Prepared for
Nevada Environmental Response Trust

Project Number
1690006606-014

Prepared by
Ramboll
Emeryville, California

Date
February 12, 2018

HEALTH RISK ASSESSMENT FOR PARCEL H, REVISION 1

NEVADA ENVIRONMENTAL RESPONSE TRUST SITE
HENDERSON, NEVADA

RAMBOLL

Health Risk Assessment for Parcel H, Revision 1

Nevada Environmental Response Trust
(Former Tronox LLC Site)
Henderson, Nevada

Nevada Environmental Response Trust (Trust) Representative Certification

I certify that this document and all attachments submitted to the Division were prepared at the request of, or under the direction or supervision of the Trust. Based on my own involvement and/or my inquiry of the person or persons who manage the system(s) or those directly responsible for gathering the information or preparing the document, or the immediate supervisor of such person(s), the information submitted and provided herein is, to the best of my knowledge and belief, true, accurate, and complete in all material respects.

Office of the Nevada Environmental Response Trust

Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

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Date: 2/12/18

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Henderson, Nevada

Responsible Certified Environmental Manager (CEM) for this project

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.

February 12, 2018

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ACRONYMS AND ABBREVIATIONS

ABS	soil absorption factor
ADD	average daily dose
AECOM	AECOM, Inc.
AP&CC	American Potash and Chemical Company
API	American Petroleum Institute
AS	analytical sensitivity
atm	atmosphere
ATSDR	Agency for Toxic Substances & Disease Registry
BaP	benzo(a)pyrene
BaPEq	benzo(a)pyrene equivalent
BCL	basic comparison level
bgs	below ground surface
BEC	Basic Environmental Company
BMI	Black Mountain Industrial
BRC	Basic Remediation Company
BTEX	benzene, toluene, ethyl benzene, and total xylenes
Cal/EPA	California Environmental Protection Agency
CAS	Chemical Abstract Service
CFR	Code of Federal Regulations
CLP	Contact Laboratory Program
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter
COC	chain-of-custody
COPC	Chemical(s) of potential concern
Converse	Converse Consultants
CSF	cancer slope factor
CSM	conceptual site model
CTE	central tendency exposure
cy	cubic yard
DDE	dichlorodiphenyldichloroethylene

DDT	dichlorodiphenyltrichloroethane
DNAPL	dense non-aqueous phase liquid
DQI	data quality indicator
DUE	data usability evaluation
DVSR	data validation summary report
ECA	Environmental Conditions Assessment
EDA	exploratory data analysis
EDD	electronic data deliverable
ENSR	ENSR Corporation
ENVIRON	Environ International Corporation
EPC	exposure point concentration
ERM-West	ERM-West, Inc.
ESA	Environmental Site Assessment
ETBE	ethyl tert-butyl ether
Exponent	Exponent, Inc.
f	fiber
ft	feet
g	gram
GC/MS	gas chromatography/mass spectroscopy
GISdT®	Guided Interactive Statistical Decision Tool
GRAS	Generally Recognized as Safe
HEAST	Health Effects Assessment
HI	hazard index
HQ	hazard quotient
HRA	health risk assessment
IF	intake factor
ILCR	incremental lifetime cancer risk
IQR	interquartile range
IRIS	Integrated Risk Information System
ITRC	Interstate Technology Regulatory Council
IUR	inhalation unit risk
IWF	interceptor well field
Kerr-McGee	Kerr-McGee Chemical Corporation

kg	kilogram
Kleinfelder	Kleinfelder, Inc.
L	liter
LADD	lifetime average daily dose
LC	laboratory control
LCD	laboratory control duplicate
LCS	laboratory control spike
LCSD	laboratory control spike duplicate
LDC	Laboratory Data Consultants, Inc.
LOAEL	lowest-observed-adverse-effect level
LOU	Letter of Understanding
LVP	Las Vegas Paving
m^3	cubic meter
MDL	method detection limit
mg	milligram
mm Hg	millimeter of mercury
mol	mole
mph	mile per hour
MRL	minimal risk level
MS	matrix spike
MSD	matrix spike duplicate
MTBE	methyl tert-butyl ether
NCP	National Contingency Plan
NDEP	Nevada Division of Environmental Protection
Neptune	Neptune and Company, Inc.
NERT	Nevada Environmental Response Trust
NFA	no further action
Northgate	Northgate Environmental Management, Inc.
NRC	National Research Council
NSF	Risk coefficient for population of non-smoking females
NSM	Risk coefficient for population of non-smoking males
OCH	organic carbon by hydrogen
OCP	organochlorine pesticide

Operations Area	the area comprising the Site, excluding Parcels C, D, E, F, G, and H
OPP	organophosphorus pesticide
OSSM	Olin Chlor-Alkali/Stauffer/Syngenta/Montrose
OSWER	Office of Solid Waste and Emergency Response
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEF	particulate emission factor
PPRTV	Provisional Peer Reviewed Toxicity Values
PQL	practical quantitation limit
Q-Q	quantile to quantile
QA/QC	quality assurance/quality control
Qal	quaternary alluvial deposit
QAPP	Quality Assurance Project Plan
Ra	radium
Ramboll	Ramboll US Corporation
Ramboll Environ	Ramboll Environ US Corporation
RAW	Removal Action Workplan
RBC	risk-based concentration
RfC	reference concentration
RfD	reference dose
RI/FS	remedial investigation/feasibility study
RME	reasonable maximum exposure
RPD	relative percent difference
RSL	regional screening level
RZ-A	Remediation Zone A
SAP	sampling and analysis plan
SDG	sample delivery group
SF	risk coefficient for population of smoking females
SIM	selective ion monitoring
Site	Nevada Environmental Response Trust Site
SM	risk coefficient for population of smoking males
SOP	standard operating procedure
SQL	sample quantitation limit

SRC	site-related chemical
SVOC	semi-volatile organic compound
TAME	tert-amyl methyl ether
TEF	toxicity equivalency factor
TEQ	toxicity equivalent
Th	thorium
TIMET	Titanium Metals Corporation
TPH	total petroleum hydrocarbon
Tronox	Tronox, LLC
Trust	Nevada Environmental Response Trust
U	uranium
UCL	upper confidence limit
µg	microgram
µm	micron or micrometer
UMCf	Upper Muddy Creek Formation
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WBZ	Water Bearing Zone
WECCO	Western Electrochemical Company
WHO	World Health Organization

EXECUTIVE SUMMARY

This report has been prepared by Ramboll US Corporation (Ramboll) and presents the post-remediation Health Risk Assessment (HRA or post-remediation HRA) for Parcel H at the Nevada Environmental Response Trust (NERT or the Trust) site in Henderson, Nevada ("Site"). The post-remediation HRA was conducted to evaluate potential risks to future onsite workers from exposures to residual levels of chemicals, radionuclides, and asbestos in soils and volatile organic compounds (VOCs) released from soil gas and groundwater to indoor, outdoor, and trench air.

Prior to 2017, a soil HRA report and a soil gas HRA report for Parcels C, D, F, G, and H were submitted separately to the Nevada Division of Environmental Protection (NDEP). In order to streamline the No Further Action (NFA) decisions for these parcels, the Trust decided to implement a new execution strategy by combining the soil and soil gas HRAs into the following reports: HRA for Parcels C, D, and G, HRA for Parcel F, and HRA for Parcel H. This report focuses on Parcel H. A previous version of the HRA for Parcel H was submitted to NDEP on October 20, 2017, which was prepared to address NDEP comments on the June 19, 2014 soil HRA report (Revision 3) and the September 23, 2016 soil gas HRA report (Revision 1). That report incorporated additional soil analytical results collected in Parcel H during the upgradient investigation in 2006, and was further revised for consistency with recent updates to NDEP guidance. NDEP comments on the October 20, 2017 HRA for Parcel H were received on December 11, 2017. This revised HRA for Parcel H has been prepared to address these NDEP comments.

The Site comprises approximately 346 acres located within the Black Mountain Industrial (BMI) Complex in unincorporated Clark County, Nevada; it is surrounded by the City of Henderson. Parcel H is located in the southernmost portion of the Site, and was identified for possible sale early in the environmental investigation process at the Site. Former activities within Parcel H were not expected to have resulted in significant chemical impacts, and no Letter of Understanding areas (LOUs) for investigation were identified in Parcel H by NDEP. The primary field investigation work for soils at Parcel H was completed in 2006 and 2008, and soil removal actions and asbestos abatement were completed in 2010. Soil gas samples were collected within Parcel H in 2008. Shallow groundwater monitoring is ongoing.

The soil removal action completed for Parcel H, which included the excavation and disposal of approximately 887 tons of soil, was completed in accordance with the 2008 Remedial Action Workplan (RAW) (Basic Environmental Company [BEC] 2008a), and asbestos was the only analyte that was identified for removal. Analytical results for confirmation samples collected following the soil removal action indicated that asbestos fiber counts were below the levels identified in the RAW (BEC 2008a). However, two small areas of un-remediated soil remain in Parcel H. An area of approximately 621 square feet was not excavated because of the presence of a landscaped, asphalt-covered public footpath, and an area of approximately 1,314 square feet was not excavated due to the presence of an existing asphalt-covered road area. For these areas, qualitative considerations suggest that associated risks would be insignificant due to the following factors: the soils are covered with asphalt, the areas are small, and the areas are in close proximity to a footpath or road where individuals would not spend a significant amount of time.

Soil analytical data collected as part of initial and confirmation sampling efforts were evaluated and data representative of current conditions were selected for purposes of the

HRA. The soil conceptual site model (CSM) and chemicals of potential concern (COPCs) are summarized as follows:

- Based on the CSM for Parcel H, potential exposure to soil was evaluated for future onsite indoor and outdoor commercial/industrial workers and construction workers via direct contact with soil (i.e., incidental ingestion and dermal contact) and inhalation of airborne particulates and vapors. Soil COPCs were selected according to a multi-step process, including concentration/ toxicity screen, background evaluation for metals and radionuclides, and chemical-specific consideration. Based on this process, four chemicals were identified as soil COPCs, including two metals (palladium and zirconium), hexachlorobenzene, and asbestos (long amphibole fibers and long chrysotile fibers).
- Non-cancer hazard indices (HIs) and excess lifetime cancer risks associated with direct contact with soil and inhalation of airborne particulates and vapors were estimated for all the soil COPCs except asbestos based on the maximum soil concentration at 0-2 feet (ft) depth interval and at 0-10 ft depth interval within Parcel H. The estimated HIs and excess lifetime cancer risks were below the NDEP significant threshold of greater than one for non-cancer effects (the maximum HI was one) and the NDEP acceptable cancer risk range of 10^{-6} to 10^{-4} (the maximum estimated excess lifetime cancer risk was 4×10^{-7}) for future onsite indoor and outdoor commercial/industrial workers and construction workers under the conditions evaluated.
- With regard to asbestos (long amphibole and long chrysotile fibers), a best estimate and an upper-bound estimate of potential cancer risk via inhalation of airborne particulates for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers were calculated for Parcel H. The estimated combined risks for death from lung cancer and mesothelioma associated with asbestos exposures were all less than 1×10^{-6}, except for the upper-bound risk estimate for exposure to amphibole fibers by future construction workers, which was less than 1×10^{-5}. However, the upper-bound estimate was based on an observed count of zero long amphibole[1] fibers in the post-abatement soil samples, considered representative of current conditions within Parcel H. Following completion of the asbestos abatement, zero fibers for long amphibole was less than the RAW specified level[2] of one (1) or more fibers. Similarly, for long chrysotile fibers, fiber counts were less than the level presented in the RAW (four or more long fibers per sample).

The soil gas and groundwater CSM and COPCs are summarized as follows:

The soil gas data collected within Parcel H were evaluated in the HRA. Potential exposure to soil gas was evaluated for future onsite indoor and outdoor commercial/industrial workers and construction workers via inhalation of vapors migrating from soil gas to indoor air, outdoor air, and trench air, respectively. All VOCs detected in at least one soil gas sample were selected as soil gas COPCs. A total of 42 VOCs were identified as soil gas COPCs for Parcel H. Non-cancer HIs and excess lifetime cancer risks associated with inhalation of

[1] Although amphibole fiber counts were zero (0), upper-bound fiber concentrations in soil are estimated assuming a Poisson distribution, which yields an upper-bound risk estimate that is greater than 0.

[2] The RAW does not specifically use the term “trigger level” or identify remediation goals. However, areas identified for asbestos abatement were those in which amphibole counts in soil samples were one (1) or more fibers and chrysotile counts were four (4) or more fibers (BEC 2008a).

vapors migrating from soil gas to indoor air, outdoor air, and trench air were calculated. The results are summarized as follows:

- The estimated HIs were well below the NDEP significant threshold of greater than one for non-cancer effects (maximum HI was 0.00005).
- The estimated excess lifetime cancer risks were below the lower end of NDEP acceptable cancer risk range of 10^{-6} to 10^{-4} (maximum estimated excess lifetime cancer risk was 2×10^{-9}) for future onsite indoor and outdoor commercial/industrial workers and construction workers under the conditions evaluated.

