8.859 E+6	< 8.859 E+6	0	0	0	0
GNC1-BC22	0	NORM	01/28/09	2.966	< 8.869 E+6	< 8.869 E+6	0	0	0	0
GNC1-BC23	0	NORM	01/28/09	2.979	< 8.908 E+6	< 8.908 E+6	0	0	0	0
GNC1-BC24	0	NORM	01/28/09	2.963	< 8.859 E+6	< 8.859 E+6	0	0	0	0
GNC1-BC25	0	NORM	01/28/09	2.987	< 8.930 E+6	< 8.930 E+6	0	0	0	0
GNC1-BC26	0	NORM	01/28/09	2.991	< 8.944 E+6	< 8.944 E+6	0	0	0	0
GNC1-BC27	0	NORM	01/28/09	2.981	< 8.912 E+6	< 8.912 E+6	0	0	0	0
GNC1-BC28	0	NORM	01/28/09	2.967	< 8.870 E+6	< 8.870 E+6	0	0	0	0
GNC1-BC29	0	NORM	01/28/09	2.963	< 8.859 E+6	< 8.859 E+6	0	0	0	0
GNC1-BD22	0	NORM	01/26/09	2.967	< 8.870 E+6	< 8.870 E+6	0	0	0	0
GNC1-BD23	0	NORM	01/26/09	2.960	< 8.851 E+6	< 8.851 E+6	0	0	0	0
GNC1-BD24	0	NORM	01/26/09	2.983	< 8.919 E+6	< 8.919 E+6	0	0	0	0
GNC1-BD25	0	NORM	01/28/09	2.959	< 8.846 E+6	< 8.846 E+6	0	0	0	0
GNC1-BD26	0	NORM	01/28/09	2.983	< 8.919 E+6	< 8.919 E+6	0	0	0	0
GNC1-BD27	0	NORM	01/28/09	2.963	< 8.859 E+6	< 8.859 E+6	0	0	0	0
GNC1-BD27	0	FD	01/28/09	2.991	< 8.944 E+6	< 8.944 E+6	0	0	0	0
GNC1-BD28	0	NORM	01/28/09	2.987	< 8.930 E+6	< 8.930 E+6	0	0	0	0
GNC1-BD29	0	NORM	01/26/09	2.981	< 8.912 E+6	< 8.912 E+6	0	0	0	0
GNC1-BE23	0	NORM	01/29/09	2.983	< 8.919 E+6	< 8.919 E+6	0	0	0	0
GNC1-BE24	0	NORM	01/29/09	2.961	< 8.854 E+6	< 8.854 E+6	0	0	0	0
GNC1-BE25	0	NORM	01/26/09	2.967	< 8.870 E+6	< 8.870 E+6	0	0	0	0
GNC1-BE27	0	NORM	01/26/09	2.959	< 8.846 E+6	< 8.846 E+6	0	0	0	0
GNC1-BE28	0	NORM	01/26/09	2.979	< 8.908 E+6	< 8.908 E+6	0	0	0	0
GNC1-BE29	0	NORM	01/26/09	2.982	< 8.915 E+6	< 8.915 E+6	0	0	0	0
GNC1-BF23	0	NORM	01/29/09	2.979	< 8.908 E+6	< 8.908 E+6	0	0	0	0
GNC1-BF24	0	NORM	01/29/09	2.898	< 8.664 E+6	< 8.664 E+6	1	0	0	0
GNC1-BG23	0	NORM	01/29/09	2.979	< 8.908 E+6	< 8.908 E+6	0	0	0	0
GNC1-BG24	0	NORM	01/29/09	2.959	< 8.846 E+6	< 8.846 E+6	0	0	0	0
GNC1-JB02	0	NORM	01/28/09	2.981	< 8.912 E+6	< 8.912 E+6	0	0	0	0
GNC1-JB04	0	NORM	01/28/09	2.979	< 8.908 E+6	< 8.908 E+6	0	0	0	0
GNC1-JB05	0	NORM	01/26/09	2.983	< 8.919 E+6	< 8.919 E+6	0	0	0	0
GNC1-JB06	0	NORM	01/28/09	2.987	< 8.930 E+6	< 8.930 E+6	0	0	0	0
GNC1-JB07	0	NORM	01/28/09	2.983	< 8.919 E+6	< 8.919 E+6	0	0	0	0
GNC1-JB07	0	FD	01/28/09	2.991	< 8.944 E+6	< 8.944 E+6	0	0	0	0
GNC1-JB08	0	NORM	01/28/09	2.987	< 8.930 E+6	< 8.930 E+6	0	0	0	0
GNC1-JB09	0	NORM	01/26/09	2.960	< 8.851 E+6	< 8.851 E+6	0	0	0	0
GNC1-JB09	0	FD	01/26/09	2.983	< 8.919 E+6	< 8.919 E+6	0	0	0	0

**TABLE 6-2**  
**ASBESTOS RESULTS AND ANALYTICAL SENSITIVITIES**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Sample ID	Depth (ft bgs)	Sample Type	Sample Date	Analytical Sensitivity (10 <sup>6</sup> s/gPM <sub>10</sub> )	Concentration		Number of			
					Protocol Structures <sup>(1)</sup>		Protocol Structures <sup>(2)</sup>			
					Chrysotile (10 <sup>6</sup> s/gPM <sub>10</sub> )	Amphibole (10 <sup>6</sup> s/gPM <sub>10</sub> )	Chrysotile		Amphibole	
		Total	Long	Total	Long					
GNC1-JB10	0	NORM	07/02/09	2.987	< 2.670 E+7	< 2.670 E+7	0	0	0	0
GNC1-JD06	0	NORM	01/26/09	2.983	< 8.919 E+6	< 8.919 E+6	0	0	0	0
GNC1-JP02	0	NORM	01/28/09	2.960	< 8.851 E+6	< 8.851 E+6	0	0	0	0
GNC1-JP02	0	FD	01/28/09	2.979	< 8.908 E+6	< 8.908 E+6	0	0	0	0
GNC1-JP03	0	NORM	01/28/09	2.967	< 8.870 E+6	< 8.870 E+6	0	0	0	0
GNC1-JP04	0	NORM	01/28/09	2.959	< 8.846 E+6	< 8.846 E+6	0	0	0	0
GNC1-JP05	0	NORM	01/28/09	2.960	< 8.851 E+6	< 8.851 E+6	0	0	0	0
GNC1-JP06	0	NORM	01/28/09	2.958	< 8.845 E+6	< 8.845 E+6	0	0	0	0
GNC1-JP07	0	NORM	01/28/09	2.967	< 8.870 E+6	< 8.870 E+6	0	0	0	0
GNC1-JS07	0	NORM	01/26/09	2.979	< 8.908 E+6	< 8.908 E+6	0	0	0	0
GNC1-JS12	0	NORM	01/28/09	2.983	< 8.919 E+6	< 8.919 E+6	0	0	0	0
GNC1-JS13	0	NORM	01/29/09	2.967	< 8.870 E+6	< 8.870 E+6	0	0	0	0
GNC1-JS13	0	FD	01/29/09	2.983	< 8.919 E+6	< 8.919 E+6	0	0	0	0
GNC1-JS14	0	NORM	01/28/09	2.991	< 8.944 E+6	< 8.944 E+6	0	0	0	0
GNC1-JS15	0	NORM	01/28/09	2.985	1.880 E+7	< 8.925 E+6	2	2	0	0
GNC1-JS16	0	NORM	01/26/09	2.967	< 8.870 E+6	< 8.870 E+6	0	0	0	0
GNC1-JS17	0	NORM	01/28/09	2.981	< 8.912 E+6	< 8.912 E+6	0	0	0	0
GNC1-JS18	0	NORM	01/30/09	2.967	< 8.870 E+6	< 8.870 E+6	0	0	0	0
GNC2-BE26	0	NORM	06/25/10	2.960	< 8.860 E+6	< 8.860 E+6	0	0	0	0
GNC2-BE26	0	FD	06/25/10	2.980	< 8.910 E+6	< 8.910 E+6	0	0	0	0
GNC2-JP08	0	NORM	06/25/10	2.990	< 8.940 E+6	< 8.940 E+6	0	0	0	0

<sup>(1)</sup>Fiber dimensions are presented in the respective analytical reports for each sample.

<sup>(2)</sup>Only long structures (>10µm) present a potential risk and are used for estimating asbestos risks. Total fiber concentrations are presented for informational purposes only. Protocol structures are structures longer than 10 µm and thinner than 0.4 µm.