Shallow groundwater data was evaluated for the vapor intrusion pathway as an additional line of evidence for vapor migration. Shallow groundwater data collected after January 2006 within Parcel H were evaluated in the HRA. Potential exposure to groundwater was evaluated for future onsite indoor and outdoor commercial/industrial workers and construction workers via inhalation of vapors migrating from shallow groundwater to indoor air, outdoor air, and trench air. All VOCs detected in at least one shallow groundwater sample were selected as groundwater COPCs. A total of 23 VOCs were identified as groundwater COPCs for Parcel H.

Non-cancer HIs and excess lifetime cancer risks associated with inhalation of vapors migrating from groundwater to indoor air, outdoor air, and trench air were calculated. The results are summarized as below:

- The estimated HIs based on maximum chemical concentrations detected in the most recent two years' groundwater data for each well were below the NDEP significant threshold of greater than one for non-cancer effects (the maximum HI was 0.00002).
- The estimated excess lifetime cancer risks were well below the lower end of the NDEP acceptable cancer risk range of 10^{-6} to 10^{-4} for future onsite indoor and outdoor commercial/industrial workers and construction workers under the conditions evaluated (the maximum estimated excess lifetime cancer risk was 2×10^{-8}).

The cumulative cancer risk and non-cancer HI for each receptor population were estimated by summing cancer risk and non-cancer HI for direct contact with soil and cancer risk and non-cancer HI for vapor migration to air, and are presented in Table ES-1. The major contributor to the cumulative risk is direct contact with soil. Vapor migration to air, whether calculated from soil gas or groundwater data, does not contribute significantly to the cumulative estimates.

The cumulative cancer risks are 4×10^{-7}, 4×10^{-7}, and 2×10^{-8} for future indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers in Parcel H, respectively, which are below the acceptable cancer risk range of 1×10^{-6} to 1×10^{-4}. The cumulative HIs (0.1 to 1) are also all below the threshold of greater than one for all three worker populations in Parcel H evaluated in this HRA. Based on the risk levels presented herein, Ramboll believes that the risk levels are acceptable for future commercial/industrial development in Parcel H.

1. INTRODUCTION

This report has been prepared by Ramboll US Corporation (Ramboll) on behalf of the Nevada Environmental Response Trust (NERT or the Trust) and presents the post-remediation health risk assessment (HRA) for Parcel H (also referred to as the Study Area) at the NERT site in Henderson, Nevada ("Site"). Soil removal and asbestos abatement activities completed at Parcel H are described, and the post-remediation HRA evaluating potential risks to future onsite workers from exposures to residual levels of chemicals, asbestos, and radionuclides[3] in soils is presented. The potential risks to future onsite workers associated with inhalation of volatile organic compounds (VOCs) released from soil gas and groundwater to indoor, outdoor, and trench air were evaluated. The cumulative risks associated with potential exposures to chemicals in soil and to VOCs in air are also presented.

The Site comprises approximately 346 acres located within the Black Mountain Industrial (BMI) Complex in unincorporated Clark County, Nevada; it is surrounded by the City of Henderson (Figure 1-1). Parcel H is a 24.5-acre parcel in the southernmost portion of the Site (Figure 1-2). Most of the parcel is vacant land crossed by dirt roads and drainage channels. A post-remediation HRA report for Parcels C, D, and G was submitted to Nevada Division of Environmental Protection (NDEP) on July, 31, 2017 (Ramboll Environ 2017a), and NDEP comments were received on September 18, 2017. A revised Parcels C, D, G HRA reported was submitted to NDEP on November 3, 2017 and was approved by NDEP on January 19, 2018. A post-remediation HRA for Parcel F was submitted to NDEP on December 16, 2017. Parcel E contains a portion of the currently operating Olin Chlor Alkali/Stauffer/Syngenta/Montrose (OSSM) groundwater treatment system. No investigation or remediation on Parcel E has been performed or is planned for the foreseeable future due to the continued operation of the OSSM groundwater treatment system (NDEP 2010a). The area surrounding the Site is shown in Figure 1-3.

Environmental investigations at Parcel H have generally been conducted separately from investigations at the main area of the Site, referred to in this report as the "Operations Area". [4] The primary field investigation work for soils at Parcel H was completed in 2006 and 2008, and soil removal actions and asbestos abatement were completed in 2010. Soil gas samples were collected within Parcel H in 2008. Shallow groundwater monitoring is ongoing.

1.1 Major Revisions

Prior to 2017, a soil HRA report and a soil gas HRA report for Parcels C, D, F, G, and H were submitted separately to the NDEP. Four versions of the soil HRA report have been submitted: (1) December 10, 2010 (Northgate Environmental Management, Inc. [Northgate] and Exponent, Inc. [Exponent] 2010a); (2) May 18, 2012 (Northgate 2012); (3) June 27, 2013 (Northgate 2013); and (4) June 19, 2014 (Northgate 2014). Two versions of the soil gas HRA report have been submitted: (1) July 25, 2013 (ENVIRON 2013a); and 2) September

[3] Chemicals, asbestos, and radionuclides are referred to as "chemicals" in this report unless it is important to distinguish among the three classes.

[4] The Operations Area is defined as the Site, excluding Parcels C, D, E, F, G, and H. The Operations Area is equivalent to the area referred to as the "Facility Area" in previous reports (with the exception of Parcel E, previously considered as part of the Facility Area for risk assessment purposes). These reports include, e.g., the *Remedial Investigation and Feasibility Study Work Plan* (ENVIRON International Corporation [ENVIRON] 2014a) and the associated risk assessment work plan and report (ENVIRON 2014b, Ramboll Environ 2015a).

23, 2016 (Ramboll Environ 2016a). NDEP commented on each submittal and each subsequent report was revised to address NDEP comments.

In order to streamline the No Further Action (NFA) decisions for these parcels, the Trust decided to implement a new execution strategy by combining the soil and soil gas HRAs into the following reports: Parcels C, D, and G HRA Report, Parcel F HRA Report, and Parcel H HRA Report. This report focuses on the Parcel H HRA. A previous version of the HRA for Parcel H was submitted to NDEP on October 20, 2017, which was prepared to address NDEP comments on the June 19, 2014 soil HRA report (Revision 3) and the September 23, 2016 soil gas HRA report (Revision 1) (Appendix A). In addition to combining the soil and soil gas HRAs for Parcel H as well as the revisions made to address NDEP comments, that report incorporated additional soil analytical results collected in Parcel H in 2006, and was further revised for consistency with recent updates to NDEP guidance. The primary revisions made to that report, as compared with the previously submitted June 19, 2014 Soil HRA Report (Revision 3) and the September 23, 2016 Soil Gas HRA Report (Revision 1), are summarized below:

- **Changes in the soil HRA data set**: Additional soil samples collected at the top 10 feet (ft) below ground surface (bgs) in Parcel H during the upgradient investigation in 2006 were included in the soil HRA data set (ENSR Corporation [ENSR] and AECOM, Inc. [AECOM] 2006a). In addition, minor changes to the parcel boundaries based on current information resulted in a few soil samples incorrectly located in the Operations Area that should have been considered within Parcel H. These samples are identified in Section 3.2.
- **Radionuclide background evaluation**: In previous versions of the soil HRA, the regional Basic Remediation Company (BRC)/Titanium Metals Corporation (TIMET) data set was used to evaluate background conditions for radionuclides. As requested by NDEP (2015a), in this evaluation the Remediation Zone A (RZ-A) background data set was used for the background evaluation for radionuclides as well as for metals. In addition, the comparison of the radionuclide data with the BRC/TIMET data set was discussed to provide perspective in the interpretation of the results relative to regional background concentrations.
- **Updated list of Soil COPCs**: The approach for identifying chemicals of potential concern (COPCs) was updated and is now consistent with the NDEP-approved approach used to identify soil COPCs for the Operations Area (Ramboll Environ 2016b). Specifically, the concentration/toxicity screen was conducted first, followed by the background evaluation and chemical-specific evaluations. In addition, the screening values used for the concentration/toxicity screen were revised for consistency with the NDEP-approved screening values used in the risk assessment for the Operations Area (i.e., for most chemicals, the screening value used was 0.1 x Basic Comparison Level [BCL]). Finally, the BCLs (and toxicity values) used in the HRA have been updated to be consistent with the most recent NDEP revision (NDEP 2017a).
- **Addition of inhalation of airborne soil particulates pathway**: For consistency with the equations used to derive BCLs, risks were evaluated for the inhalation of airborne particulates pathway for all soil COPCs and all receptors.
- **Evaluation of risks for each individual parcel**: In previous versions of the soil and soil gas HRAs, the risk results were estimated for all parcels as a whole and not for each

individual parcel. To help support risk management decisions, this report presents risks for Parcel H only.

- **Asbestos:** The asbestos evaluation has been updated for consistency with current NDEP guidance (Neptune and Company, Inc. [Neptune] 2015).
- Incorporation of groundwater data in the HRA: As presented in the 2010 HRA work plan (Northgate and Exponent 2010b), complete direct contact pathways have not been identified for groundwater, which is not used as a source of drinking water at the Site. However, inhalation of vapors migrating from shallow groundwater is a potentially complete pathway. Shallow groundwater monitoring data that were previously included in the appendices have been moved into the main text of this report for further evaluation.
- **Addition of a trench scenario for construction workers**: Inhalation of volatile compounds in vapors migrating from soil gas or shallow groundwater to trench air could occur for construction workers while conducting excavation activities. Therefore a trench scenario for the construction workers was added.
- **Cumulative risks**: This report presents cumulative risks for Parcel H.

NDEP comments on the October 20, 2017 HRA for Parcel H were received on December 11, 2017. This revised report has been prepared to address these NDEP comments. The December 11, 2017 NDEP comments and the Trust's response to comment letter addressing NDEP's comments are submitted as Attachment 1 to the cover letter of this revised report.

1.2 Report Organization

The remainder of this report is organized as follows:

- Section 2 provides background information on the Site.
- Section 3 describes former uses at Parcel H, and summarizes the results of soil, soil gas, and groundwater investigations conducted at this parcel. The soil removal actions and confirmation sampling program are also described.
- Section 4 presents the data usability evaluation (DUE), including the data analysis step of the DUE.
- Section 5 presents the methodology and results from each of the four steps of the risk assessment, i.e., 1) identification of COPCs, 2) exposure assessment, 3) toxicity assessment, and 4) risk characterization.
- Section 6 presents the uncertainty analysis, which discusses the relative impact of data uncertainties and the primary assumptions used in the HRA on the risk results.
- Section 7 provides the data quality assessment.
- Section 8 presents the cumulative cancer risks and non-cancer hazards.
- Section 9 summarizes the HRA and presents conclusions regarding current conditions within Parcel H.
- Section 10 lists the references cited in this report.

Supporting tables, figures, and appendices follow the text of the report.

2. SITE BACKGROUND

2.1 Site Description

The 346-acre Site is located approximately 13 miles southeast of the city of Las Vegas in an unincorporated area of Clark County, Nevada, within Sections 1, 12, and 13 of Township 22 S, Range 62 E (Figure 1-1). The Site is located within the BMI complex, which consists of several facilities that are owned and/or operated by various chemical companies. The City of Henderson surrounds the BMI complex. Tronox, LLC (Tronox) currently leases a portion of the Site from the Trust, on which it operates a chemical manufacturing facility.

The BMI complex was first developed by the U.S. government in 1942 as a magnesium plant for World War II operations. Later, a part of the BMI complex was leased by Western Electrochemical Company (WECCO). WECCO produced manganese dioxide, sodium chlorate and sodium perchlorate, and other perchlorates. WECCO also produced ammonium perchlorate for the Navy during the early 1950s, using a plant that was constructed on the Site by the Navy. WECCO merged with American Potash and Chemical Company (AP&CC) in 1956 and continued production of ammonium perchlorate for the Navy. In 1967, AP&CC merged with Kerr-McGee Chemical Corporation (Kerr-McGee) and in the early 1970s, began producing boron chemicals (including elemental boron, boron trichloride, and boron tribromide). The production of boron tribromide was discontinued in 1994, and the production of sodium chlorate and ammonium perchlorate was discontinued in 1997 and 1998, respectively. Perchlorate was reclaimed at the Site using existing equipment until early 2002.

In 2005, Kerr-McGee Chemical LLC was renamed Tronox LLC. Tronox's Henderson facility continues to produce electrolytic manganese dioxide, used in the manufacture of alkaline batteries; elemental boron, a component of automotive airbag igniters; and boron trichloride, used in the pharmaceutical and semiconductor industries and in the manufacture of high-strength boron fibers.

During the 1970s, the United States Environmental Protection Agency (USEPA), the State of Nevada, and Clark County investigated potential environmental impacts from BMI company operations, including atmospheric emissions, groundwater and surface-water discharges, and soil impacts (Ecology and Environment 1982). From 1971 to 1976, Kerr-McGee modified its manufacturing processes and constructed lined surface impoundments to recycle and evaporate industrial wastewater. In 1976, the facility achieved zero discharge status for industrial wastewater management. In 1980, the USEPA issued Section 308 letters requesting specific information from the BMI companies regarding their manufacturing and waste management practices. In 1993, a Phase 1 Environmental Conditions Assessment (ECA) was completed for the Site and approved by NDEP (Kleinfelder, Inc. [Kleinfelder] 1993).