**TABLE 6-3**  
**EXPOSURE POINT CONCENTRATIONS FROM SURFACE FLUX**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	GNC1-BC29				GNC1-BD22				GNC1-BD23			
	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air
Carbon tetrachloride	S	5.5 E-6	2.2 E-6	1.8 E-6	S	1.2 E-5	4.9 E-6	4.1 E-6	S	1.2 E-5	4.8 E-6	4.0 E-6
Chloroform	S	1.5 E-5	6.1 E-6	5.1 E-6	S	4.9 E-6	2.0 E-6	1.7 E-6	S	2.2 E-6	8.8 E-7	7.3 E-7
Tetrachloroethene	--	--	--	--	S	2.4 E-6	9.5 E-7	7.9 E-7	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--
Chemical	GNC1-BD26				GNC1-BD28				GNC1-BD29			
	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air
Carbon tetrachloride	S	4.0 E-6	1.6 E-6	1.3 E-6	S	4.6 E-6	1.9 E-6	1.6 E-6	S	1.7 E-5	6.9 E-6	5.8 E-6
Chloroform	S	2.9 E-5	1.2 E-5	9.8 E-6	S	1.4 E-5	5.5 E-6	4.6 E-6	S	5.4 E-5	2.2 E-5	1.8 E-5
Tetrachloroethene	S	1.2 E-6	4.7 E-7	3.9 E-7	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--
Chemical	GNC1-BE23				GNC1-BE23R				GNC1-BE24			
	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air
Carbon tetrachloride	S	4.8 E-6	1.9 E-6	1.6 E-6	S	5.1 E-6	2.0 E-6	1.7 E-6	S	7.0 E-6	2.8 E-6	2.3 E-6
Chloroform	S	5.1 E-6	2.0 E-6	1.7 E-6	S	6.7 E-6	2.7 E-6	2.2 E-6	S	1.7 E-5	6.7 E-6	5.6 E-6
Tetrachloroethene	S	2.7 E-6	1.1 E-6	9.2 E-7	--	--	--	--	S	2.3 E-6	9.3 E-7	7.8 E-7
Trichloroethene	S	1.7 E-6	6.8 E-7	5.7 E-7	S	1.0 E-5	4.2 E-6	3.5 E-6	S	2.1 E-6	8.2 E-7	6.9 E-7
Chemical	GNC1-BE25				GNC1-BE27				GNC1-BE28			
	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air
Carbon tetrachloride	S	3.9 E-6	1.6 E-6	1.3 E-6	S	6.7 E-6	2.7 E-6	2.2 E-6	S	2.4 E-6	9.5 E-7	7.9 E-7
Chloroform	S	1.1 E-5	4.2 E-6	3.5 E-6	S	3.6 E-5	1.4 E-5	1.2 E-5	S	3.8 E-5	1.5 E-5	1.3 E-5
Tetrachloroethene	--	--	--	--	S	1.5 E-6	6.1 E-7	5.1 E-7	--	--	--	--
Trichloroethene	--	--	--	--	S	1.3 E-6	5.1 E-7	4.3 E-7	--	--	--	--
Chemical	GNC1-BE29				GNC1-BF23				GNC1-BF24			
	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air
Carbon tetrachloride	--	--	--	--	S	5.3 E-6	2.1 E-6	1.8 E-6	S	1.1 E-5	4.3 E-6	3.6 E-6
Chloroform	S	3.5 E-5	1.4 E-5	1.2 E-5	S	4.7 E-6	1.9 E-6	1.6 E-6	S	2.2 E-6	8.7 E-7	7.3 E-7
Tetrachloroethene	--	--	--	--	S	1.4 E-6	5.5 E-7	4.6 E-7	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--

**Notes:**

All units in mg/m<sup>3</sup>.

Method represents the surface flux measurement used in the risk calculations for that particular chemical/location: S = SIM; F = Full Scan.

See Appendix H for all indoor and outdoor air concentration calculations from surface flux measurement data. See Table 6-6 for outdoor air exposure point concentrations for non-volatile COPCs in soil.

Exposure point concentrations for surface flux data are based on a sample by sample basis. Averaging of the data was not conducted. Therefore only those chemicals detected in a particular sample were included in the risk estimates. A "--" is presented for those chemical not detected and not included in the risk estimates for each sample location. The exposure point concentration is the maximum of the full scan or SIM analysis results (when both had detected values, otherwise the detected value from one or the other is used). Thus, summary statistics are not presented in this table (see Table 3-14 for the surface flux data summary).

**TABLE 6-3**  
**EXPOSURE POINT CONCENTRATIONS FROM SURFACE FLUX**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	GNC1-BG23				GNC1-BG24				GNC1-JB05			
	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air
Carbon tetrachloride	S	7.0 E-6	2.8 E-6	2.3 E-6	S	8.0 E-6	3.2 E-6	2.7 E-6	S	4.1 E-6	1.6 E-6	1.4 E-6
Chloroform	S	3.3 E-6	1.3 E-6	1.1 E-6	S	3.7 E-6	1.5 E-6	1.2 E-6	S	1.9 E-5	7.6 E-6	6.4 E-6
Tetrachloroethene	--	--	--	--	S	1.7 E-6	6.6 E-7	5.6 E-7	--	--	--	--
Trichloroethene	S	7.5 E-6	3.0 E-6	2.5 E-6	S	1.1 E-6	4.5 E-7	3.8 E-7	S	1.3 E-6	5.1 E-7	4.3 E-7
Chemical	GNC1-JB07				GNC1-JP02				GNC1-JP02R			
	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air
Carbon tetrachloride	S	2.3 E-6	9.1 E-7	7.6 E-7	S	3.4 E-6	1.4 E-6	1.1 E-6	S	1.2 E-5	4.6 E-6	3.9 E-6
Chloroform	S	2.0 E-5	8.0 E-6	6.7 E-6	S	2.5 E-5	9.9 E-6	8.3 E-6	S	4.3 E-5	1.7 E-5	1.4 E-5
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--
Chemical	GNC1-JP03				GNC1-JP04				GNC1-JP06			
	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air
Carbon tetrachloride	S	6.2 E-6	2.5 E-6	2.1 E-6	S	4.6 E-6	1.8 E-6	1.5 E-6	S	2.6 E-4	1.0 E-4	8.7 E-5
Chloroform	S	3.3 E-5	1.3 E-5	1.1 E-5	S	5.2 E-5	2.1 E-5	1.7 E-5	S	1.9 E-4	7.6 E-5	6.3 E-5
Tetrachloroethene	--	--	--	--	--	--	--	--	S	4.6 E-6	1.8 E-6	1.5 E-6
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--
Chemical	GNC1-JP07				GNC1-JP08				GNC1-JS14			
	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air
Carbon tetrachloride	S	1.7 E-5	6.6 E-6	5.5 E-6	S	5.8 E-6	2.3 E-6	1.9 E-6	S	8.5 E-6	3.4 E-6	2.8 E-6
Chloroform	S	2.2 E-5	8.9 E-6	7.4 E-6	S	2.7 E-4	1.1 E-4	8.9 E-5	S	5.8 E-6	2.3 E-6	1.9 E-6
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--
Chemical	GNC1-JS15				GNC1-JS18							
	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air	Method	Residential Indoor Air	Commercial Indoor Air	Outdoor Air				
Carbon tetrachloride	S	4.6 E-6	1.8 E-6	1.5 E-6	S	4.1 E-6	1.7 E-6	1.4 E-6				
Chloroform	S	4.6 E-6	1.8 E-6	1.5 E-6	S	4.7 E-5	1.9 E-5	1.6 E-5				
Tetrachloroethene	--	--	--	--	S	2.3 E-6	9.0 E-7	7.6 E-7				
Trichloroethene	--	--	--	--	S	1.5 E-6	5.9 E-7	4.9 E-7				

**Notes:**

All units in mg/m<sup>3</sup>.

Method represents the surface flux measurement used in the risk calculations for that particular chemical/location: S = SIM; F = Full Scan.

See Appendix H for all indoor and outdoor air concentration calculations from surface flux measurement data. See Table 6-6 for outdoor air exposure point concentrations for non-volatile COPCs in soil.

Exposure point concentrations for surface flux data are based on a sample by sample basis. Averaging of the data was not conducted. Therefore only those chemicals detected in a particular sample were included in the risk estimates. A "--" is presented for those chemical not detected and not included in the risk estimates for each sample location. The exposure point concentration is the maximum of the full scan or SIM analysis results (when both had detected values, otherwise the detected value from one or the other is used). Thus, summary statistics are not presented in this table (see Table 3-14 for the surface flux data summary).

**TABLE 6-4**  
**PARTICULATE EMISSION FACTOR (PEF) FOR ON-SITE RESIDENTIAL SCENARIO**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Parameter	Abbrev.	Units	Value
<b>Wind Erosion and Construction Activities</b>			
Fraction of vegetative cover <sup>(1)</sup>	V	--	0.5
Mean annual wind speed <sup>(2)</sup>	U <sub>m</sub>	m/s	4.10
Equivalent threshold value of wind speed <sup>(1)</sup>	U <sub>t</sub>	m/s	11.32
Function dependent on U/U <sub>t</sub> <sup>(1)</sup>	F(x)	--	0.19
<b>Air Dispersion Factor for Area Source<sup>(4)</sup></b>			
	Q/C <sub>wind</sub>	g/m <sup>2</sup> -sec per kg/m <sup>3</sup>	37.71
Constant A <sup>(1)</sup>	A	--	13.31
Constant B <sup>(1)</sup>	B	--	19.84
Constant C <sup>(1)</sup>	C	--	230.17
Areal Extent of site surface contamination <sup>(3)</sup>	A <sub>surf</sub>	acres	78
<b>Onsite Residential PEF<sup>(5)</sup></b>			
	PEF <sub>Onsite Resident</sub>	m <sup>3</sup> /kg	8.18E+08
<b>Total outdoor ambient air dust concentration<sup>(6)</sup></b>			
	D <sub>Onsite Resident</sub>	kg/m <sup>3</sup>	1.22E-09

(1) Assumed value for the site based upon USEPA (2002b). Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.

Office of Solid Waste and Emergency Response, Washington, DC. OSWER 9355.4-24. December.

(2) Derived by averaging data from the Las Vegas Airport and Nellis AFB stations.

(3) Site area.

(4) From USEPA 2002b -  $Q/C_{sa} = A \times \exp[(\ln(A_{surf}) - B)^2/C]$ .

$$\{[2.6 \times (s/12)^{0.8} \times (W/3)^{0.4}/(M/0.2)^{0.3}] \times [(365-p)/365] \times 281.9 \times \sum VKT_{road}\}.$$

(5) From USEPA 2002b -  $PEF_{Onsite Resident} = Q/C_{wind} * (3600/(0.036*(1-V)*((U_m/U_t)^3)*F(x)))$

(6)  $D_{Onsite Resident} = 1/PEF_{Onsite Resident}$

**TABLE 6-5**  
**PARTICULATE EMISSION FACTOR (PEF) FOR CONSTRUCTION SCENARIO**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**

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Parameter	Abbrev.	Units	Value
<b>Wind Erosion and Construction Activities</b>			
<b>Fugitive dust from wind erosion<sup>(1)</sup></b>	$M_{wind}$	g	<b>9.2E+05</b>
Fraction of vegetative cover <sup>(2)</sup>	V	--	0.00
Mean annual wind speed <sup>(3)</sup>	$U_m$	m/s	4.10
Equivalent threshold value of wind speed <sup>(2)</sup>	$U_t$	m/s	11.32
Function dependent on $U/U_t$ <sup>(2)</sup>	F(x)	--	0.194
Areal Extent of site surface contamination <sup>(4)</sup>	$A_{surf}$	m <sup>2</sup>	315,666
Exposure duration <sup>(5)</sup>	ED	year	1
<b>Fugitive dust from excavation soil dumping<sup>(6)</sup></b>	$M_{excav}$	g	<b>1.0E+05</b>
In situ wet soil bulk density <sup>(7)</sup>	$\rho_{soil}$	Mg/m <sup>3</sup>	1.78
Gravimetric Soil Moisture Content % <sup>(8)</sup>	M	%	4.21
Areal extent of site excavation <sup>(9)</sup>	$A_{excav}$	m <sup>2</sup>	63133.20
Average depth of site excavation <sup>(2)</sup>	$d_{excav}$	m	1.00
Number of times soil is dumped <sup>(2)</sup>	$N_A$	--	2.00
<b>Fugitive dust from dozing<sup>(10)</sup></b>	$M_{doz}$	g	<b>3.0E+04</b>
Soil silt content % <sup>(7)</sup>	s	%	7.32
Gravimetric Soil Moisture Content % <sup>(8)</sup>	M	%	4.21
Average dozing speed <sup>(2)</sup>	$S_{doz}$	km/hr	11.40
Number of times area is dozed	$N_{doze}$	--	3.00
Length of dozer blade	$B_d$	m	2.44
Sum dozing kilometers traveled <sup>(11)</sup>	$VKT_{doz}$	km	388.11
<b>Fugitive dust from grading<sup>(12)</sup></b>	$M_{grade}$	g	<b>1.7E+05</b>
Average grading speed <sup>(2)</sup>	$S_{grade}$	km/hr	11.40
Number of times area is graded	$N_{grade}$	--	3.00
Length of grading blade	$B_g$	m	2.44
Sum grading kilometers traveled <sup>(12)</sup>	$VKT_{grade}$	km	388.11

**TABLE 6-5**  
**PARTICULATE EMISSION FACTOR (PEF) FOR CONSTRUCTION SCENARIO**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
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Parameter	Abbrev.	Units	Value
Fugitive dust from tilling <sup>(13)</sup>	M <sub>till</sub>	g	4.6E+04
Soil silt content % <sup>(7)</sup>	s	%	7.32
Areal extent of site tilling <sup>(9)</sup>	A <sub>till</sub>	acre	15.60
Number of times soil is tilled <sup>(2)</sup>	N <sub>A</sub>	--	2.00
<b>Total Time Averaged PM<sub>10</sub> Emission<sup>(14)</sup></b>	<b>J'<sub>T</sub></b>	<b>g/m<sup>2</sup>-sec</b>	<b>1.27E-07</b>
Duration of construction <sup>(2)</sup>	T	sec	3.15E+07
<b>Subchronic Dispersion Factor for Area Source<sup>(15)</sup></b>	<b>Q/C<sub>sa</sub></b>	<b>g/m<sup>2</sup>-sec per kg/m<sup>3</sup></b>	<b>6.18</b>
Constant A <sup>(2)</sup>	A	--	2.45
Constant B <sup>(2)</sup>	B	--	17.57
Constant C <sup>(2)</sup>	C	--	189.04
Areal Extent of site surface contamination <sup>(4)</sup>	A <sub>surf</sub>	acres	78.0
<b>Dispersion correction factor<sup>(16)</sup></b>	<b>F<sub>D</sub></b>	<b>--</b>	<b>0.186</b>
Duration of construction (time period during which construction activities occur)	t <sub>c</sub>	hr	8760
<b>Subchronic PEF for Construction Activities<sup>(17)</sup></b>	<b>PEF<sub>sc</sub></b>	<b>m<sup>3</sup>/kg</b>	<b>2.62E+08</b>
<b>Unpaved Road Traffic</b>			
Length of road segment <sup>(18)</sup>	L <sub>R</sub>	m	561.84
Width of road segment <sup>(2)</sup>	W <sub>R</sub>	m	6.10
Surface area of contaminated road segment <sup>(19)</sup>	A <sub>R</sub>	m <sup>2</sup>	3424.99
Road surface silt content % <sup>(20)</sup>	s	%	7.32
Mean vehicle weight <sup>(2)</sup>	W	tons	8.00
Percent moisture in dry road surface <sup>(20)</sup>	M	%	3.52
Number of days/year with at least 0.01 inches of precipitation <sup>(3)</sup>	p	days	27.00
Number of vehicles for duration of construction	N <sub>V</sub>	vehicles	30.00
Length of road traveled per day	L <sub>D</sub>	m/day	561.84
Sum of fleet vehicle kilometers traveled during the exposure duration <sup>(21)</sup>	VKT <sub>road</sub>	km	2191.18

**TABLE 6-5**  
**PARTICULATE EMISSION FACTOR (PEF) FOR CONSTRUCTION SCENARIO**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
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Parameter	Abbrev.	Units	Value
Subchronic Dispersion Factor for road segment <sup>(22)</sup>	Q/C <sub>sr</sub>	g/m <sup>2</sup> -sec per kg/m <sup>3</sup>	13.28
Constant A <sup>(2)</sup>	A		12.94
Constant B <sup>(2)</sup>	B		5.74
Constant C <sup>(2)</sup>	C		71.77
Subchronic PEF for Unpaved Road Traffic <sup>(23)</sup>	PEF <sub>sc_road</sub>	m <sup>3</sup> /kg	1.23E+07
Total construction related PEF <sup>(24)</sup>	PEF <sub>sc_total</sub>	m <sup>3</sup> /kg	1.18E+07
Total outdoor ambient air dust concentration <sup>(25)</sup>	D <sub>construct</sub>	kg/m <sup>3</sup>	8.50E-08

(1) From USEPA. (2002b). Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Solid Waste and Emergency Response, Washington, DC. OSWER 9355.4-24. December. -  $M_{wind} = 0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x) \times A_{surf} \times ED \times 8760\text{hr/yr}$ .

(2) Assumed value for the site based upon USEPA (2002b).

(3) Derived by averaging data from the Las Vegas Airport and Nellis AFB stations.

(4) Site area.

(5) Construction worker ED

(6) From USEPA 2002b -  $M_{excav} = 0.35 \times 0.0016 \times [(U_m/2.2)^{1.3}/(M/2)^{1.4}] \times \rho_{soil} \times A_{excav} \times d_{excav} \times N_A \times 10^3\text{g/kg}$ .

(7) This value can change based on site specific characteristics

(8) Based on the average of percent moisture across the site.

(9) Assumed value of one fifth of the site based upon USEPA (2002b).

(10) From USEPA 2002b -  $M_{doz} = 0.75 \times [(0.45 \times s^{1.5})/(M)^{1.4}] \times \sum VKT_{doz}/S_{doz} \times 10^3\text{g/kg}$ .

(11) From USEPA 2002b -  $VKT_{doz} = [(A_{surf}^{0.5}/2.44\text{m}) \times A_{surf}^{0.5} \times 3]/1,000\text{ m/km}$ .

(12) From USEPA 2002b -  $M_{grade} = 0.60 \times (0.0056 \times S^{2.0}) \times \sum VKT_{grade} \times 10^3\text{g/kg}$ .

(13) From USEPA 2002b -  $M_{fill} = 1.1 \times s^{0.6} \times A_{fill} \times 4,047\text{m}^2/\text{acre} \times 10^{-4}\text{ha/m}^2 \times 10^3\text{g/kg} \times N_A$ .

(14) From USEPA 2002b -  $J'_T = (M_{wind} + M_{excav} + M_{doz} + M_{grade} + M_{fill})/(A_{surf} \times T)$ .

(15) From USEPA 2002b -  $Q/C_{sa} = A \times \exp[(\ln(A_{surf}) - B)^2/C]$ .

(16) From USEPA 2002b -  $F_D = 0.1852 + (5.3537/t_c) + (-9.6318/t_c^2)$ ,  $t_c = T/(3,600\text{sec}/\text{hour})$ .

(17) From USEPA 2002b -  $PEF_{sc} = Q/C_{sa} \times (1/F_D) \times (1/J'_T)$ .

(18) Assumed value of the square root of the site area, based upon USEPA (2002b).

(19) From USEPA 2002b -  $A_R = L_R \times W_R \times 0.092903\text{ m}^2/\text{ft}^2$

(20) Average of surface soil percent moisture results.

(21) From USEPA 2002b -  $VKT_{road} = 30\text{ vehicles} \times L_R \times [(52\text{ wks}/\text{yr})/2] \times (5\text{ days}/\text{week}) / (1000\text{ m}/\text{km})$ .

(22) From USEPA 2002b -  $Q/C_{sr} = A \times \exp[(\ln(A_{surf}) - B)^2/C]$ .

(23) From USEPA 2002b -  $PEF_{sc\_road} = Q/C_{sr} \times (1/F_D) \times T \times A_R / \{ [2.6 \times (s/12)^{0.8} \times (W/3)^{0.4}/(M/0.2)^{0.3}] \times [(365-p)/365] \times 281.9 \times \sum VKT_{road} \}$ .

(24)  $PEF_{sc\_total} = \{ 1/[(1/PEF_{sc}) + (1/PEF_{sc\_road})] \}$ .

(25)  $D_{construct} = 1/PEF_{sc\_total}$ .