In 1994, NDEP issued a Letter of Understanding (LOU) to Kerr-McGee that identified 69 specific areas or items of interest at the Site and identified the level of environmental investigation required for each LOU (NDEP 1994). The LOUs for the Site are shown in Figure 2-1. In 2005, a Conceptual Site Model (CSM) Report was prepared for the Site that integrated information from the soil and groundwater investigations conducted to date in order to document information on site-specific sources, release mechanisms, transport pathways, exposure routes, and potential receptors (ENSR 2005). Historical site investigations conducted since completion of the 2005 CSM Report include primarily the

Phase A and Phase B Source Area Investigations, which were designed to further characterize soil, groundwater, and soil gas across the Site, as described in the Remedial Investigation and Feasibility Study Work Plan (RI/FS Work Plan) (ENVIRON 2014a). Tronox continued field investigation and remediation efforts at the Site until February 14, 2011, on which date the Trust took title to the Site and assumed responsibility for all investigation and removal activities pursuant to an Interim Consent Agreement.

2.2 Climate

The climate of Las Vegas Valley is arid, consisting of mild winters and dry, hot summers. Average annual precipitation as measured in Las Vegas from 1971 to 2000 was 4.49 inches. Precipitation generally occurs during two periods, December through March and July through September. Winter storms generally produce low intensity rainfall over a large area. Summer storms generally produce high intensity rainfall over a smaller area for a short duration. The violent summer thunderstorms account for most of the documented floods in the Las Vegas area. Winds frequently blow from the south or northwest at a mean velocity of approximately nine miles per hour (mph); however, velocities in excess of 50 mph are not atypical when weather fronts move through the area. During these windy events, dust, sand, and soil at the ground surface can become airborne and may travel several miles. Temperatures can rise to 120°F in the summer, and the average relative humidity is approximately 20%. The estimated annual mean evaporation rate from lake and reservoir surfaces at the Site is 97 inches per year.[5]

2.3 Geologic and Hydrogeological Setting

The Site is located within Las Vegas Valley, which occupies a topographic and structural basin trending northwest-southeast and extending approximately 55 miles from near Indian Springs on the north to Railroad Pass on the south. The valley is bounded by the Las Vegas Range, Sheep Range, and Desert Range to the north, by the Frenchman and Sunrise Mountains to the east, by the McCullough Range and River Mountains to the south and southeast, and the Spring Mountains to the west. The mountain ranges bounding the east, north, and west sides of the valley consist primarily of Paleozoic and Mesozoic sedimentary rocks (limestones, sandstones, siltstones, and fanglomerates), whereas the mountains on the south and southeast consist primarily of Tertiary volcanic rocks (basalts, rhyolites, andesites, and related rocks) that overlie Precambrian metamorphic and granitic rocks (ENSR 2007). The Site is located on Quaternary alluvial deposits (Qal) that slope north toward Las Vegas Wash. The thickness of the alluvial deposits ranges from less than one foot to more than 50 ft beneath the Site. Soil types identified in onsite soil borings include poorly sorted gravel, silty gravel, poorly sorted sand, well sorted sand, and silty sand (ENSR 2005). The Upper Muddy Creek Formation (UMCf) of Pleistocene age occurs in Las Vegas Valley as valley-fill deposits that are coarse-grained near mountain fronts and become progressively finer-grained toward the center of the valley. Where encountered beneath the Site, the UMCf is composed of at least two thicker units of fine-grained sediments of clay and silt (the first and second fine-grained facies, respectively) interbedded with at least two thinner units of

[5] Ramboll calculated the mean annual evaporation rate using the linear regression for Nevada Region 1 shown in Table 3 of Shevenell (1996) and a mean elevation for the Site of 1,772 ft (540 meters). The mean elevation was calculated from elevations reported in Kerr-McGee (1985) ranging from 1,675 ft (northwest) to 1,870 ft (southwest).

coarse-grained sediments of sand, silt, and gravel (the first and second coarse-grained facies, respectively) (ENSR 2005).

Depth to groundwater ranges from about 27 to 80 ft bgs across the Site and is generally deepest in the southernmost portion of the Site, becoming shallower as it approaches the Las Vegas Wash to the north. For Parcel H, groundwater depth is approximately 55 ft bgs. The groundwater flow direction at the Site is generally north to north-northwesterly, whereas north of the Site, the direction changes slightly to the north-northeast (ENVIRON 2014a).

A major feature of the alluvial deposits is the stream-deposited sands and gravels that were laid down within paleochannels that were eroded into the surface of the UMCf during infrequent flood runoff periods. These deposits are thickest within the paleochannel boundaries, which are narrow and linear and trend northeastward. The paleochannels act as preferential pathways for groundwater flow, which may significantly influence the chemical distribution in the alluvium (ENSR 2005). Additional details on the regional and local geology and hydrogeology, including information on the water-bearing zones, are provided in the RI/FS Work Plan (ENVIRON 2014a).

As shown on Figure 1-2, an extraction well field, referred to as the interceptor well field (IWF), and groundwater barrier wall are present at the Site. The groundwater barrier wall was constructed in 2001 as a physical barrier across the higher concentration portion of an existing perchlorate/chromium plume. The IWF generally captures groundwater with higher contaminant concentrations and is located downgradient of on-site source areas. The interceptor wells and barrier wall have significantly decreased chemical concentrations in the Qal downgradient of the IWF (Ramboll Environ 2016c).

3. HISTORICAL INVESTIGATIONS AND REMOVAL ACTIONS

3.1 Overview of Environmental Investigations

Parcel H was identified for possible sale early in the environmental investigation process at the Site. Former activities within Parcel H were not expected to have resulted in significant chemical impacts, and no LOUs were identified in Parcel H by NDEP (Figure 2-1).

The primary soil investigations conducted within Parcel H are summarized below:

- **Phase 1 ECA and Environmental Site Assessments (ESAs):** In 1993, Kleinfelder completed a comprehensive ECA (Kleinfelder 1993), which included Parcel H, in compliance with a consent agreement with NDEP. In March 2007, Converse Consultants (Converse) completed a Phase 1 ESA (the "2007 Phase I ESA") that included the areas occupied by Parcel H (Converse 2007). As part of the 2007 Phase 1 ESA, Converse conducted a site visit and reviewed historical aerial photographs dating from 1950 through 2006.
- **Upgradient investigation**: In order to characterize soil and groundwater conditions in the southern (upgradient) portion of the Site, a work plan to address this concern was submitted to the NDEP on March 29, 2005. After addressing comments received from the NDEP dated May 6, July 28, and October 6, 2005, a Upgradient Investigation Work Plan Addendum (ENSR 2006) was submitted to NDEP on February 21, 2006. On February 22, 2006, the NDEP issued a letter approving the work plan. Soil samples were collected from four boring locations within Parcel H as part of the upgradient investigation in March, 2006. The results were reported in the data validation summary report (DVSR) initially prepared by ENSR and AECOM in September, 2006 (ENSR and AECOM 2006b), but this DVSR and the associated electronic data deliverable (EDD) were not finalized. On July 25, 2016, NDEP provided several comments on the DVSR and the associated EDD. The revised DVSR addressing NDEP's comments was prepared by Ramboll Environ, and was submitted to NDEP on September 28, 2017 for NDEP's review and approval (Ramboll Environ 2017b).
- **Phase 2 soil investigation:** Phase 2 sampling and analysis plans (SAPs) were prepared to identify and characterize the distribution of site-related chemicals (SRCs) in soil for Parcel H (Basic Environmental Company [BEC] 2007a,b). NDEP reviewed and approved the SAPs (approval dates are provided in Section 10, References). The Phase 2 soil sampling in Parcel H was conducted between January and March 2008. The results were reported in the associated DVSR (ERM-West, Inc. [ERM-West] 2008) and discussed with NDEP on May 15, 2008 (NDEP 2008a).
- **Phase 2 supplemental soil investigation**: Based on the results of the Phase 2 soil investigation and discussions with NDEP, a supplemental SAP was prepared (BEC 2008b). Additional samples were collected in Parcel H in June and July 2008 to delineate areas for asbestos remediation. At that time, BEC also proposed additional soil borings to depths greater than 10 ft "as part of the site-wide soil investigation"

(BEC 2008b). The results of the supplemental investigation were reported in the associated DVSR (ERM-West 2009).

The primary soil gas and groundwater investigation conducted within the Parcel H is summarized below:

- **Phase B soil gas investigation**: The Phase B soil gas investigation was conducted in 2008. Two soil gas samples were collected within Parcel H. Details of the soil gas sampling are provided in the *Phase B Source Area Investigation Soil Gas Survey Work Plan* (the "2008 Site-Wide Soil Gas Work Plan"; ENSR 2008a). Sampling locations were based on the following: (1) results of the Phase A investigation (ENSR 2007), which identified the presence of several VOCs in soil and/or groundwater samples collected at the Site; (2) historic soil and groundwater data collected during prior investigations; and (3) an assessment of former chemical usage at the individual LOUs. Both samples were collected at approximately five (5) ft bgs. Analytical results for samples collected during the soil gas survey were presented in a DVSR (ENSR 2008b) that was submitted to NDEP on October 13, 2008, and approved by NDEP on October 20, 2008.
- **Groundwater Monitoring Wells:** For groundwater monitoring well sampling results, all shallow groundwater analytical results for VOCs entered either into the BMI or Ramboll project database were included if they were within or adjacent to Parcel H. Shallow groundwater was evaluated as an additional line of evidence for the vapor intrusion pathway. Data were extracted for the years 2006-2015 to determine the concentration trends, but only the last two years of data for each well were used in the risk evaluation.

All soil, soil gas, and groundwater monitoring well locations within or adjacent to Parcel H are shown on Figure 3-1. Table 3-1 lists the soil gas samples for Parcel H, and Table 3-2 summarizes the shallow groundwater monitoring wells for Parcel H. Figure 3-2 shows the 2008 shallow soil gas sampling locations in relation to the chloroform groundwater plume as depicted in 2015 (Ramboll Environ 2015b).

3.2 Historical Uses and Investigations of Parcel H

This section describes features and historical uses of Parcel H, and summarize the results of the soil, soil gas, and groundwater investigations.

Parcel H is a 25.8-acre parcel in the southernmost portion of the Site (Figure 2-1). Most of the parcel is vacant land crossed by dirt roads and drainage channels. Three debris piles are present and a transformer (on a concrete pad) and electrical control box were observed near Lake Mead Parkway during the April 2016 site visit conducted by Ramboll Environ (Ramboll Environ 2016d); electrical vaults, in line with the control box and transformer and running parallel to Lake Mead Parkway, were also observed.

BEC (2007b) and Converse (2007) reported that a pad-mounted transformer (not observed in a previous site visit by ENVIRON on March 8, 2013), three debris piles (two of which were not observed on March 8, 2013), and an abandoned water supply line that served the landscaping area along Lake Mead Parkway were located within the parcel. BEC (2007b) reported that based on the age of the transformer, it is unlikely that the

transformer contained polychlorinated biphenyls (PCBs).[6] No LOUs were identified within Parcel H.

Soil Investigations

During the upgradient investigation (ENSR and AECOM 2006a), soil samples were collected from four locations (M117, M118, M120, and M121) within the current boundaries of Parcel H, at depths of 0.5, 5, 10, 20, 30, 40, 50, 60 and 80 ft bgs (Figure 3-1). During the Phase 2 soil investigation (ERM-West 2008), soil samples were collected from 19 locations within the current boundaries of Parcel H, at the surface and at a depth of 10 ft bgs (Figure 3-1). Both random (TSB-HR-01 to TSB-CR-08) and judgmental (TSB-HJ-01 to TSB-HJ-11) locations were sampled, with judgmental samples specifically targeting specific features within Parcel H, including the debris piles, pad mounted transformer, and drainage features (BEC 2007a, b). During the Phase 2 supplemental soil investigation, three surface samples (TSB-HJ-09NE, TSB-HJ-12 and TSB-HJ-13) were collected to delineate areas for asbestos removal. Furthermore, changes to the Parcel H boundaries based on current information resulted in two sampling locations (RSAU6 and RSAU7) previously believed to be in the Operations Area, now considered to be within Parcel H.

As described in the 2008 Remedial Action Workplan (RAW) (BEC 2008a, also included as Appendix B of this report), removal polygons were identified for asbestos at two locations: TSB-HR-06 and TSB-HJ-09 (Figure 3-1).

Soil Gas Investigation

During the 2008 Phase B soil gas investigation (ENSR 2008a), two soil gas samples were collected within the current boundaries of Parcel H at a depth of five ft bgs (Figure 3-1, samples SG49 and SG50). Over 40 VOCs were detected in the two soil gas samples, at very low concentrations. The detections (and maximum detected concentration) included acetone (39 microgram/cubic meter [µg/m^3]), carbon disulfide (32 µg/m^3), and vinyl acetate (16 µg/m^3). Chloroform was detected at a maximum concentration of 1.3 µg/m^3.