**TABLE 6-6**  
**OUTDOOR AIR EXPOSURE POINT CONCENTRATIONS FROM SOIL**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
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Chemical	Soil Conc. (mg/kg)	Construction Worker Outdoor Air		Non-Construction Worker Outdoor Air	
		PEF/VF <sup>(1)</sup> (kg/m <sup>3</sup> )	Air Conc. <sup>(2)</sup> (mg/m <sup>3</sup> )	PEF/VF <sup>(3)</sup> (kg/m <sup>3</sup> )	Air Conc. <sup>(2)</sup> (mg/m <sup>3</sup> )
<i>Inorganics</i>					
Aluminum	1.2 E+4	7.7 E-8	9.1 E-4	1.2 E-9	1.4 E-5
Arsenic	6.6 E+0	7.7 E-8	5.1 E-7	1.2 E-9	8.1 E-9
Lithium	2.2 E+1	7.7 E-8	1.7 E-6	1.2 E-9	2.7 E-8
Manganese	7.4 E+2	7.7 E-8	5.7 E-5	1.2 E-9	9.0 E-7
Perchlorate	1.0 E+0	7.7 E-8	7.8 E-8	1.2 E-9	1.2 E-9
Strontium	6.8 E+2	7.7 E-8	5.3 E-5	1.2 E-9	8.4 E-7
Vanadium	5.5 E+1	7.7 E-8	4.2 E-6	1.2 E-9	6.7 E-8
<i>Polynuclear Aromatic Hydrocarbons</i>					
Benzo(a)anthracene	1.4 E-3	7.7 E-8	1.1 E-10	1.2 E-9	1.8 E-12
Benzo(a)pyrene	2.4 E-3	7.7 E-8	1.9 E-10	1.2 E-9	2.9 E-12
Benzo(b)fluoranthene	6.9 E-3	7.7 E-8	5.3 E-10	1.2 E-9	8.4 E-12
Benzo(k)fluoranthene	1.4 E-3	7.7 E-8	1.1 E-10	1.2 E-9	1.8 E-12
Chrysene	4.2 E-3	7.7 E-8	3.3 E-10	1.2 E-9	5.2 E-12
Dibenzo(a,h)anthracene	5.1 E-3	7.7 E-8	3.9 E-10	1.2 E-9	6.2 E-12
Indeno(1,2,3-cd)pyrene	1.7 E-3	7.7 E-8	1.3 E-10	1.2 E-9	2.0 E-12

**Notes:**

- (1) Construction worker PEF from Table 6-5.
- (2) Soil concentration × PEF.
- (3) Non-construction PEF from Table 6-4.

**TABLE 6-7**  
**PLANT UPTAKE FACTORS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Chemical	Aboveground Plant <sup>1</sup> Uptake Factor mg/kg plant DW/mg/kg soil	Belowground Plant <sup>1</sup> Uptake Factor mg/kg plant DW/mg/kg soil	Reference
<i>Inorganics</i>			
Aluminum	4.0 E-3	6.5 E-4	Baes et al 1984
Arsenic	6.3 E-3	8.0 E-3	USEPA 2005
Lithium	2.5 E-2	4.0 E-3	Baes et al 1984
Manganese	2.5 E-1	5.0 E-2	Baes et al 1984
Perchlorate	NA	NA	see text
Strontium	2.5 E+0	2.5 E-1	Baes et al 1984
Vanadium	5.5 E-3	3.0 E-3	Baes et al 1984
<i>Semi-Volatile Organic Compounds</i>			
Benzo(a)anthracene	2.0 E-2	3.0 E-3	USEPA 2005b
Benzo(a)pyrene	1.1 E-2	2.6 E-3	USEPA 2005b
Benzo(b)fluoranthene	1.0 E-2	2.4 E-3	USEPA 2005b
Benzo(k)fluoranthene	1.0 E-2	2.4 E-3	USEPA 2005b
Chrysene	1.9 E-2	3.3 E-3	USEPA 2005b
Dibenzo(a,h)anthracene	4.9 E-3	2.0 E-2	USEPA 2005b
Indeno(1,2,3-cd)pyrene	3.9 E-3	3.1 E-3	USEPA 2005b

(1) Calculations were performed as identified in the BRC Closure Plan (BRC, ERM, and DBS&A 2007) as shown in USEPA 2005b - Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

**TABLE 6-8**  
**RESIDENTIAL EXPOSURE FACTORS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
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Parameter	Abbrev.	Value	Units	Reference
Dermal absorption fraction	ABS	---chemical-specific---		see text
Soil-plant bioconcentration factors	Br	---chemical-specific---		see text
Dermal adherence factor, adult	AF <sub>a</sub>	0.07	mg/cm <sup>2</sup>	Closure Plan
Dermal adherence factor, child	AF <sub>c</sub>	0.2	mg/cm <sup>2</sup>	Closure Plan
Averaging time, carcinogenic	AT <sub>c</sub>	70	years	Closure Plan
Averaging time, carcinogenic (inhalation)	AT <sub>c</sub>	613200	hours	Closure Plan
Averaging time, non-carcinogenic	AT <sub>nc</sub>	6	years	Closure Plan
Averaging time, non-carcinogenic (inhalation)	AT <sub>nc</sub>	52560	hours	Closure Plan
Adult body weight	BW <sub>a</sub>	70	kg	Closure Plan
Child body weight	BW <sub>c</sub>	15	kg	Closure Plan
Exposure frequency	EF <sub>r</sub>	350	days/year	Closure Plan
Exposure duration - child	ED <sub>rc</sub>	6	years	Closure Plan
Exposure duration - child (inhalation)	ED <sub>rc</sub>	52560	hours	Closure Plan
Exposure duration - adult (for age-weighted)	ED <sub>n</sub>	24	years	Closure Plan
Exposure duration - adult (for age-weighted; inhalation)	ED <sub>n</sub>	210240	hours	Closure Plan
Exposure duration	ED <sub>r</sub>	30	years	Closure Plan
Exposure duration (inhalation)	ED <sub>r</sub>	262800	hours	Closure Plan
Exposure time - outdoors (inhalation only)	ET <sub>o</sub>	2.0	hours	Closure Plan
Exposure time - indoors (inhalation only)	ET <sub>i</sub>	16.7	hours	Closure Plan
Dilution factor for outdoor-to-indoor air	DF <sub>i</sub>	0.4	unitless	Closure Plan
Available skin surface area, adult	SA <sub>a</sub>	5,700	cm <sup>2</sup> /day	Closure Plan
Available skin surface area, child	SA <sub>c</sub>	2,800	cm <sup>2</sup> /day	Closure Plan
Fruit/vegetable ingestion rate, aboveground, child	CR <sub>ag,c</sub>	0.0179	kg DW/d	Closure Plan
Fruit/vegetable ingestion rate, belowground, child	CR <sub>bg,c</sub>	0.0033	kg DW/d	Closure Plan
Fruit/vegetable ingestion rate, aboveground, adult	CR <sub>ag,a</sub>	0.0609	kg DW/d	Closure Plan
Fruit/vegetable ingestion rate, belowground, adult	CR <sub>bg,a</sub>	0.0098	kg DW/d	Closure Plan
Contaminated plant fraction from the site	CPF	0.25	--	Closure Plan
Adult soil ingestion rate	IR <sub>a,s</sub>	100	mg/day	Closure Plan
Child soil ingestion rate	IR <sub>c,s</sub>	200	mg/day	Closure Plan
Soil ingestion, noncancer	--	1.28 E-5	day <sup>-1</sup>	Calculated
Soil ingestion, cancer	--	1.57 E-6	day <sup>-1</sup>	Calculated
Soil dermal contact, noncancer	--	3.58 E-5	day <sup>-1</sup>	Calculated
Soil dermal contact, cancer	--	4.94 E-6	day <sup>-1</sup>	Calculated
Inhalation, soil-dust, outdoor, noncancer	--	7.99 E-2	unitless	Calculated
Inhalation, soil-dust, outdoor, cancer	--	3.42 E-2	unitless	Calculated
Inhalation, soil-volatiles, outdoor, noncancer	--	7.99 E-2	unitless	Calculated
Inhalation, soil-volatiles, outdoor, cancer	--	3.42 E-2	unitless	Calculated
Fruit/Vegetable ingestion, noncancer - aboveground	--	2.86 E-4	day <sup>-1</sup>	Calculated
Fruit/Vegetable ingestion, noncancer - belowground	--	5.27 E-5	day <sup>-1</sup>	Calculated
Fruit/Vegetable ingestion, cancer - aboveground	--	9.60 E-5	day <sup>-1</sup>	Calculated
Fruit/Vegetable ingestion, cancer - belowground	--	1.60 E-5	day <sup>-1</sup>	Calculated
Inhalation, soil-dust, indoor, noncancer	--	2.67 E-1	unitless	Calculated
Inhalation, soil-dust, indoor, cancer	--	1.14 E-1	unitless	Calculated

**TABLE 6-9**  
**WORKERS EXPOSURE FACTORS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 1)

Parameter	Abbrev.	Value	Units	Reference
Dermal absorption fraction	ABS	---chemical-specific---		see text
Maintenance worker dermal adherence factor	AF <sub>mw</sub>	0.2	mg/cm <sup>2</sup>	Closure Plan
Commercial worker dermal adherence factor	AF <sub>cmw</sub>	NA	mg/cm <sup>2</sup>	Closure Plan
Construction worker dermal adherence factor	AF <sub>cw</sub>	0.3	mg/cm <sup>2</sup>	Closure Plan
Averaging time, carcinogenic	AT <sub>c</sub>	70	years	Closure Plan
Averaging time, carcinogenic (inhalation)	AT <sub>c</sub>	613200	hours	Closure Plan
Averaging time, non-carcinogenic, maintenance/commercial worker	AT <sub>nc</sub>	25	years	Closure Plan
Averaging time, non-carcinogenic, maintenance/commercial worker (inhalation)	AT <sub>nc</sub>	219000	hours	Closure Plan
Averaging time, non-carcinogenic, construction worker	AT <sub>nc,c</sub>	1	years	Closure Plan
Averaging time, non-carcinogenic, construction worker (inhalation)	AT <sub>nc,c</sub>	8760	hours	Closure Plan
Adult body weight	BW <sub>a</sub>	70	kg	Closure Plan
Maintenance worker exposure frequency	EF <sub>mw</sub>	225	days/year	Closure Plan
Commercial worker exposure frequency	EF <sub>cmw</sub>	250	days/year	Closure Plan
Construction worker exposure frequency	EF <sub>cmw</sub>	250	days/year	Closure Plan
Exposure duration, maintenance/commercial worker	ED	25	years	Closure Plan
Exposure duration, maintenance/commercial worker (inhalation)	ED	219000	hours	Closure Plan
Exposure duration, construction worker	ED	1	years	Closure Plan
Exposure duration, construction worker (inhalation)	ED	8760	hours	Closure Plan
Maintenance worker exposed surface area	SA <sub>mw</sub>	3,300	cm <sup>2</sup> /day	Closure Plan
Construction worker exposed surface area	SA <sub>mw</sub>	3,300	cm <sup>2</sup> /day	Closure Plan
Commercial worker exposed surface area	SA <sub>cmw</sub>	NA	cm <sup>2</sup> /day	Closure Plan
Maintenance worker soil ingestion rate	IR <sub>s,mw</sub>	100	mg/day	Closure Plan
Commercial worker soil ingestion rate	IR <sub>s,cmw</sub>	50	mg/day	Closure Plan
Construction worker soil ingestion rate	IR <sub>s,cmw</sub>	330	mg/day	Closure Plan
Commercial worker exposure time, indoors	ET <sub>cmw,i</sub>	8	based on 8 hr/d	Closure Plan
Commercial worker exposure time, outdoors	ET <sub>cmw,o</sub>	0	indoor worker	Closure Plan
Maintenance worker exposure time, indoors	ET <sub>mw,i</sub>	0	outdoor worker	Closure Plan
Maintenance worker exposure time, outdoors	ET <sub>mw,o</sub>	8	based on 8 hr/d	Closure Plan
Soil ingestion, non-cancer, commercial worker	--	4.89 E-7	day <sup>-1</sup>	Calculated
Soil ingestion, cancer, commercial worker	--	1.75 E-7	day <sup>-1</sup>	Calculated
Soil ingestion, non-cancer, maintenance worker	--	8.81 E-7	day <sup>-1</sup>	Calculated
Soil ingestion, cancer, maintenance worker	--	3.15 E-7	day <sup>-1</sup>	Calculated
Soil dermal contact, non-cancer, maintenance worker	--	5.81 E-6	day <sup>-1</sup>	Calculated
Soil dermal contact, cancer, maintenance worker	--	2.08 E-6	day <sup>-1</sup>	Calculated
Inhalation, fugitive-dust, outdoor, non-cancer, maintenance worker	--	2.05 E-1	unitless	Calculated
Inhalation, fugitive-dust, outdoor, cancer, maintenance worker	--	7.34 E-2	unitless	Calculated
Soil ingestion, noncancer, construction worker	--	3.23 E-6	day <sup>-1</sup>	Calculated
Soil ingestion, cancer, construction worker	--	4.61 E-8	day <sup>-1</sup>	Calculated
Soil dermal contact, noncancer, construction worker	--	9.69 E-6	day <sup>-1</sup>	Calculated
Soil dermal contact, cancer, construction worker	--	1.38 E-7	day <sup>-1</sup>	Calculated
Inhalation, soil-dust, outdoor, noncancer, construction worker	--	2.28 E-1	unitless	Calculated
Inhalation, soil-dust, outdoor, cancer, construction worker	--	3.26 E-3	unitless	Calculated

Note: Exposure parameters for maintenance workers and commercial workers are based on outdoor and indoor commercial/industrial worker exposure factors, respectively, from USEPA, 2002b.

**TABLE 6-10**  
**TOXICITY CRITERIA FOR SURFACE FLUX**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 1)

Compound	Cancer		Non-Cancer	
	IUR		RfC	
	1/( $\mu\text{g}/\text{m}^3$ )		( $\text{mg}/\text{m}^3$ )	
Carbon tetrachloride	6.0 E-6	I	1.0 E-1	I
Chloroform	2.3 E-5	I	9.8 E-2	A
Tetrachloroethene	2.6 E-7	I	4.0 E-2	I
Trichloroethene	4.1 E-6	I	2.0 E-3	I

Key:

A = ATSDR

I = IRIS (USEPA 2013)

**TABLE 6-11**  
**NON-CANCER TOXICITY CRITERIA FOR SOIL**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 1)

Chemical	Inhalation - Chronic		Inhalation - Subchronic		Oral <sup>(1)</sup> - Chronic		Oral <sup>(1)</sup> - Subchronic		Oral BIO	Dermal ABS <sup>(2)</sup>
	Value (mg/m <sup>3</sup> )	Reference	Value (mg/m <sup>3</sup> )	Reference	Value (mg/kg/day)	Reference	Value (mg/kg/day)	Reference		
<b><u>Inorganics</u></b>										
Aluminum	5.0 E-3	PPRTV	5.0 E-3	Chronic	1.0 E+0	PPRTV	1.0 E+0	Chronic	1.0	NA
Arsenic	1.5 E-5	Cal/EPA	1.5 E-5	Chronic	3.0 E-4	USEPA 2013	3.0 E-4	Chronic	0.3	NA
Lithium	NA		NA		2.0 E-3	PPRTV	2.0 E-3	Chronic	1.0	NA
Manganese	5.0 E-5	USEPA 2013	5.0 E-5	Chronic	1.4 E-1	USEPA 2013	1.4 E-1	Chronic	1.0	NA
Perchlorate	NA		NA		7.0 E-4	USEPA 2013	7.0 E-4	Chronic	1.0	NA
Strontium	NA		NA		6.0 E-1	USEPA 2013	6.0 E-1	Chronic	1.0	NA
Vanadium	NA		NA		5.0 E-3	USEPA 2013	5.0 E-3	Chronic	1.0	NA
<b><u>Organic Compounds</u></b>										
Benzo(a)anthracene	NA		NA		3.0 E-2	pyrene as surrogate	3.0 E-2	Chronic	1.0	0.13
Benzo(a)pyrene	NA		NA		3.0 E-2	pyrene as surrogate	3.0 E-2	Chronic	1.0	0.13
Benzo(b)fluoranthene	NA		NA		3.0 E-2	pyrene as surrogate	3.0 E-2	Chronic	1.0	0.13
Benzo(k)fluoranthene	NA		NA		3.0 E-2	pyrene as surrogate	3.0 E-2	Chronic	1.0	0.13
Dibenzo(a,h)anthracene	NA		NA		3.0 E-2	pyrene as surrogate	3.0 E-2	Chronic	1.0	0.13
Chrysene	NA		NA		3.0 E-2	pyrene as surrogate	3.0 E-2	Chronic	1.0	0.13
Indeno(1,2,3-cd)pyrene	NA		NA		3.0 E-2	pyrene as surrogate	3.0 E-2	Chronic	1.0	0.13

**Notes**

Values obtained from NDEP (2013).

NA = Not applicable. Data is either not applicable for this chemical or not available.

BIO = bioavailability.

ABS = dermal absorption efficiency.

PPRTV = USEPA Provisional Peer Reviewed Toxicity Values.

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

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

**TABLE 6-12**  
**CANCER TOXICITY CRITERIA FOR SOIL**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 1)

Chemical	Inhalation		Oral <sup>(1)</sup>		Oral BIO	Dermal ABS <sup>(2)</sup>
	Value ( $\mu\text{g}/\text{m}^3$ ) <sup>-1</sup>	Reference	Value ( $\text{mg}/\text{kg}\text{-day}$ ) <sup>-1</sup>	Reference		
<u>Inorganics</u>						
Aluminum	NA		NA		1.0	NA
Arsenic	4.3 E-3	USEPA 2013	1.5 E+0	USEPA 2013	0.3	NA
Lithium	NA		NA		1.0	NA
Manganese	NA		NA		1.0	NA
Perchlorate	NA		NA		1.0	NA
Strontium	NA		NA		1.0	NA
Vanadium	NA		NA		1.0	NA
<u>Organic Compounds</u>						
Benzo(a)anthracene	1.1 E-4	OEHHA 2013	7.3 E-1	USEPA 1993	1.0	0.13
Benzo(a)pyrene	1.1 E-3	OEHHA 2013	7.3 E+0	USEPA 1993	1.0	0.13
Benzo(b)fluoranthene	1.1 E-4	OEHHA 2013	7.3 E-1	USEPA 1993	1.0	0.13
Benzo(k)fluoranthene	1.1 E-4	OEHHA 2013	7.3 E-2	USEPA 1993	1.0	0.13
Chrysene	1.1 E-5	OEHHA 2013	7.3 E-3	USEPA 1993	1.0	0.13
Dibenzo(a,h)anthracene	1.2 E-3	OEHHA 2013	7.3 E+0	USEPA 1993	1.0	0.13
Indeno(1,2,3-cd)pyrene	1.1 E-4	OEHHA 2013	7.3 E-1	USEPA 1993	1.0	0.13

**Notes**

Values obtained from NDEP (2013).

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

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

ABS = dermal absorption efficiency.

OEHHA = California Office of Environmental Health Hazard Assessment.

(1) No COPCs required oral toxicity criteria adjustment for the dermal soil exposure pathway (USEPA 2004e).