Groundwater Investigations

As listed in Table 3-2, four (4) shallow groundwater monitoring wells are located within or adjacent to Parcel H. Three of those wells (M-103, M-121, and TR-10) were sampled in March 2006 as part of the Phase A groundwater investigation. All samples were analyzed for inorganic compounds (metals and cyanide), fuel alcohols, organochlorine pesticides (OCPs), PCBs, radionuclides, organophosphorus pesticides (OPPs), organic carbon by hydrogens (OCHs), VOCs, and semi-volatile organic compounds (SVOCs). In 2009, all four wells (M-103, M-120, M-121, and TR-10) were sampled as part of the Phase B investigation with the objective to characterize the presence of SRCs in specific areas around the Site. Samples were analyzed for metals, VOCs, PCBs, OCPs, OPPs, organic acids, perchlorate, hexavalent chromium, and total cyanide. In early 2015, three (3) wells (M-120, M-121, and TR-10) were sampled as part of the Phase 1 portion of the remedial investigation.

[6] The age of the transformer was not provided by BEC (2007b); further, the transformer observed in 2007 is not at the location of the transformer observed in 2016.

Over 20 VOCs were detected at least once in these wells, with very low concentrations. Chemicals detected, along with their maximum concentrations, include acetone (4.8 microgram per liter [µg/L]), and chloroform (3.8 µg/L).

3.3 Soil Removal and Confirmation Sampling

In July 2008, a RAW (BEC 2008a, also included as Appendix B of this report) was prepared to address impacted soils identified in the parcel Phase 2 investigations described in Section 3.2; NDEP approved the RAW on July 2, 2008 (NDEP 2008b). The RAW identified a target cancer risk of one in a million (1×10^{-6}) as a guide for remediation and for most chemicals, the NDEP commercial/industrial worker BCL (based on an incremental lifetime cancer risk [ILCR] of 1×10^{-6}) was used to target soils for removal. For dioxin/furans, soils with concentrations greater than 1,000 pg/g were identified for removal. For asbestos abatement, removal polygons were identified in the RAW for soils with the presence of amphibole (one or more long fibers) and/or chrysotile (four or more long fibers). The RAW did not include a definition of long fibers; however, current NDEP guidance (Neptune 2015) identifies fibers that should be counted for risk assessment purposes as those longer than 10 microns (µm) in length and less than 0.4 µm in width.

3.3.1 Removal Action

Northgate implemented the soil removal action in Parcel H in April 2010 under the oversight of NDEP. Work was performed in accordance with the approved RAW (BEC 2008a). In Parcel H, asbestos was the only analyte that was identified for removal. The polygon size and shape were determined based on the Phase 2 soil sampling results and locations where asbestos were detected above levels specified in the RAW. The removal included the excavation of one foot of soil in each of the identified polygons and collection of confirmation samples (described below).

The remediation polygons for Parcel H are shown on Figure 3-1. Additional figures prepared by Las Vegas Paving (LVP) are provided in Appendix C and the soil disposal manifests are provided in Appendix D. A total of 887 tons of soil in Parcel H were excavated from the soil surface and transported in covered trucks to Apex Landfill, approximately 37 miles from the Site.

Two excavated areas were located in Parcel H (Figure 3-1 and Appendix C), from which a total of 617 cubic yards (cy) of soil was removed; over half of the removed soil (563 cy) was in the vicinity of sample TSB-HR-06. The total excavation depths ranged from 0.3 to 0.7 ft below original grade (Table 3-3). An area of approximately 621 square feet from one polygon identified for removal was not excavated because of the presence of a landscaped, asphalt-covered public footpath and an area of approximately 1,314 square feet in the same remediation polygon was not excavated due to the presence of an existing asphalt-covered road area (shown in Appendix C). Soil was excavated to the edge of these inaccessible areas. For these areas, qualitative considerations suggest that associated risks would be insignificant due to the following factors: the soils are covered with asphalt, the areas are small, and the areas are in close proximity to a footpath or road where individuals would not spend a significant amount of time. In addition, it appears that the areas under paved roads along the Site boundary are an artifact of the mapping of the remediation polygons and that these areas should not have been identified for removal.

3.3.2 Confirmation Sampling

Northgate collected confirmation samples in April 2010, following the excavation of impacted soils. Field activities and sampling procedures were performed under the supervision of a Certified Environmental Manager and in accordance with the BRC Health and Safety Plan, BMI Common Areas, Clark County, Nevada (BRC and MWH 2005); the BRC Field Sampling and Standard Operating Procedures (SOP), BMI Common Areas (BRC, ERM, and MWH 2007a); and the BRC SOP-12 Surface Soil Sampling for Asbestos (BRC, ERM, and MWH 2008).

Confirmation samples were collected in a manner consistent with the approved RAW. Specifically, LVP surveyed the location of the original samples prior to the removal action and then collected the confirmation samples at the same locations; confirmation samples were then analyzed for the chemicals that had triggered the removal (i.e., analyses were conducted for asbestos exceeding the RAW specified levels). A total of two asbestos samples were collected from the two remediation polygons in Parcel H.

The analytical data were validated by Laboratory Data Consultants, Inc. (LDC) in accordance with procedures described in NDEP guidance Data Verification and Validation Requirements – Supplement, April 13, 2009 established for the BMI Plant Sites and Common Areas Projects (NDEP 2009a). A complete listing of the soil confirmation samples is presented in Table 1-2 of the DVSR (Northgate 2010b, see Appendix E). Final confirmation sampling results indicated that asbestos fiber counts were below the levels identified in the RAW (BEC 2008a).

Table 3-3 identifies the sample locations with asbestos detected above the levels specified in the RAW and the corresponding confirmation samples.

4. DATA USABILITY EVALUATION AND DATA ANALYSIS

This section presents the updated DUE conducted for soil and soil gas (Sections 4.1 and 4.2). These DUEs were previously included in the Soil HRA Report (Revision 3) and the Soil Gas HRA Report (Revision 1). This section also presents a DUE conducted for groundwater (Section 4.3). For each medium, the first component of the DUE focuses on the quality of each individual data point to ensure that the quality of the data is sufficient to support the HRA. The second component of the DUE, data analysis, focuses on the data set as a whole.

The DUE was conducted in accordance with NDEP's Supplemental Guidance for Assessing Data Usability for Environmental Investigations at the Black Mountain Industrial (BMI) Facility in Henderson, NV (NDEP 2010b), which is based on the USEPA's Guidance for Data Usability in Risk Assessment (Parts A and B) (USEPA 1992a, b). The USEPA DUE framework provides the basis for identifying and evaluating uncertainties in HRAs with regard to site characterization data. USEPA (1992a) states that "data usability is the process of assuring or determining that the quality of data generated meets the intended use," and that when risk assessment is the intended use, USEPA's guidance "provide[s] direction for planning and assessing analytical data collection activities for the HRA." USEPA has established a specific framework to provide risk assessors a consistent basis for making decisions about the minimum quality and quantity of environmental analytical data to support risk assessment decisions (USEPA 1992a, b; NDEP 2010b). The USEPA data usability guidance identifies the following data quality criteria for evaluating the usability of site investigation data in the risk assessment process:

- Criterion I – Reports to Risk Assessor;
- Criterion II – Documentation;
- Criterion III – Data Sources;
- Criterion IV – Analytical Methods and Detection Limits;
- Criterion V – Data Review; and
- Criterion VI – Data Quality Indicators.

Criteria I through VI are discussed in Sections 4.1.1, 4.2.1, and 4.3.1 for soil, soil gas, and groundwater, respectively.

The second component of the DUE (data analysis) is also presented in Sections 4.1.2, 4.2.2, and 4.3.2. As described in NDEP guidance (NDEP 2010b), the purpose of the data analysis step is to "use simple exploratory data analysis to compare data to the expectations of the CSM, to determine if the data adequately represent the source terms and exposure areas or evaluation areas." In particular, through statistical summaries, background evaluation (for soil metals and radionuclides only), spatial plots, and other exploratory analyses, the data are reviewed relative to our current understanding of Parcel H (as represented by the CSM) and for possible data gaps or other investigation issues. A discussion of the Study Area CSM is presented in Section 4.4.

4.1 Soil

4.1.1 Data Usability Evaluation

The soil data set evaluated using the data quality criteria is identified in Section 4.1.1.1. Sections 4.1.1.2 through 4.1.1.7 describe the results of the evaluation.

4.1.1.1 Soil Data Set and Data Processing

The post-remediation soil HRA data set comprises the analytical results that are representative of current conditions within Parcel H. Specifically, the data set includes soil samples collected at 0-10 ft bgs as part of the following investigations:

- 2006 upgradient investigation;
- 2008 Phase 2 soil investigation;
- 2008 Phase 2 supplemental soil investigation; and
- 2010 confirmation sampling following soil removal.

For each soil sample collected from the above investigations, sampling locations were verified relative to current parcel and Operations Area boundaries. Samples were excluded from the post-removal soil HRA data set if 1) locations were outside the current boundaries of Parcel H; 2) the sampling depths were greater than 10 ft bgs; or 3) location and/or depth information were not available.

Compared to the Soil HRA Report Revision 3 (Northgate 2014), in addition to the inclusion of samples collected during the upgradient investigation in 2006, changes of the parcel boundaries based on current information resulted in samples collected at two locations (RSAU6 and RSAU7) previously believed to be in the Operations Area that now are considered to be within Parcel H; these samples are also included in the Parcel H soil HRA data set.

Only soil data representative of current conditions within Parcel H (i.e., conditions following the soil removal and asbestos abatement activities) are used for the post-remediation HRA. Specifically, the Phase 2 sampling results for surface soils (for asbestos that had triggered the 2010 soil removal) were replaced by the 2010 soil confirmation sampling results for asbestos at the same locations (see Table 3-3) since these earlier data represented soil that has been removed. The Phase 2 sampling results in surface soils for all the other chemicals at the same locations are retained in the post-remediation HRA data set, since soil removal was only conducted at the top few inches (at most down to one foot) and these data are still representative of the conditions of the rest of the soil column (down to 1.5 ft bgs). A summary of soil data not considered in the post-remediation HRA due to soil removal and asbestos abatement activities is presented in Appendix E, Table E-1.

The "NERT project database," maintained by Rambollon behalf of the Trust, houses the analytical data collected during historical and ongoing investigations at NERT.[7] After identifying the preliminary set of data for the post-remediation HRA, an initial task before the DUE was to 1) identify and correct inconsistencies in data field entries and 2)

[7] Historically, the database has been managed by different entities responsible for investigations and data collection at the Site. Ramboll assumed responsibility for the database in early 2011.

create additional fields to support data management and interpretation. The following steps of data processing were completed:

- Standardize chemical names and Chemical Abstract Service (CAS) registry numbers;
- Standardize reporting units, e.g., milligram per kilogram (mg/kg) for metals and microgram per kilogram (µg/kg) for organic compounds;
- Standardize analytical method names;
- Correct errors in data entry (e.g. typos in sample identification codes);
- Identify a unique result for use in the HRA for sample/analyte pairs for which more than one result was reported. For example, if two results were reported for naphthalene in the same sample – one by USEPA Method 8260 and the second by USEPA Method 8270 or 8270 Selective Ion Monitoring (SIM) – the result to be used in the HRA was identified as that from the 8270 or 8270 SIM analysis because naphthalene is classified as a SVOC in soil;
- Enter BCLs and confirm that BCLs correspond to the chemical form or species reported. For example, the database compared analytical results for phosphorus with the BCL for white phosphorus. There is no evidence to suggest that white phosphorus is present in parcel soils. The most abundant form of phosphorus in soil is orthophosphate. Analytical methods were reviewed to confirm that the analyses were not for white phosphorus; and
- Develop database queries and confirm that queries returned the correct output.

The above steps were necessary due to the approximately four-year period over which the soil data was collected and the differences in sampling, analysis, and data entry across investigations. This can be understood in the context of soil samples collected by different entities, analyzed by different analytical laboratories for overlapping suites of chemicals, and the use of different reporting conventions.

No change was made to a datum without first understanding the issue and the steps necessary to correct the issue. As needed, sampling plans, laboratory reports, DVSRs, and other supporting documents were reviewed. Data points were considered unusable for risk assessment if information could not be located to confirm and/or correct an identified issue. Soil data excluded from the post-remediation HRA data set during data processing are summarized in Appendix E, Table E-2.

To ensure calculation consistency, dioxin toxicity equivalents (TEQs) were calculated (or recalculated) using the results for dioxins and furans and the World Health Organization (WHO) toxicity equivalency factors (TEFs) scheme (van den Berg et al. 2006). Benzo(a)pyrene (BaP) equivalents (BaPEqs) were also calculated (or recalculated) for the seven carcinogenic polynuclear aromatic hydrocarbons (PAHs) (i.e., BaP, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, and indeno[1,2,3-c,d]pyrene) for which USEPA has derived TEFs (USEPA 2017a). Nondetects were addressed using the Kaplan-Meier approach from USEPA's TEQ calculator.

Total petroleum hydrocarbon (TPH) data were excluded from the post-remediation soil HRA data set, consistent with NDEP guidance (NDEP 2017a). TPH was evaluated through

the indicator chemicals, including benzene, toluene, ethyl benzene, and total xylenes (BTEX); methyl tert-butyl ether (MTBE); and PAHs.