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

**TABLE 6-13**  
**TARGET ORGANS FOR NON-CARCINOGENS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 2)

Chemical	Oral/Dermal					
	Primary Target Organ	Reference	Secondary <sup>(1)</sup> Target Organ	Reference	Tertiary <sup>(1)</sup> Target Organ	Reference
<b><u>Inorganics</u></b>						
Aluminum	CNS	ORNL 2013	Reproduction	ORNL 2013	NA	
Arsenic	Skin	ORNL 2013	CNS	ORNL 2013		
Lithium	CNS	ORNL 2013	Developmental	ORNL 2013		
Manganese	CNS	USEPA 2013	Reproduction	ORNL 2013	NA	
Perchlorate	Thyroid	USEPA 2013	NA		NA	
Strontium	Bone	USEPA 2013	NA		NA	
Vanadium	Kidney	ORNL 2013	Gastrointestinal	ORNL 2013	Blood	ORNL 2013
<b><u>Organic Compounds</u></b>						
Benzo(a)anthracene	Kidney	Pyrene	Liver	Pyrene	Blood	Pyrene
Benzo(a)pyrene	Kidney	Pyrene	Liver	Pyrene	Blood	Pyrene
Benzo(b)fluoranthene	Kidney	Pyrene	Liver	Pyrene	Blood	Pyrene
Benzo(k)fluoranthene	Kidney	Pyrene	Liver	Pyrene	Blood	Pyrene
Chrysene	Kidney	Pyrene	Liver	Pyrene	Blood	Pyrene
Dibenzo(a,h)anthracene	Kidney	Pyrene	Liver	Pyrene	Blood	Pyrene
Indeno(1,2,3-cd)pyrene	Kidney	Pyrene	Liver	Pyrene	Blood	Pyrene

Note: Target organs are not included for the surface flux COPCs.

(1) According to ORNL (2013), all three target organs identified are considered primary target organs.

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

CNS - Central Nervous System

IRIS - USEPA's Integrated Risk Information System. (<http://cfpub.epa.gov/ncea/iris/index.cfm>).

ORNL - Oak Ridge National Laboratory ([http://rais.ornl.gov/tools/tox\\_profiles.html](http://rais.ornl.gov/tools/tox_profiles.html)).

**TABLE 6-13**  
**TARGET ORGANS FOR NON-CARCINOGENS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 2 of 2)

Chemical	Inhalation					
	Primary Target Organ	Reference	Secondary <sup>(1)</sup> Target Organ	Reference	Tertiary <sup>(1)</sup> Target Organ	Reference
<b><u>Inorganics</u></b>						
Aluminum	Respiratory system	ORNL 2013	NA		NA	
Arsenic	Skin	ORNL 2013	CNS	ORNL 2013		
Lithium	Respiratory system	ORNL 2013				
Manganese	CNS	ORNL 2013	Respiratory System	ORNL 2013	Reproduction	ORNL 2013
Perchlorate	NA		NA		NA	
Strontium	NA		NA		NA	
Vanadium	NA		NA		NA	
<b><u>Organic Compounds</u></b>						
Benzo(a)anthracene	NA		NA		NA	
Benzo(a)pyrene	NA		NA		NA	
Benzo(b)fluoranthene	NA		NA		NA	
Benzo(k)fluoranthene	NA		NA		NA	
Chrysene	NA		NA		NA	
Dibenzo(a,h)anthracene	NA		NA		NA	
Indeno(1,2,3-cd)pyrene	NA		NA		NA	

Note: Target organs are not included for the surface flux COPCs.

(1) According to ORNL (2013), all three target organs identified are considered primary target organs.

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

CNS - Central Nervous System

IRIS - USEPA's Integrated Risk Information System. (<http://cfpub.epa.gov/ncea/iris/index.cfm>).

ORNL - Oak Ridge National Laboratory ([http://rais.ornl.gov/tools/tox\\_profiles.html](http://rais.ornl.gov/tools/tox_profiles.html)).

**TABLE 6-14**  
**CHEMICAL RISK SUMMARY FOR RESIDENTIAL RECEPTORS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 1)

Receptor	HI	Target Organ	Target Organ HIs	ILCR
<b>Future On-Site Resident</b>				
Soil, Dermal, Homegrown Produce and Dust	2.1	--	--	1 E-5
Volatile Inhalation (from Flux) <sup>(1)</sup>	0.0037	--	--	2 E-6
Combined	2.1	--	--	1 E-5

Chemical	Soil Conc. (mg/kg)	Oral HQ	Dermal HQ	Homegrown Produce HQ	Indoor Dust Inhal HQ	Outdoor Dust Inhal HQ	Total HI	Oral ILCR	Dermal ILCR	Homegrown Produce ILCR	Indoor Dust Inhal ILCR	Outdoor Dust Inhal ILCR	Total ILCR
<i>Inorganics</i>													
Aluminum	11830	1.5 E-1	NA	1.4 E-2	7.7 E-4	2.3 E-4	1.7 E-1	NA	NA	NA	NA	NA	NA
Arsenic	6.6	8.5 E-2	NA	4.9 E-2	1.4 E-4	4.3 E-5	1.3 E-1	5 E-6	NA	7 E-6	4 E-9	1 E-9	1 E-5
Lithium	22	1.4 E-1	NA	8.0 E-2	NA	NA	2.2 E-1	NA	NA	NA	NA	NA	NA
Manganese	736	2.0 E-1	NA	3.9 E-1	4.8 E-3	1.4 E-3	6.0 E-1	NA	NA	NA	NA	NA	NA
Perchlorate	1.0	1.9 E-2	NA	NA	NA	NA	1.9 E-2	NA	NA	NA	NA	NA	NA
Strontium	685	1.5 E-2	NA	8.3 E-1	NA	NA	8.5 E-1	NA	NA	NA	NA	NA	NA
Vanadium	55	1.4 E-1	NA	1.9 E-2	NA	NA	1.6 E-1	NA	NA	NA	NA	NA	NA
<i>Polynuclear Aromatic Hydrocarbons</i>													
Benzo(a)anthracene	0.0014	6.1 E-7	2.2 E-7	2.8 E-7	NA	NA	1.1 E-6	2 E-9	7 E-10	2 E-9	2 E-14	7 E-15	4 E-9
Benzo(a)pyrene	0.0024	1.0 E-6	3.7 E-7	2.6 E-7	NA	NA	1.7 E-6	3 E-8	1 E-8	2 E-8	4 E-13	1 E-13	6 E-8
Benzo(b)fluoranthene	0.0069	2.9 E-6	1.1 E-6	6.9 E-7	NA	NA	4.7 E-6	8 E-9	3 E-9	5 E-9	1 E-13	3 E-14	2 E-8
Benzo(k)fluoranthene	0.0014	6.1 E-7	2.2 E-7	1.5 E-7	NA	NA	9.8 E-7	2 E-10	7 E-11	1 E-10	2 E-14	7 E-15	3 E-10
Chrysene	0.0042	1.8 E-6	6.5 E-7	7.8 E-7	NA	NA	3.2 E-6	5 E-11	2 E-11	6 E-11	6 E-15	2 E-15	1 E-10
Dibenzo(a,h)anthracene	0.0051	2.2 E-6	7.8 E-7	4.1 E-7	NA	NA	3.3 E-6	6 E-8	2 E-8	3 E-8	8 E-13	3 E-13	1 E-7
Indeno(1,2,3-cd)pyrene	0.0017	7.1 E-7	2.6 E-7	7.0 E-8	NA	NA	1.0 E-6	2 E-9	8 E-10	5 E-10	3 E-14	8 E-15	3 E-9
<b>Total</b>		0.75	0.000004	1.4	0.0057	0.0017	2.1	5 E-6	4 E-8	7 E-6	4 E-9	1 E-9	1 E-5

HQ = hazard quotient

HI - hazard index

ILCR = incremental lifetime cancer risk

(1) Note that risk estimates for surface flux data were done on a sample-by-sample basis, therefore, risks are presented as a range. See Appendix H for sample-specific risk estimates.

**TABLE 6-15**  
**BACKGROUND RISK SUMMARY FOR RESIDENTIAL RECEPTORS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 1)

Receptor	HI	Target Organ	Target Organ HIs	ILCR
<b>Future On-Site Resident</b>				
Soil, Dermal, Homegrown Produce and Dust	1.2	--	--	8 E-6
Volatile Inhalation (from Flux) <sup>(1)</sup>	0.0037	--	--	2 E-6
Combined	1.2	--	--	1 E-5

Chemical	Soil Conc. (mg/kg)	Oral HQ	Dermal HQ	Homegrown Produce HQ	Indoor Dust Inha HQ	Outdoor Dust Inha HQ	Total HI	Oral ILCR	Dermal ILCR	Homegrown Produce ILCR	Indoor Dust Inha ILCR	Outdoor Dust Inha ILCR	Total ILCR
<i>Inorganics</i>													
Aluminum	9466	1.2 E-1	NA	1.1 E-2	6.2 E-4	1.8 E-4	1.3 E-1	NA	NA	NA	NA	NA	NA
Arsenic	4.4	5.6 E-2	NA	3.3 E-2	9.6 E-5	2.9 E-5	8.9 E-2	3 E-6	NA	5 E-6	3 E-9	8 E-10	8 E-6
Lithium	15	9.5 E-2	NA	5.5 E-2	NA	NA	1.5 E-1	NA	NA	NA	NA	NA	NA
Manganese	437	1.2 E-1	NA	2.3 E-1	2.9 E-3	8.5 E-4	3.5 E-1	NA	NA	NA	NA	NA	NA
Perchlorate	--	--	--	--	--	--	--	--	--	--	--	--	--
Strontium	257	5.5 E-3	NA	3.1 E-1	NA	NA	3.2 E-1	NA	NA	NA	NA	NA	NA
Vanadium	41	1.0 E-1	NA	1.4 E-2	NA	NA	1.2 E-1	NA	NA	NA	NA	NA	NA
<i>Polynuclear Aromatic Hydrocarbons</i>													
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	--	--	--	--	--	--	--	--
<b>Total</b>		0.50	NA	0.66	0.0036	0.0011	1.2	3 E-6	NA	5 E-6	3 E-9	8 E-10	<b>8 E-6</b>

HQ = hazard quotient

HI - hazard index

ILCR = incremental lifetime cancer risk

(1) Note that risk estimates for surface flux data were done on a sample-by-sample basis, therefore, risks are presented as a range. See Appendix H for sample-specific risk estimates.