For asbestos, several issues were identified in the DVSRs (Neptune 2014). A memorandum responding to the specific issues identified in the DVSRs along with the agreed data set for risk assessment purposes in the EDD was submitted to NDEP (ENVIRON 2014c). As further discussed in Section 6.1.6, the overall impact of asbestos data issues on the risk estimates is relatively small. Compared to the EDD submitted to NDEP (ENVIRON 2014c), the final asbestos data set used in this post-remediation HRA includes two additional samples based on the current boundaries of Parcel H (i.e., RSAU6-0.0B and RSAU7-0.0B). In addition, during the upgradient investigation, asbestos samples were collected at 0.5, 10, and 30 ft bgs at one location (M120) and analyzed for asbestos by polarized light microscopy using USEPA Method 600-R-93-116 (ENSR and AECOM 2006a). Asbestos was reported as less than the reporting limit of 0.25 percent in all samples. However, USEPA notes that Method 600-R-93-116 "is not recommended for characterization activities at Superfund sites".[8] Therefore, the asbestos data from the upgradient investigation are not included in the post-remediation soil HRA data set.

The final post-remediation soil HRA data set for Parcel H is presented in Appendix F (Table F-1 for chemicals and radionuclides, and Table F-2 for asbestos), which includes 86 samples collected at 0, 0.5, 1, 5, and 10 ft bgs from 28 sampling locations.

4.1.1.2 Criterion I – Reports to Risk Assessor

Criterion I requires confirmation that the reports relied upon are complete and appropriate for use in the HRA. The required information specified under this criterion was verified and is available from the following documentation:

- Parcel H is described in Section 3.2 of this report. Information on the regional and local geology and hydrogeology is provided in the RI/FS Work Plan (ENVIRON 2014a).
- The soil investigations and removal actions conducted in Parcel H are described in the following work plans:
  - *Upgradient Investigation Work Plan Addendum, Tronox Henderson Facility (ENSR 2006, approved by NDEP on February 22, 2006);*
  - *Phase 2 Sampling and Analysis Plan to Conduct Soil Characterization, Tronox Parcel "H" Site (BEC 2007a, approved by NDEP on November 20, 2007);*
  - *Phase 2 Sampling and Analysis Plan to Conduct Soil Characterization, Tronox Parcel "H" Site (BEC 2007b, approved by NDEP on December 17, 2007);*
  - *Sampling and Analysis Plan to Conduct Supplemental Soil Characterization, Tronox Parcels "C", "D", "F", "G", and "H" (BEC 2008b, approved by NDEP on June 5, 2008); and*
  - *Removal Action Workplan for Soil, Tronox Parcels "C", "D", "F", "G" and "H" Sites (BEC 2008a, approved by NDEP on July 2, 2008).*

[8] https://www.epa.gov/superfund/superfund-asbestos-technical-resources.

- The soil analytical data are presented in the following DVSRs (included in Appendix E of this report):
  - *Revisions to ENSR AECOM 2006b. Data Validation Summary Report, Document No. 04020-023-152 and Associated EDD, Upgradient Investigation, Tronox, LLC, Henderson, Nevada (Ramboll Environ 2017b, under NDEP review);*
  - *Data Validation Summary Report, Tronox Parcel H Investigation (ERM-West 2008, approved by NDEP on May 5, 2008);*
  - *Data Validation Summary Report, Tronox Parcels C, D, F, G and H Supplemental Investigations-June-July 2008 (ERM-West 2009, approved by NDEP on January 12, 2009);*
  - *Data Validation Summary Report, Parcel "C", "D", "F", "G" and "H" Soil Confirmation (Northgate 2010b, with final response to comments [Northgate 2010c], approved by NDEP on July 28, 2010);*
  - *Data Validation Summary Report for Asbestos Data Associated with the Post-Remediation Screening Health Risk Assessment Report for Parcels C, D, F, G, and H (Neptune 2014); and*
  - *Response to Issues Identified in: Data Validation Summary Report for Asbestos Data Associated with the Post-Remediation Screening Health Risk Assessment Report for Parcels C, D, F, G and H (ENVIRON 2014c).*
- The laboratories provide a quality assurance/quality control (QA/QC) narrative with each analytical data package, and the data review provides a narrative of qualified analytical results. A description of the analytical methods and detection limits is included. These narratives are included as part of each DVSR.
- Method-specific QC results are provided in each laboratory report, along with the associated raw data. The laboratory reports and QC results are included as part of each DVSR.
- Data flags used by the laboratory are defined adequately and are discussed further below.
- Laboratory reports include the name and address of the laboratory, unique identification of the test report, client and project name, and dates of sample receipt and analysis. Each analytical report describes the analytical method used, the analytical results on a sample-by-sample basis, and the practical quantitation limits (PQLs). The results of the QC samples, including method blanks, laboratory control spike (LCS) samples, surrogate recoveries, internal standard recoveries, matrix spike (MS) samples, matrix spike duplicate (MSD) samples, second column confirmation, interference checks, and serial dilutions are also provided. All laboratory reports contained data equivalent to a Contract Laboratory Program (CLP) deliverable, inclusive of CLP QC summary forms where applicable, and the supporting raw data. Reported sample analysis results were imported into the NERT project database, which at the time the studies were conducted, was maintained by BEC, then by Northgate, and currently maintained by Ramboll.

The available reports, and the accompanying laboratory reports and DVSRs, are considered complete for HRA purposes.

4.1.1.3 Criterion II – Documentation

The objective of the documentation review is to ensure that each analytical result can be associated with a specific sampling location, and that the procedures used to collect the samples are appropriate. As part of this DUE step, Rambollcompleted a comprehensive review of the soil samples collected and reported in the documents listed under Criterion I and/or in the NERT project database. As discussed in Section 4.1.1.1, the geographic location of each soil sample was confirmed relative to current parcel and Operations Area boundaries. Samples with missing geographic location information (i.e., x, y coordinates and/or depth) were removed from the post-remediation soil HRA data set. Samples located outside Parcel H were removed, and samples collected as part of an Operations Area investigation but actually located in Parcel H were included.

Also, as discussed in the work plans listed under Criterion I, all sample collection and handling procedures were consistent with the NDEP-approved Quality Assurance Project Plan (QAPP; AECOM and Northgate 2009). Northgate and Rambollreviewed the chain-of-custody (COC) forms prepared in the field and compared them with the analytical data results provided by the laboratories to ensure completeness of the data set.

Figure 3-1 depicts the location of all soil samples included in the Parcel H post-remediation soil HRA data set; the analytical results for each sample are included in Appendix F.

The available information is adequate to relate each analytical result retained in the post-remediation soil HRA data set to a geographic location, depth interval, and sampling procedure.

4.1.1.4 Criterion III – Data Sources

The objective of the data sources review is to ensure that adequate sample coverage of source areas was obtained and the analytical methods used were appropriate to identify chemicals and derive associated exposure point concentrations (EPCs) for the HRA.

The review of sample coverage is based on the distribution of sample locations from soil investigations listed in Section 4.1.1.1. Samples were collected in accordance with the work plans listed under Criterion I, with both judgmental and random sampling collected. As noted in Section 3.2, judgmental samples were collected at locations targeting specific features within Parcel H, including the debris piles, pad mounted transformer, and drainage features. Following each investigation, results were reviewed in consultation with NDEP and areas for additional sampling were identified. The vertical coverage of the soil samples ranged from surface down to 10 ft bgs. Based on the review, sample coverage from the soil investigations in Parcel H are considered adequate for purposes of the post-remediation HRA.

As part of the SAPs and the QAPP, the use of standard USEPA analytical methods (listed under Criterion IV) were approved by NDEP. Analyses were conducted by NDEP-certified laboratories for the classes of chemical compounds identified as SRCs in Parcel H, including chlorine oxyanions (chlorate and perchlorate), metals and other inorganics, radionuclides, asbestos, dioxins/furans, organic acids, PAHs, PCBs, OCPs, OPPs, SVOCs, TPHs (diesel, gasoline, and oil/grease), and VOCs. The USEPA methods are adequate for characterizing potential contaminants in soils and provide quantitative analytical results that are of adequate quality for deriving EPCs.

4.1.1.5 Criterion IV – Analytical Methods and Detection Limits

Criterion IV requires that the analytical method appropriately identifies the chemical form or species, and that for each chemical, the sample quantitation limit (SQL) is sufficiently low for risk characterization. Standard analytical methods were used for all analytes as listed below:

- USEPA Method 300 or 300.1 (chlorate)
- USEPA Method 314.0 (perchlorate)
- USEPA Method 6020 or 6010 (metals)
- USEPA Method 7199 (chromium VI)
- USEPA Method 7471 (mercury)
- USEPA Method 1630 (methyl mercury)
- USEPA Method 365.1 or 365.2 (phosphorus)
- USEPA Method 350.1 (ammonia)
- USEPA Method 9056 or 300 (bromide, chloride, fluoride, nitrate, ortho-phosphate, and sulfate)
- USEPA Method 9014 or 9012A (cyanide)
- USEPA Method 300, 353.2, or 9056 (nitrite)
- DOE EML HASL 300 (thorium [Th])
- DOE EML HASL 300 or ASTM D 5174 (uranium [U])
- DOE EML HASL 300 or USEPA Method 903.1 (radium [Ra]-226)
- DOE EML HASL 300 or USEPA Method 904.0 (Ra-228)
- USEPA Method 540-R-97-028 (asbestos)
- USEPA Method 8290 (dioxins/furans)
- USEPA Method 8270 (organic acids)
- USEPA Method 8270 or 8270 SIM (PAHs)
- USEPA Method 8082 (PCB Aroclors)
- USEPA Method 8081 (OCPs)
- USEPA Method 8141 (OPPs)
- USEPA Method 8270 or 8270 SIM (SVOCs)
- USEPA Method 8015 (TPHs)
- USEPA Method 8260 (VOCs)

The above methods are adequate to characterize the corresponding chemical groups in soil.

During Northgate's review of the analytical results reported in the NDEP-approved DVSRs for the initial 2008 sampling event, Northgate noted that for some samples, nondetect

results were reported to the PQL rather than the SQL. Based on review of the laboratory data packages, and as discussed with the laboratory, the procedure for evaluating these results consisted of the following steps. If a chemical was detected above the PQL, then the value was reported. If the chemical was detected above the SQL, but below the PQL, the value was reported and flagged as a J value. If there was no indication that the chemical was detected, it was reported as a non-detect value at the PQL. These procedures were consistent with the approved DVSR for the 2008 sampling program. However, after taking the responsibility for maintaining the project database on behalf of the Trust in early 2011, Ramboll reassessed the nondetect data according to the current NDEP guidance on the use of censoring limits (NDEP 2008c). In the soil HRA data set, nondetect results are reported to the SQL whenever it is available; otherwise, nondetect results are reported to the method detection limit (MDL). Only when either a SQL or a MDL was not available, the nondetect results are reported to the PQL. Based on NDEP (2008c), the uncensored data for radionulcides were used in the soil HRA, which means a detection frequency of 100%.

For analytes where the detection frequency was less than 100%, the SQLs from the soil HRA data set were compared to 0.1 times the BCL (0.1×BCL)[9] (NDEP 2017a) to confirm that they were sufficiently low for risk characterization. For chemicals where a BCL was not available, representative surrogates were identified and used for the comparison. For dioxin TEQs, the SQLs were compared to the site-specific action level of 0.0027 mg/kg, derived based on a study that evaluated the bioaccessibility of dioxins in soils collected from the NERT Site [Northgate 2010a]). Table 4-1 presents the results of SQL evaluation for Parcel H along with the screening levels.

As shown in Table 4-1, maximum SQLs in Parcel H were less than the screening levels, with the following exceptions:

- For BaPEqs, only two out of 47 samples were detected, and the SQLs exceeded 0.1xBCL in 42 out of 45 samples reported as nondetects.
- For hexachlorobenzene, only one out of 47 samples were detected, and the SQLs exceeded 0.1xBCL in 42 out of 46 samples reported as nondetects.
- Bis(2-Chloroethyl) ether, dieldrin, 2,6-dinitrotoluene, n-nitroso-di-n-propylamine, and toxaphene were not detected in any samples; the SQLs exceeded 0.1xBCL in one or two out of all the non-detected samples.

Overall, the SQLs are generally low enough for risk characterization. The impacts of the few exceptions on the soil risk estimates are further discussed in Section 6.1.2.

4.1.1.6 Criterion V – Data Review

The data review included evaluation of completeness, instrument calibration, laboratory precision, laboratory accuracy, blanks, adherence to method specification and QC limits, and method performance in sample matrix. The laboratory results for the parcel soil investigations were subjected to formal data validation consistent with USEPA guidelines (USEPA 1999a; 2001; 2004a; 2005a,b; 2008; 2009a), the BMI Plant Site Specific Supplemental Guidance on Data Validation (NDEP 2009a), and BRC SOP 40 and Data Review/Validation (BRC 2009). The USEPA guidelines, which were prepared for CLP data,

[9] The lower of the indoor and outdoor industrial/commercial worker BCL was used for the comparison.

were adapted to reflect the analytical methods and measurement quality objectives established for the individual sampling events and NDEP guidance.

The DVSRs listed in Criterion I for soil data included in the HRA data set are provided in Appendix E, in which the names and qualifications of the reviewers, the specific data validation procedures, and the qualification findings are presented. Each DVSR (with the exception of the asbestos DVSR) includes the following tabular summaries of the data qualifications:

- Summary of data qualified due to holding time exceedances
- Summary of data qualified due to detection below quantitation limit
- Summary of data qualified due to laboratory blank contamination
- Summary of data qualified due to field blank contamination
- Summary of data qualified due to MS/MSD recovery exceedances
- Summary of data qualified due to LCS recovery exceedances
- Summary of data qualified due to field/laboratory duplicate
- Summary of data qualified due to surrogate recovery exceedances
- Summary of data qualified due to calibration violations
- Summary of data qualified due to calibration range exceedances
- Summary of data qualified due to internal standard recovery exceedances
- Summary of data qualified due to serial dilutions
- Summary of qualified data results
- Summary of rejected data results

These data qualifications are further discussed below as a component of Criterion VI.

4.1.1.7 Criterion VI – Data Quality Indicators

The project QAPP (AECOM and Northgate 2009) identified five data quality indicators (DQIs) to insure that the overall quality of the data is sufficient to support the risk assessment, as follows: completeness, comparability, representativeness, precision, and accuracy. The DQIs provide quantitative and qualitative measures for evaluating the risk assessment data as they relate to uncertainties in the selection of COPCs, characterization of EPCs, and risk descriptors used in support of the HRA. Specifically, the DQIs address field and analytical data quality aspects as they affect uncertainties in the data collected for site characterization and risk assessment.

Completeness

The completeness criterion includes evaluation of field completeness and laboratory completeness. Field completeness is defined as the percentage of samples collected versus those intended to be collected as specified in the sampling work plans. Laboratory completeness is defined as the percentage of samples reported by the laboratories versus those requested on the COCs. The completeness goal stated in the QAPP is 90% or greater.

First, completeness was reviewed as reported in the DVSR prepared for each individual investigation contributing to the soil HRA data set. A comparison of samples reported in the NERT project database with the work plans for soil investigations listed under Criterion I indicates an actual field completeness of 99.1% to 100% for all sampling events. In addition, all COC requests were executed by the laboratories, with minor exceptions detailed in the DVSRs. Depending on the specific DVSR, 91.41% to 99.8% laboratory completeness was archived based on validated data, with 0.2% to 8.59% of the data qualified as rejected ("R" qualified).

Rejected ("R" qualified) data associated with post-remediation soil samples at 0-10 ft bgs in Parcel H are summarized in Appendix E, Table E-3. Laboratory completeness was calculated for the post-remediation soil HRA data set (Appendix F) for Parcel H as 99.9%.

In summary, both field and laboratory completeness meet the completeness goals of 90% established in the QAPP. Rejected data are excluded from the post-remediation soil HRA data set, and a discussion of how these rejected data occurrences potentially affect the HRA is presented in Section 6.1.3.

Comparability

Comparability is a qualitative characteristic expressing the confidence with which one data set can be combined with another for purposes of estimating exposure. More specifically, comparability is a qualitative expression of the measure of confidence that two or more data sets may contribute to a common analysis. In general, comparability of data is maximized by using standard methods for sampling and analysis, reporting data, and data validation.

Soil samples identified for the post-remediation HRA were collected by different entities and analyzed by different analytical laboratories (and in some cases, different analytical methods were used for the same analyte); overall, the investigations from which data are being used span a period of approximately four years. As discussed in Section 4.1.1.5, Ramboll updated he nondetect data to be reported to the SQL whenever it is available, which maximized the comparability of reporting requirements among different investigations. However, different reporting limits for the same analyte may also impact the comparability of the data sets. The ranges of the SQLs for each analyte for which the detection frequency was less than 100% are presented in Table 4-1. As discussed in Section 4.1.1.5, for most of the analytes, the SQLs are well below 0.1xBCL (or other screening criteria); therefore, different reporting limits for the same analyte would not affect the COPC selection and risk estimates. There are a few analytes with SQLs exceeding 0.1xBCL, and their impacts on the COPC selection and risk estimates are further discussed in Section 6.1.2.

Of particular concern are possible differences between the Parcel H data set and the RZ-A background data set for both metals and radionuclides as a result of different sample preparation methods, modified (or different) analytical methods, and possible systematic differences among the internal laboratory SOPs. For example, the quantile to quantile (Q-Q) plots for aluminium and iron indicate that Parcel H concentrations are generally less than background (see Section 4.1.2.2). These observations indicate possible differences in the data sets, possibly associated with sample extraction, analytical methods, or other less-identifiable differences across the SOPs used by the different

laboratories. For radionuclides, such issues were even more obvious, and may be important factors in explaining some of the radionuclide data anomalies. The Trust submitted a radionuclide data packet prepared by Ramboll Environ to NDEP via email on September 17, 2015, including a comparison of sample preparation and analytical methods between the parcel data sets and the RZ-A background data set. RZ-A background samples were collected and analyzed in 2009, while Parcel H samples were collected and analyzed between 2006 and 2009, i.e, both before and after NDEP issued guidance for evaluating radionuclide data (NDEP 2009b). Over this time period, samples were submitted for analysis to different analytical laboratories and analyzed using different preparation and analytical methods. During a meeting on October 13, 2015, NDEP, NDEP's consultants, the Trust, and Ramboll Environ discussed the analytical issues of radionuclide data and how they would affect the results of background evaluation. These issues are further discussed in Sections 5.1.1.2 and 6.1.4.

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. There is no standard method or formula for evaluating representativeness, which is a qualitative term. Spatial representativeness is achieved through selection of sampling locations that are appropriate relative to the objective of the specific investigation, and by collection of an adequate number of samples from locations identified in relation to the investigation objectives. Concentration representativeness is achieved by obtaining analytical results of sufficient quality, as specified in the QAPP.

Spatial representativeness was discussed previously under Criterion III. As noted, soil samples were collected in accordance with the NDEP-approved work plans listed under Criterion I. Both judgmental and random sampling approaches were followed, with judgmental samples collected at locations targeting targeting specific features within Parcel H, including the debris piles, pad mounted transformer, and drainage features. Following each investigation, results were reviewed in consultation with NDEP and areas for additional sampling were identified. The vertical coverage of the soil samples is also adequate for Parcel H. Overall, the objectives of the investigations were met, and the placement of the sample locations is deemed representative to evaluate the Parcel H soil conditions in the context of the CSM.

As presented in the DVSRs listed under Criterion I, standard methods for sampling and analysis were used for all the investigations, which confirmed that the analytical data are representative of the soil concentrations at the locations sampled.

Precision

Precision is a measure of the degree of agreement between replicate measurements of the same source (field precision) or sample (analytical precision). Field precision is evaluated by calculating the relative percent difference (RPD) between the primary field sample and its field duplicate. Laboratory precision is quantitated for each laboratory data batch by calculating the RPD using data for the LCS/laboratory control spike duplicate (LCSD) and/or data for the MS/MSD. The field precision goal established in the QAPP is a RPD of less than or equal to 50%, except for the case in which one (or both) of the primary or duplicate result is less than five times the reporting limit. For the latter case, the acceptance criteria is the reporting limit (i.e., the absolute value of the

difference between the primary and duplicate result is less than or equal to the reporting limit). Laboratory precision goals are defined for specific analytical methods.

Field precision for the parcel samples was assessed by evaluating the field duplicate results in accordance with the Statistical Analysis Recommendations for Field Duplicates and Field Splits (NDEP 2008d), where the primary sample and field duplicate are independent samples. A total of 27 pairs of primary and field duplicate results for Parcel H were qualified due to RPD or reporting limit exceedance (see Appendix E, Table E-4). For laboratory duplicates, there were 15 data points (for dimethoate and Ra-228) qualified due to RPD or reporting limit exceedance (see DVSRs tables in Appendix E). In addition, 17 data points for dioxins/furans, barium, and perchlorate were qualified for MS/MSD RPD exceedance (see DVSR tables in Appendix E). All data with precision exceedances were qualified as "J/Estimated" or "UJ/Estimated non-detected" and are determined to be usable for purposes of the HRA, and the effects of these qualified data on the results of conclusions of HRA are further discussed in Section 6.1.5.

Accuracy

Accuracy measures the level of bias that an analytical method or measurement exhibits. Both field accuracy and laboratory accuracy are evaluated under this DQI. Accuracy in the field is assessed through the use of trip and equipment blanks and through adherence to all sample handling, preservation, and holding time requirements. Accuracy in the laboratory analytical data is a measure of the overestimation or underestimation of reported concentrations. Several QC parameters are used to evaluate the accuracy of reported analytical results, including:

- Holding times;
- Field and laboratory blanks;
- MS/MSD percent recovery;
- Surrogate spike recovery; and
- LCS percent recovery.

All qualified results (i.e., U, J, J-, and J+ qualified data)[10] for the non-asbestos analytes are presented in Appendix F, Table F-1, and the reasons for these qualified results are summarized in the DVSRs (see Appendix E). Although laboratory limits were exceeded for certain compounds or analyses, as identified by the laboratory (and confirmed during data validation), there does not appear to be a systematic or widespread impact on the quality of the analytical results. Furthermore, based on a review of the laboratory narratives (provided in the laboratory reports in each DVSR), the laboratory does not believe that the observed exceedances of laboratory criteria are cause for concern. Therefore, the qualified data are determined to be usable and valid for purposes of the post-remediation HRA and are included in the HRA data set. As discussed further in Section 6.1.6, use of qualified data resulting from one or more of the above parameters is not expected to significantly impact the results and conclusions of the post-remediation HRA.

Data collected before 2012 and associated with field and laboratory blank contamination were originally qualified as nondetects based on the NDEP guidance at that time. As

[10] J, estimated value; J-, estimated, biased low; J+, estimated, biased high; U, not detected.

requested by NDEP and in accordance with the most recent guidance (NDEP 2012) for evaluating data associated with blank contamination, Rambollqueried the censored data for blank contamination from the project database, and updated them from nondetected values at PQLs (U qualified) to detected values at reported concentrations (J qualified) if the PQLs were higher than the reported concentrations. Such revisions only affected the two samples collected during the 2009 Phase B investigation (RSAU6 and RSAU7). However, during our review, Ramboll noticed that several discrepancies in the data associated with blank contamination collected during the 2008 Phase 2 soil investigation exist between the project database and the amended tables of the DVSRs Northgate prepared in the Soil HRA Report Revision 3 (Northgate 2014), especially for the reported concentrations. Data consistent with the project database are included in this HRA, and the impacts of such discrepancies on the HRA results are further discussed in Section 6.1.6.

4.1.1.8 Data Usability Conclusions

Evaluation of the soil analytical data for Parcel H in terms of usability for the risk assessment was conducted in accordance with USEPA and NDEP guidance. Based on the evaluation, the overall goals for data quality for risk assessment were achieved, and all

DVSRs were reviewed and approved by NDEP (with the exception of the revised DVSR for the upgradient investigation in 2006, which was submitted to NDEP on September 28, 2017 and is currently under NDEP's review). In summary, with the exception of the rejected data discussed above, all parcel data are deemed to be usable for risk assessment purposes.

4.1.2 Data Analysis

Consistent with guidance (NDEP 2010b), the steps of the exploratory data analysis (EDA), as described in the following sections, include (1) preparation of summary statistics for the post-remediation soil HRA data set (Section 4.1.2.1), (2) evaluation of background conditions for metals and radionuclides (Section 4.1.2.2), and (3) preparation and review of spatial plots for detected analytes (Section 4.1.2.3). Section 4.1.2.4 discusses the results of the EDA in the context of current and former land use and operations within Parcel H and the CSM.

4.1.2.1 Summary Statistics

Summary statistics for analytical data collected from shallow soils (i.e., samples collected between 0 and 10 ft bgs) in Parcel H are presented in Table 4-2. Table 4-2 includes analytes detected in one or more soil samples; Appendix G presents summary statistics for all analytes (i.e., detected analytes and analytes reported at less than the SQL in all samples). Individual sample locations are shown on Figure 3-1. In developing the summary statistics, soil samples with primary and field duplicate results were treated as independent samples. The effect of duplicate treatment on the HRA results and conclusions is further discussed in Section 6.1.7.

Table 4-3 presents the soil data summary results for asbestos (long amphibole and long chrysotile fibers). Results are reported in terms of the number of long fibers (i.e., >10 µm long and <0.4 µm wide) observed in the sample. As shown in Table 4-3, no long amphibole fibers were observed in any of the samples. One long chrysotile fiber was observed in five out of 25 post-abatement samples in Parcel H.