**TABLE 6-16**  
**CHEMICAL RISK SUMMARY FOR CONSTRUCTION WORKER RECEPTORS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
 (Page 1 of 1)

Receptor	HI	ILCR							
<b>Future On-Site Construction Worker</b>									
Soil, Dermal and Dust	0.53	1 E-7							
Volatile Inhalation (from Flux) <sup>(1)</sup>	0.00041	7 E-9							
Combined	0.53	2 E-7							
Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Outdoor Inhal HQ	Total HI	Oral ILCR	Dermal ILCR	Outdoor Inhal ILCR	Total ILCR
<i>Inorganics</i>									
Aluminum	11830	3.8 E-2	0.0 E+0	4.6 E-2	8.4 E-2	NA	NA	NA	NA
Arsenic	6.6	2.1 E-2	0.0 E+0	8.6 E-3	3.0 E-2	1 E-7	0 E+0	8 E-9	1 E-7
Lithium	22	3.5 E-2	0.0 E+0	NA	3.5 E-2	NA	NA	NA	NA
Manganese	736	5.1 E-2	0.0 E+0	2.9 E-1	3.4 E-1	NA	NA	NA	NA
Perchlorate	1.0	4.7 E-3	0.0 E+0	NA	4.7 E-3	NA	NA	NA	NA
Strontium	685	3.7 E-3	0.0 E+0	NA	3.7 E-3	NA	NA	NA	NA
Vanadium	55	3.5 E-2	0.0 E+0	NA	3.5 E-2	NA	NA	NA	NA
<i>Polynuclear Aromatic Hydrocarbons</i>									
Benzo(a)anthracene	0.0014	1.5 E-7	6.0 E-8	NA	2.1 E-7	5 E-11	2 E-11	4 E-14	7 E-11
Benzo(a)pyrene	0.0024	2.6 E-7	1.0 E-7	NA	3.6 E-7	8 E-10	3 E-10	7 E-13	1 E-9
Benzo(b)fluoranthene	0.0069	7.4 E-7	2.9 E-7	NA	1.0 E-6	2 E-10	9 E-11	2 E-13	3 E-10
Benzo(k)fluoranthene	0.0014	1.5 E-7	6.0 E-8	NA	2.2 E-7	5 E-12	2 E-12	4 E-14	7 E-12
Chrysene	0.0042	4.5 E-7	1.8 E-7	NA	6.3 E-7	1 E-12	6 E-13	1 E-14	2 E-12
Dibenzo(a,h)anthracene	0.0051	5.4 E-7	2.1 E-7	NA	7.6 E-7	2 E-9	7 E-10	2 E-12	2 E-9
Indeno(1,2,3-cd)pyrene	0.0017	1.8 E-7	6.9 E-8	NA	2.5 E-7	6 E-11	2 E-11	5 E-14	8 E-11
<b>Total</b>		0.19	0.000001	0.34	<b>0.53</b>	1 E-7	1 E-9	8 E-9	1 E-7

HQ = hazard quotient

HI - hazard index

ILCR = incremental lifetime cancer risk

(1) Note that risk estimates for surface flux data were done on a sample-by-sample basis, therefore, risks are presented as a range. See Appendix H for sample-specific risk estimates.

**TABLE 6-17**  
**CHEMICAL RISK SUMMARY FOR COMMERCIAL (INDOOR) WORKER RECEPTORS**  
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Receptor	HI	ILCR
<b>Future On-Site Commercial Worker</b>		
Soil and Dust	0.031	5 E-7
Volatile Inhalation (from Flux) <sup>(1)</sup>	0.00036	2 E-7
Combined	0.031	7 E-7

Chemical	Soil Concentration (mg/kg)	Oral HQ	Indoor Dust Inhal HQ	Total HI	Oral ILCR	Indoor Dust Inhal ILCR	Total ILCR
<i>Inorganics</i>							
Aluminum	11830	5.8 E-3	2.6 E-4	6.1 E-3	NA	NA	NA
Arsenic	6.6	3.2 E-3	4.9 E-5	3.3 E-3	5 E-7	1 E-9	5 E-7
Lithium	22	5.3 E-3	NA	5.3 E-3	NA	NA	NA
Manganese	736	7.7 E-3	1.6 E-3	9.3 E-3	NA	NA	NA
Perchlorate	1.0	7.1 E-4	NA	7.1 E-4	NA	NA	NA
Strontium	685	5.6 E-4	NA	5.6 E-4	NA	NA	NA
Vanadium	55	5.3 E-3	NA	5.3 E-3	NA	NA	NA
<i>Polynuclear Aromatic Hydrocarbons</i>							
Benzo(a)anthracene	0.0014	2.3 E-8	NA	2.3 E-8	2 E-10	6 E-15	2 E-10
Benzo(a)pyrene	0.0024	3.9 E-8	NA	3.9 E-8	3 E-9	1 E-13	3 E-9
Benzo(b)fluoranthene	0.0069	1.1 E-7	NA	1.1 E-7	9 E-10	3 E-14	9 E-10
Benzo(k)fluoranthene	0.0014	2.3 E-8	NA	2.3 E-8	2 E-11	6 E-15	2 E-11
Chrysene	0.0042	6.9 E-8	NA	6.9 E-8	5 E-12	2 E-15	5 E-12
Dibenzo(a,h)anthracene	0.0051	8.2 E-8	NA	8.2 E-8	6 E-9	2 E-13	6 E-9
Indeno(1,2,3-cd)pyrene	0.0017	2.7 E-8	NA	2.7 E-8	2 E-10	7 E-15	2 E-10
<b>Total</b>		0.029	0.0020	0.031	5 E-7	1 E-9	5 E-7

HQ = hazard quotient

HI - hazard index

ILCR = incremental lifetime cancer risk

(1) Note that risk estimates for surface flux data were done on a sample-by-sample basis, therefore, risks are presented as a range. See Appendix H for sample-specific risk estimates.

**TABLE 6-18**  
**CHEMICAL RISK SUMMARY FOR MAINTENANCE (OUTDOOR) WORKER RECEPTORS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
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Receptor	HI	ILCR
<b>Future On-Site Maintenance Worker</b>		
Soil, Dermal, and Dust	0.056	1 E-6
Volatile Inhalation (from Flux) <sup>(1)</sup>	0.00036	2 E-7
<b>Combined</b>	<b>0.056</b>	<b>1 E-6</b>

Chemical	Soil Concentration (mg/kg)	Oral HQ	Dermal HQ	Outdoor Inhal HQ	Total HI	Oral ILCR	Dermal ILCR	Outdoor Inhal ILCR	Total ILCR
<i>Inorganics</i>									
Aluminum	11830	1.0 E-2	0.0 E+0	5.9 E-4	1.1 E-2	NA	NA	NA	NA
Arsenic	6.6	5.8 E-3	0.0 E+0	1.1 E-4	6.0 E-3	9 E-7	0 E+0	3 E-9	9 E-7
Lithium	22	9.6 E-3	0.0 E+0	NA	9.6 E-3	NA	NA	NA	NA
Manganese	736	1.4 E-2	0.0 E+0	3.7 E-3	1.7 E-2	NA	NA	NA	NA
Perchlorate	1.0	1.3 E-3	0.0 E+0	NA	1.3 E-3	NA	NA	NA	NA
Strontium	685	1.0 E-3	0.0 E+0	NA	1.0 E-3	NA	NA	NA	NA
Vanadium	55	9.6 E-3	0.0 E+0	NA	9.6 E-3	NA	NA	NA	NA
<i>Polynuclear Aromatic Hydrocarbons</i>									
Benzo(a)anthracene	0.0014	4.2 E-8	3.6 E-8	NA	7.8 E-8	3 E-10	3 E-10	1 E-14	6 E-10
Benzo(a)pyrene	0.0024	7.0 E-8	6.0 E-8	NA	1.3 E-7	6 E-9	5 E-9	2 E-13	1 E-8
Benzo(b)fluoranthene	0.0069	2.0 E-7	1.7 E-7	NA	3.7 E-7	2 E-9	1 E-9	7 E-14	3 E-9
Benzo(k)fluoranthene	0.0014	4.2 E-8	3.6 E-8	NA	7.8 E-8	3 E-11	3 E-11	1 E-14	6 E-11
Chrysene	0.0042	1.2 E-7	1.1 E-7	NA	2.3 E-7	1 E-11	8 E-12	4 E-15	2 E-11
Dibenzo(a,h)anthracene	0.0051	1.5 E-7	1.3 E-7	NA	2.8 E-7	1 E-8	1 E-8	5 E-13	2 E-8
Indeno(1,2,3-cd)pyrene	0.0017	4.9 E-8	4.2 E-8	NA	9.0 E-8	4 E-10	3 E-10	2 E-14	7 E-10
<b>Total</b>		<b>0.052</b>	<b>0.0000006</b>	<b>0.0044</b>	<b>0.056</b>	<b>1 E-6</b>	<b>2 E-8</b>	<b>3 E-9</b>	<b>1 E-6</b>

HQ = hazard quotient

HI - hazard index

ILCR = incremental lifetime cancer risk

(1) Note that risk estimates for surface flux data were done on a sample-by-sample basis, therefore, risks are presented as a range. See Appendix H for sample-specific risk estimates.