4.1.2.2 Background Evaluation

To support the EDA, a background evaluation was conducted for Parcel H. As requested by NDEP (2010d), analytical results for soil samples within RZ-A were used as the background data set for metals.[11] A detailed discussion of this data set is presented in the Revised Technical Leaching Memorandum (Northgate 2010d). In summary, 31 soil samples, including three field duplicates, were collected from 14 borings[12] within RZ-A during the Phase B investigation; 16 of these samples were collected between 0 and 2 ft bgs and 15 samples were collected between 10 and 11.5 ft bgs. Consistent with the background evaluations conducted in previous versions of this HRA, a single Phase A boring location (SA02) and five Phase B boring locations (RSAU4, RSAU5, SA28, SA146, and SA147) within LOU 62 (former State Industries, Inc. operational area and boron source area) were excluded from the RZ-A background set due to elevated concentrations of boron and other metals (arsenic, chromium, cobalt, iron, molybdenum, nickel, platinum, and sodium).[13]

The RZ-A samples identified for the metals background evaluation were also used for the radionuclide background evaluation. In previous versions of Parcel Soil HRA, the BRC/TIMET background data set presented in *Background Shallow Soil Summary Report, BMI Complex and Common Area Vicinity* (BRC and TIMET 2007) was used for the radionuclide background evaluation. However, in comments on Soil HRA Report Revision 3 (NDEP 2015), NDEP clarified that the RZ-A data set (and not the BRC/TIMET data set) should also be used for the radionuclides. The data set used for the background evaluation of both metals and radionuclides and the background sample locations are included in Appendix H.

The background evaluation was performed using normal and lognormal Q-Q plots, and side-by-side box-and-whisker plots (box plots). These plots are included in Appendix I. Normal and lognormal Q-Q plots provide a visual assessment of how closely the data follow a normal or lognormal distribution. Data points that fall roughly on a straight line may be considered to follow a normal or lognormal distribution. Both background and parcel data are included on these plots such that the Q-Q plots provide a direct visual comparison of the two distributions. The Shapiro-Wilk test was used to more formally evaluate the consistency of each data set with a normal or lognormal distribution.

Box plots provide a visual comparison between Parcel H and background data. These plots are included in Appendix I. For each data set, the “box” in the box-and-whisker plot encompasses the central 50 percent of the results (i.e., the results from the 25th to 75th percentiles, or equivalently, between quartile 1 [Q1] and quartile 3 [Q3]). Substantial overlap between the boxes for background and parcel data indicates that the parcel data may not be significantly different from background. The whiskers demarcate one “step”

[11] NDEP investigated the differences observed in metals concentrations among available BMI background data sets and determined that the RZ-A data set was appropriate for statistical background analysis of metals at the Tronox facility (presently the NERT Site) (NDEP 2010c).

[12] As shown on Figure H-1, RSAT7, RSAT8, and RSAS6 are located outside the boundaries of RZ-A and the Site. These three off-site samples are retained in the background data set.

[13] Although metals concentrations in these samples were elevated relative to background, the results of the RZ-A HRA indicated that exposures to residual chemicals in the upper 10 ft of soil were below risk levels of concern (Northgate 2010e).

above the 75th percentile and one step below the 25th percentile. One "step" is defined as 1.5 times the interquartile range (IQR, the difference between the 75th and 25th percentiles). Data points above and below the whiskers are considered potential outliers from the distribution and are shown on the plots as open circles for non-detected values and as crosses for detected values. As used here, "outliers" may indicate potential hotspots for spatial analysis.

The computer statistical software program Guided Interactive Statistical Decision Tools (GiSdT®, Neptune 2007) was used to perform all statistical tests.[14] Specifically, statistical background comparisons were performed using the t-test, Gehan test, Quantile test, and Slippage test. This suite of tests is sometimes referred to as "Gilbert's Toolbox." The t-test is a parametric test (i.e., an underlying condition is that the data or log-transformed data are normally distributed). In contrast, the Gehan test, Quantile test, and Slippage test are nonparametric, and thus do not require that the data are normally or lognormally distributed (USEPA 2002a; NDEP 2009c). These tests are described below:

The two-sample t-test tests for equality of the means of the parcel and background concentrations. An underlying assumption of the test is that concentrations are normally distributed for both data sets.

The Gehan test is a modification of the Wilcoxon Rank Sum test that evaluates the difference between the sums of the ranks for two populations. This is a nonparametric method for assessing differences in the centers of the distributions and is based solely on the relative order (or ranking) of the observations from the two samples. This test has less power than the two-sample t-test when the data are normally distributed, but the assumptions are not as restrictive. The GiSdT® version of the Gehan test uses the Mantel approach for ranking the data, which is equivalent to using the Gehan ranking system. The Gehan ranking system is used to rank non-detects with the detected concentrations (NDEP 2009d).

The Quantile test evaluates "tail effects" that are not specifically considered in the Wilcoxon Rank Sum test. The Quantile test looks for differences in the right tails (upper end of the distribution), rather than evaluating central tendency. The Quantile test was performed using a defined quantile of 0.80, consistent with the approach used in previous versions of the parcel soil HRA (personal communication between Northgate and Neptune on October 7, 2009).

The Slippage test looks for a shift to the right in the extreme right tail of the background data set as compared with the extreme right tail of the parcel data set. This test evaluates whether the number of parcel samples with concentrations greater than the maximum background concentration is greater than would be expected statistically if the parcel and background distributions were the same.

NDEP guidance (2008d) recommends including field duplicates in a data set when the variance of the duplicates is similar to the variance of the primary samples. As noted in the guidance, field duplicate samples represent a discrete and unique measurement of soil chemical conditions proximal to the primary sample (unlike split samples). For the background evaluation presented in this report, soil samples with primary and field

[14] Neptune provided Ramboll with a copy of the GiSdT® program used for the statistical evaluation.

duplicate results were treated as independent samples, consistent with Option 2 in NDEP guidance (NDEP 2008d). The effect of duplicate treatment on the COPC selection and HRA results is further discussed in Section 6.1.7.

Consistent with NDEP guidance (NDEP 2009d), non-detect results were set equal to one-half the limit of detection for the parametric tests and equal to the detection limit for the non-parametric tests. Substitution is not required for the non-parametric tests, which use the Gehan ranking scheme to rank non-detects. For the t-test, the Gehan ranking scheme cannot be used; in comments on Revision 2 of the parcel soil HRA, NDEP stated that the value of one-half the detection limit for non-detects is preferred to represent the results by the most-likely actual values (NDEP 2009d).

Metals

The background evaluation for metals in Parcel H is presented in Appendix I, as follows:

- Table I-1 presents summary statistics for each metal, including the total number of samples, number of detections, percent detections, minimum SQL, maximum SQL, minimum detected value, maximum detected value, median, mean, and standard deviation. Consistent with NDEP guidance (NDEP 2008e), the median, mean, and standard deviation are calculated based on detected concentrations only. The results of the Shapiro-Wilk test are also presented.
- Table I-2 includes the calculated probability (p-values) for the four statistical tests and the overall determination as to whether soil concentrations in Parcel H are greater than background levels. (Five results are shown in the table because the t-test was performed twice, once on the raw data set and once on the log-transformed data set).
- Figures I1-1 through I1-32 present boxplots for metals in background soils and Parcel H soils (upper 10 ft).
- Figures I2-1 through I2-32 present normal and lognormal Q-Q plots for metals in background soils and Parcel H soils (upper 10 ft).

A significance level of alpha = 0.025 was used to evaluate the statistical significance of the Gilbert's Toolbox results, consistent with NDEP guidance (NDEP 2009d).

Radionuclides

The background (RZ-A) data set includes results for the long-lived radionuclides in the U-238 decay series (U-238, U-234, Th-230, and Ra-226) and in the Th-232 series (Th-232, Ra-228, and Th-228). The RZ-A background data set also includes data for U-235, but not for the U-235 decay chain. NDEP guidance (2009b) notes that most isotopes of the U-235 decay chain are barely discernible from the minimal detectable concentrations. The background evaluation and tests for secular equilibrium are presented in Appendix I, as follows:

- Table I-3 presents summary statistics for each radionuclide, including the total number of samples, number of detections, percent detections, minimum SQL, maximum SQL, minimum and maximum detected values, median, mean, and standard deviation. Consistent with NDEP guidance (NDEP 2008e), the median,

mean, and standard deviation are calculated based on detected concentrations only. The results of the Shapiro-Wilk test are also presented.

- Table I-4 includes the p-values for the four statistical tests and the overall determination as to whether soil concentrations in Parcel H are greater than background levels. (Five results are shown in the table because the t-test was performed twice, once on the raw data set and once on the log-transformed data set).
- Tables I-5a and H-5b present the results of the equivalence testing for secular equilibrium of the uranium decay series (U-238 chain) and thorium decay series (Th-232 chain), respectively.
- Table I-6 presents the correlation matrices for the uranium decay series and the thorium decay series.
- Figures I1-33 through I1-40 present the boxplots for radionuclides in background soils and Parcel H soils (upper 10 ft).
- Figures I2-33 through I2-40 present normal and lognormal Q-Q plots for radionuclides in background soils and Parcel H soils (upper 10 ft).

The significance level used for the background evaluation of metals (alpha = 0.025) was also used for the background evaluation of radionuclides.

4.1.2.3 Spatial Analysis of Chemicals in Soil

Spatial quartile plots (included in Appendix J) were prepared for detected chemicals in Parcel H to illustrate the spatial distribution of the data, identify potential hotspots, and compare the results to the expectations of the CSM. Each spatial quartile plot presents the following information:

- Sample locations;
- Chemical concentrations. The concentration shown at each sample location is the maximum detected concentration for all samples collected at that location for soils from 0-10 ft bgs, unless results for all samples at that location were reported as less than the detection limits; concentration bins are defined as follows:
  - *Dark green - concentrations < detection limits;*
  - *Light green - concentrations <Q1;*
  - *Yellow - concentrations within the IQR;*
  - *Orange - concentrations >Q3 and <(Q3 + 1.5×IQR); and*
  - *Red - concentrations >(Q3 + 1.5×IQR).*

Spatial quartile plots are presented for 13 detected analytes for Parcel H, as follows:

- Chloroxyanions – chlorate and perchlorate;
- Metals – all metal COPCs (identified in Section 5.1.1) and metals with concentrations greater than background (with the exception of potassium and sodium);
- Radionuclides – U-238, Th-232, and U-235 (the parent radionuclides); and
- Organics - all organic COPCs (identified in Section 5.1.1) and organics with a detection frequency of 20 percent or greater (with the exception of common field/laboratory contaminants, e.g., methylene chloride).

The plots are presented in Appendix J (organized alphabetically by chemical name) and discussed in Section 4.4. The EDA (including the review of the Appendix J spatial quartile plots) is presented in Table 4-4 for chlorine oxyanions, metals, other inorganics, and radionuclides, and in Table 4-5 for dioxins/furans, other organics, PAHs, pesticides, SVOCs, and VOCs.

4.2 Soil Gas

4.2.1 Data Usability Evaluation

The soil gas samples evaluated using the data quality criteria previously described for soil are identified in Section 4.2.1.1 and the evaluation of the sample results relative to these criteria is presented in Sections 4.2.1.2 through 4.2.1.7. A summary of the DUE is presented in Section 4.2.1.8.

4.2.1.1 Soil Gas Data Set

Soil gas samples within Parcel H were collected in 2008 during the Phase B site-wide (including Parcel H) soil gas survey. Two soil gas samples (SG-49 and SG50) were collected within the boundary of Parcel H. The analytical data for these two soil samples are summarized in Appendix K of this report.

4.2.1.2 Criterion I – Reports to Risk Assessor

Criterion I requires confirmation that the reports relied upon are complete and appropriate for use in the HRA. The required information specified under this criterion was verified and is available within the following documentation associated with the Study Area data collection efforts:

- A description of Parcels H is provided in Section 3 of this HRA. Information on the regional and local geology, hydrogeology, and historical industrial operations is provided in the Site RI/FS Work Plan (ENVIRON 2014a).
- The sampling design, rationale, and sampling procedures for the 2008 soil gas investigation are provided in the following 2008 work plan:
  - *Phase B Source Area Investigation Work Plan, Soil Gas Survey, Tronox LLC Facility (ENSR 2008a, approved by NDEP on March 26, 2008); and*
  - *Soil gas sampling locations for the 2008 sampling events, provided in the work plan, are shown on Figures 3-1 and 3-2 of this HRA.*
- Laboratory reports for the 2008 soil gas data are included in the 2008 DVSRs (Appendix L). The laboratory reports include the name and address of the laboratory,

a unique identifier for the test report, client and project name, and dates of sample receipt and analysis.

- The reports also identify the analytical methods and include information on sample preparation. Results are provided individually for each sample. For each analyte, method detection limits and PQLs are provided. The reports also include information on the gas chromatography/mass spectroscopy (GC/MS) tuning, initial and continuing calibrations, method and canister blanks, surrogate spike recoveries, internal standard results, laboratory control (LC) samples, field duplicate results, laboratory duplicate results, target compound identification, and dilution factors. A QA/QC narrative was included with each analytical data package, and the data review provided a narrative of qualified analytical results. These narratives are included in the Revised DVSR for the 2008 soil gas data (Appendix L).
- Data flags used by the laboratories were defined and described adequately in the 2008 DVSR (Appendix L). The qualification findings are summarized in Section 4.2.1.7.

The soil gas data from the 2008 investigation was provided in the 2008 DVSR as an Access© compatible database (ENSR 2008b, Appendix L), which was approved by NDEP on October 20, 2008.[15] The 2008 analytical data are provided on a per-sample basis, qualified for analytical limitations and error, and accompanied by SQLs.

The 2008 work plans and associated DVSR are considered complete for HRA purposes.