**TABLE 6-19**  
**ASBESTOS RISK SUMMARY**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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<i>Asbestos Risk Calculations</i>		$Risk = (C_{soil} * URF * (ET_{out} + (ET_{in} * ATT_{in})) * EF * ED) / (PEF * AT)$							
<i>ESTIMATED RISK</i>	Units	<i>CHRYSOTILE</i>				<i>AMPHIBOLE</i>			
		Construction	Outdoor Worker	Indoor Worker	Onsite Resident	Construction	Outdoor Worker	Indoor Worker	Onsite Resident
Estimated Risk (Total Structures)	Unitless	2 E-9	5 E-10	2 E-10	1 E-9	0 E+0	0 E+0	0 E+0	0 E+0
95% UCL (Total Structures)	Unitless	5 E-9	2 E-9	7 E-10	3 E-9	3 E-7	8 E-8	4 E-8	2 E-7
<i>ESTIMATED AIR CONCENTRATIONS</i>									
Estimated Airborne Concentration, $C_{air}$ (best estimate) <sup>A</sup>	f/m <sup>3</sup>	8.72E+00	1.16E-01	1.16E-01	1.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Estimated Airborne Concentration (upper bound) <sup>B</sup>	f/m <sup>3</sup>	2.74E+01	3.66E-01	3.66E-01	3.94E-01	1.31E+01	1.74E-01	1.74E-01	1.88E-01

<sup>A</sup> Estimated Airborne Concentration = Estimated  $C_{soil}$  \* 1/PEF

<sup>B</sup> Estimated Airborne Concentration = 95% UCL (upper bound) \* 1/PEF

**TABLE 7-1**  
**UNCERTAINTY ANALYSIS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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Source of Uncertainty	May Underestimate Risk	May Overestimate Risk	May Under or Overestimate Risk
<b>Environmental Sampling and Analysis</b>			
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		
Some non-detect analytes had SQLs that exceeded risk-based comparison levels.	Low		
Although radon flux sampling was performed, the results were not evaluated in the human health risk assessment based on results of recent radon testing performed in groundwater and indoor air samples.	Low		
<b>Exposure Assumptions</b>			
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., visitors) were not assessed.	Low		
Only primary exposure pathways were evaluated. Other pathways were not assessed.	Low		
Residential receptors were evaluated; however, the planned development of the Site includes parks. Potential residential exposures are considered more conservative, and therefore, protective and representative of any potential recreational receptors.		Moderate	
Some of the exposure point concentrations used in the exposure assessment were based on modeled, rather than measured, levels in various media (e.g., air).			Moderate

**TABLE 7-1**  
**UNCERTAINTY ANALYSIS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
**BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA**  
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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 in conjunction with the 95 percent UCL chemical concentration.		Moderate	
Exposure point concentrations and the amount of media intake were assumed to be constant over time.		Low	
<b>Toxicological Data</b>			
Sub-chronic RfDs are appropriate to characterize non-cancer effects for short-term exposures (i.e., construction workers). However, sub-chronic RfDs were not available and therefore, chronic RfDs were used.		Moderate	
RfDs are derived and extrapolated from laboratory animal studies that expose animals to relatively high intakes. Errors are inherent in the extrapolation of data from animals to humans, from high to low doses, and from one exposure route to another.			Moderate
RfDs used to estimate non-carcinogenic risk are derived from NOAELs which are based on the sensitive endpoints in the sensitive species. As a result, extrapolation of toxicity data from animals to humans is uncertain. There may be differences in metabolism, uptake, or distribution of chemicals in the body between animals and humans. To account for this, NOAELs are divided by uncertainty factors spanning several orders of magnitude to establish the RfD. The combination of these two conservative assumptions may establish RfDs which greatly overprotect human health.		Moderate	

**TABLE 7-1**  
**UNCERTAINTY ANALYSIS**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
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<b>Source of Uncertainty</b>	<b>May Underestimate Risk</b>	<b>May Overestimate Risk</b>	<b>May Under or Overestimate Risk</b>
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 immunosurveillance.		High	
RfDs, CSFs and defensible carcinogenicity data were not available for some COPCs, which were therefore not quantitatively evaluated.	Low		
<b>Aggregation of Exposure Units</b>			
Aggregating the exposure areas or extrapolating from Site analytical results to estimated concentrations for individual 1/8-acre exposure areas.	Low		

**TABLE 9-1**  
**DATA QUALITY ASSESSMENT**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
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Table 9-1a: Sample Size Results for Aluminum with BCL = 77,200 mg/kg

Number of samples = 149		s = 2000		
Threshold = 77,200 mg/kg		$\alpha = 5\%$	$\alpha = 10\%$	$\alpha = 15\%$
MDD = 10% (7720 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1
MDD = 20% (15440 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1
MDD = 30% (23160 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1

Table 9-1b: Sample Size Results for Arsenic with Max. Background = 7.2 mg/kg

Number of samples = 149		s = 2.2		
Threshold = 7.2 mg/kg		$\alpha = 5\%$	$\alpha = 10\%$	$\alpha = 15\%$
MDD = 10% (0.72 mg/kg)	$\beta = 15\%$	79	59	47
	$\beta = 20\%$	69	50	39
	$\beta = 25\%$	60	42	32
MDD = 20% (1.44 mg/kg)	$\beta = 15\%$	21	16	12
	$\beta = 20\%$	18	13	10
	$\beta = 25\%$	16	11	9
MDD = 30% (2.16 mg/kg)	$\beta = 15\%$	10	7	6
	$\beta = 20\%$	9	6	5
	$\beta = 25\%$	8	6	4

Table 9-1c: Sample Size Results for Benzo(a)pyrene with BCL = 0.0621 mg/kg

Number of samples = 134		s = 0.0013		
Threshold = 0.0621 mg/kg		$\alpha = 5\%$	$\alpha = 10\%$	$\alpha = 15\%$
MDD = 10% (0.0062 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1
MDD = 20% (0.0124 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1
MDD = 30% (0.0186 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1

**TABLE 9-1**  
**DATA QUALITY ASSESSMENT**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
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Table 9-1d: Sample Size Results for Lithium with BCL = 156 mg/kg

Number of samples = 149		s = 9.9		
Threshold = 156 mg/kg		$\alpha = 5\%$	$\alpha = 10\%$	$\alpha = 15\%$
MDD = 10% (15.6 mg/kg)	$\beta = 15\%$	5	3	3
	$\beta = 20\%$	4	3	2
	$\beta = 25\%$	4	3	2
MDD = 20% (31.2 mg/kg)	$\beta = 15\%$	2	2	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1
MDD = 30% (46.8 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1

Table 9-1e: Sample Size Results for Manganese with BCL = 1,820 mg/kg

Number of samples = 149		s = 180		
Threshold = 1,820 mg/kg		$\alpha = 5\%$	$\alpha = 10\%$	$\alpha = 15\%$
MDD = 10% (182 mg/kg)	$\beta = 15\%$	10	7	5
	$\beta = 20\%$	9	6	5
	$\beta = 25\%$	8	5	4
MDD = 20% (364 mg/kg)	$\beta = 15\%$	4	2	2
	$\beta = 20\%$	3	2	2
	$\beta = 25\%$	3	2	1
MDD = 30% (546 mg/kg)	$\beta = 15\%$	2	2	1
	$\beta = 20\%$	2	2	1
	$\beta = 25\%$	2	1	1

Table 9-1f: Sample Size Results for Perchlorate with BCL = 54.8 mg/kg

Number of samples = 133		s = 1.1		
Threshold = 54.8 mg/kg		$\alpha = 5\%$	$\alpha = 10\%$	$\alpha = 15\%$
MDD = 10% (5.48 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1
MDD = 20% (11.0 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1
MDD = 30% (16.4 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1

**TABLE 9-1**  
**DATA QUALITY ASSESSMENT**  
**HUMAN HEALTH RISK ASSESSMENT AND CLOSURE REPORT FOR GALLERIA NORTH OF ROW SUB-AREA**  
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Table 9-1g: Sample Size Results for Strontium with BCL = 46,900 mg/kg

Number of samples = 149		s = 770		
Threshold = 46,900 mg/kg		$\alpha = 5\%$	$\alpha = 10\%$	$\alpha = 15\%$
MDD = 10% (4690 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1
MDD = 20% (9380 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1
MDD = 30% (14070 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1

Table 9-1h: Sample Size Results for Vanadium with BCL = 391 mg/kg

Number of samples = 149		s = 16		
Threshold = 391 mg/kg		$\alpha = 5\%$	$\alpha = 10\%$	$\alpha = 15\%$
MDD = 10% (39.1 mg/kg)	$\beta = 15\%$	3	2	1
	$\beta = 20\%$	3	2	1
	$\beta = 25\%$	3	2	1
MDD = 20% (78.2 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1
MDD = 30% (117 mg/kg)	$\beta = 15\%$	2	1	1
	$\beta = 20\%$	2	1	1
	$\beta = 25\%$	2	1	1

Table 9-1i: Sample Size Results for TCDD TEQ with BCL = 50 ppt

Number of samples = 77		s = 10		
Threshold = 50 ppt		$\alpha = 5\%$	$\alpha = 10\%$	$\alpha = 15\%$
MDD = 10% (5 ppt)	$\beta = 15\%$	35	26	21
	$\beta = 20\%$	30	22	17
	$\beta = 25\%$	27	19	14
MDD = 20% (10 ppt)	$\beta = 15\%$	10	7	6
	$\beta = 20\%$	9	6	5
	$\beta = 25\%$	8	5	4
MDD = 30% (15 ppt)	$\beta = 15\%$	5	4	3
	$\beta = 20\%$	5	3	2
	$\beta = 25\%$	4	3	2

$\alpha$  = alpha

$\beta$  = beta

s = standard deviation of sample data