4.2.1.3 Criterion II - Documentation

The objective of the documentation review is to ensure that all analytical data can be associated with a specific sample location and appropriate sample collection procedure.

Both soil gas locations were surveyed as described in the the BRC SOP-10 (ERM-West and MWH 2008). Chain-of-custody forms prepared in the field were reviewed and compared to the analytical results provided by the laboratory, and all samples and results were correlated to the correct geographic location at the property. Reviewed reports provided adequate information regarding sample results relative to location, time of sampling and analysis, and sampling procedures. Figures 3-1 and 3-2 show the location of all soil gas samples included in the HRA data set; a complete set of the analytical results is summarized in Appendix K and also included in the EDD (Appendix L).

4.2.1.4 Criterion III – Data Sources

The review of data sources is performed to ensure that adequate sample coverage of source areas has been obtained and that the analytical methods are appropriate to identify COPCs and estimate exposure concentrations.

Samples collected in accordance with the 2008 Work Plan were (1) located within LOUs where VOCs may have been used in historical operations; (2) located to evaluate soil gas concentrations associated with on-site plumes; (3) co-located with existing groundwater monitoring wells; and (4) located randomly throughout the Site (including the Study

[15] The soil gas analytical data presented in the 2008 DVSR (ENSR 2008b) included data from samples collected across the entire Site. The 2008 data discussed in this section includes only the data from samples collected in or near the Study Area and evaluated in this HRA.

Area) to obtain spatial coverage. The 2008 sampling locations are shown on Figures 3-1 and 3-2. As shown on Figure 3.2, Parcel H is not located over the main chloroform plume area (as defined by >70 µg/L concentration of chloroform). One soil gas sample was collected on the west half of the parcel (SG49) and one soil gas sample was collected on the east half of the parcel SG50). No hot spots of VOCs were detected in soil, soil gas or groundwater throughout Parcel H. Based on this review, sample coverage is considered adequate for purposes of this HRA, assuming groundwater conditions remain stable.

Analytical methods were appropriate to identify a broad spectrum of VOCs in soil gas. As identified in the approved 2008 work plan (ENSR 2008a) and approved by NDEP, the soil gas samples and QC samples collected in 2008 were analyzed by USEPA Method TO-15, as described in Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) (USEPA 1999b). Analyses were conducted by NDEP-certified laboratories for VOCs in soil gas.

4.2.1.5 Criterion IV – Analytical Method and Detection Limits

Under Criterion IV, the SQLs were evaluated to confirm that they were sufficient for risk characterization. Because NDEP has not derived BCLs for soil gas, risk–based concentrations (RBCs) were derived corresponding to the more stringent of (1) a cancer risk of 1×10^{-6} or (2) a noncancer hazard quotient (HQ) of 1. The RBCs were derived using the outputs from the Johnson and Ettinger (1991) model and values for exposure assumptions and toxicity criteria presented in Section 5 of this HRA. The lowest RBCs among the RBCs developed for indoor workers, outdoor workers and construction workers for 5 ft soil gas were selected in the evaluation of the SQLs of the 5 ft soil gas data set for Parcel H.

For analytes for which the detection frequency was less than 100%, the maximum SQL from the 2008 data set for Parcel H was compared to the RBCs. Table 4-6 lists the maximum SQLs from the soil gas data set (both samples were approximately 5 ft bgs samples) and 5-ft soil gas RBCs, present the ratio of the maximum SQL to 1/10th of the RBC, and include the number of samples with SQLs greater than 1/10th of the RBC for Parcels H. For both soil gas samples collected in Parcel H, the maximum SQLs were less than 10% of the respective RBCs for all analytes (i.e. no non-detects were greater than 10% of the RBC) except that the SQL for one chemical (1,2-Dibromo-3-chloropropane) for SB50 is slightly higher than 10% of the RBC. This result is in general consistent with the QAPP goal that SQLs are less than 1/10th of the BCL, as established by NDEP for the BMI Complex and Common Areas (NDEP 2010b). The SQLs achieved were confirmed to be adequate for risk assessment. The uncertainty associated with the SQL for 1,2-Dibromo-3-chloropropane for SG50 is discussed in Section 6.1.2.

4.2.1.6 Criterion V – Data Review

The laboratory results of the soil gas samples for the 2008 Phase B Source Area Soil Gas Survey were subjected to formal data validation consistent with (1) USEPA guidance on data validation (USEPA 1999a, 2001, 2008, 2009a), (2) the BMI Plant Site Specific Supplemental Guidance on Data Validation (NDEP 2009a), and (3) BRC SOP 40 and Data Review/Validation (BRC 2009). The specific data validation procedures are summarized in the following paragraphs.

The 2008 soil gas data from the laboratory were submitted to Exponent and ENVIRON, respectively, as CLP-like data packages in PDF format and EQuIS® format EDDs. The EDDs were imported into an EQuIS® database specifically created for this project. ENSR validated the 2008; all data validation qualifiers were entered into the project database. The soil gas data set from 2008 was compared to the goals established in the 2008 QAPP (ENSR 2008c).

As part of the 2008 soil gas DVSR, an individual validation memorandum was developed for the 2008 soil gas samples (ENSR 2008b). Exponent reviewed the 2008 soil gas DVSR. The 2008 soil gas DVSR reported on the verification and examination of the following data elements:

- Data package completeness;
- Holding times;
- Initial and continuing calibrations;
- Method blanks/canister blanks;
- Surrogate spike recoveries;
- Internal standard results;
- LC sample results;
- Field duplicate results;
- Laboratory duplicate results;
- Quantitation limits and sample results; and
- Helium gas concentrations

Within Appendix L, the data validation memo summarizes the qualification findings as presented in the 2008 DVSR with regard to blank contamination, calibrations, field duplications, quantitation problems, and helium tracer results, respectively. These data qualifications are discussed below, as a component of Criterion VI.

4.2.1.7 Criterion VI – Data Quality Indicators

The DQIs include completeness, comparability, representativeness, precision, and accuracy. The information from the DQI review supports the discussion of uncertainties in the HRA (presented in Section 6) as related to (1) selection of COPCs; (2) characterization of exposure concentrations; and (3) the estimated cancer risks and noncancer hazards. Further, this final step of the DUE is conducted to insure that the overall quality of the data is sufficient to support the HRA and the risk management decisions that will be made for the Study Area. The specific criteria for assessing DQIs were identified in the NDEP-approved QAPPs (BRC, ERM, and MWH 2007b, ENSR 2008c, AECOM and Northgate 2009).

Completeness

The completeness criterion includes an evaluation of field completeness and laboratory completeness. Field completeness was 100% for the 2008 sampling events, exceeding the goal of greater than 90% completeness established in the QAPPs (BRC, ERM, and MWH 2007b, ENSR 2008c, AECOM and Northgate 2009). The field completeness calculation is based on the number of locations sampled and number of samples

collected, as identified in the investigation work plans, as compared with the number of locations sampled and number of samples shown on the completed chain-of-custodies.

All chain-of-custody requests were executed by the laboratories, with only a few minor exceptions reported for the 2008 sampling. (Exceptions are detailed in the data validation memoranda included in Appendix L.) No rejected data were identified in the soil gas data set for Parcel H. Laboratory completeness achieved for the 2008 data sets was 100%, based on the number of requested analyses on the chain-of-custodies as compared with the number reported by the laboratory. Overall data completeness was 99% for the 2008 data set, based on the number of validated data points,exceeding the QAPP goals of 95%.

Comparability

Comparability is a qualitative characteristic expressing the confidence with which one data set can be combined with another for purposes of estimating exposure. More specifically, comparability is a qualitative measure of confidence that two or more data sets may contribute to a common analysis. In general, comparability of data was maximized by using standard methods for sampling and analysis, data reporting, and data validation over the sampling programs. Because the soil gas samples collected in Parcel H were both from the 2008 site-wide soil gas survey, the comparability evaluation was not performed. For the same reason, temporal trends in the soil gas concentrations in Parcel H were not evaluated (this issue is discussed in Section 6.1, Uncertainty Analysis).

Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of the population at a sampling point or across an area (e.g., represented by the average concentration). There is no standard method or formula for evaluating representativeness. Spatial representativeness is achieved through selection of sampling locations that are appropriate relative to the objective of the specific investigation and by collection of an adequate number of samples from locations identified in relation to the investigation objectives. Concentration representativeness is achieved by obtaining analytical results of sufficient quality, as specified in the QAPP.

Spatial representativeness was discussed previously in Section 4.2.1.4. Locations sampled in 2008 were placed at five ft bgs near or within LOUs where VOCs may have been used in past operations; in areas overlying trespassing (western site boundary) groundwater plumes; and/or co-located with groundwater monitoring wells. Additional locations were included to achieve spatial coverage. For Parcel H, the two soil gas samples, SG49 and SG50, were co-located with monitoring wells M-121 and M-103, respectively, consistent with the investigation objective. Addtionally, Parcel H is located outside the main groundwater chloroform plume area (as defined by >70 µg/L concentration of chloroform). The VOC concentrations detected in both soil gas samples are all very low, which is in line with the VOC concentrations detected in the groundwater samples collected in Parcel H. Collectively, the soil gas data sets are representative of potential source areas (i.e., LOUs) and areas overlying the highest VOC concentrations in groundwater within Parcel H.

The degree to which the analytical data are representative of soil gas concentrations at the locations sampled is evaluated in this section by reviewing the helium leak check

data from the 2008 investigations. Analytical precision and accuracy, also considered in the evaluation of representativeness, are discussed in Section 4.2.1.7.

Entrainment of contaminants and dilution with surface air can impact the representativeness of analytical results. Helium gas was used in the 2008 investigation as a leak check compound during purging and sampling. For the 2008 investigation, all sample results with helium concentrations between 1% and 10% of the shroud average were qualified as estimated (J) based on possible contamination and dilution by surface air. This rule was based on a conservative interpretation of the Interstate Technology Regulatory Council (ITRC) document *Vapor Intrusion Pathway: A Practical Guideline* (ITRC 2007) and *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (New York State Department of Health 2006). None of the analytical result from the two soil gas samples collected within Parcel H was J qualified due to this criteria. No helium concentration in soil gas exceeded 10% of the shroud average.

Precision

Precision is a measure of the degree of agreement between replicate measurements of the same source (field precision) or sample (analytical precision). Precision is expressed by the RPD between replicate measurements. Replicate measurements can be made on the same sample or on two samples from the same source.

Field precision for the Study Area samples was assessed by evaluating the field duplicate results for the 2008 investigation. Although field duplicate samples were collected in 2008, none of the duplicate samples were collected from locations in or near Parcel H. As summarized in the 2010 Site-Wide Soil Gas HRA (Northgate and Exponent 2010c), for samples collected outside Parcel H, 84 associated field sample results in nine primary sample/field duplicate pairs were qualified estimated (J) based on RPDs that exceeded the QAPP criteria. These values were summarized from information in the 2008 DVSR. Field duplicates were associated with each of the 2008 sample delivery groups (SDGs), as discussed further in Section 6.1.5.

Laboratory precision was quantitated for each laboratory data batch using data for the laboratory control versus the laboratory control duplicate (LC/LCD) and/or data for the MS/MSD. The laboratory duplicate precision was within the limits established in the QAAPs for the 2008 analytical program.

Accuracy

For this DQI, field accuracy and laboratory accuracy are evaluated. Accuracy in the field is assessed through the use of trip and equipment blanks and through adherence to all sample handling, preservation, and holding time requirements. As specified in the QAPP, the objective for trip and equipment blanks is for no analyte to be present at levels greater than the laboratory PQL.

For the 2008 data set, two results were qualified due to contamination in equipment or field blanks. All 2008 soil gas samples were analyzed within the holding time of 30 days specified for USEPA Method TO-15, and sample preservation and sample integrity criteria were met. No deviations in sample handling were reported.

Accuracy in the laboratory analytical data is a measure of the overestimation or underestimation of reported concentrations. Accuracy is quantitated for each laboratory data batch using data for method blanks, LC samples and/or MS samples.

- Method blanks or eauipment blanks. Qualifications based on contamination in method or equipment blanks were reviewed. For the 2008 soil gas data in Parcel H, two acetone results were qualified as estimated (J or J+) due to contamination in blanks associated with samples SG49 and SG50 (Table L-1). The uncertainties associated with these two acetone results are discussed in Section 6.1.
- Spike recovery. Surrogate percent recovery and LC standard percent recovery met the QAPP acceptance criteria of 70 to 130% for all 2008 soil gas sample analyses.

4.2.1.8 Data Usability Conclusions

All analytical results from the soil gas samples for Parcel H were deemed usable for conducting the HRA. The HRA soil gas data set includes a total of 2 soil gas samples collected in 2008 within Parcel H, both collected at a depth of approximately five ft bgs.

All J-qualified data were considered usable and were retained for purposes of the HRA and are summarized in Table L-2 of Appendix L. The impact of "J" qualified data on the HRA risk results is discussed in Section 6.1 of the Uncertainty Analysis.

4.2.2 Data Analysis

As described by NDEP (2010c), the purpose of the data analysis step is to "use simple exploratory data analysis to compare data to the expectations of the CSM, to determine if the data adequately represent the source terms and exposure areas or evaluation areas." Consistent with the NDEP guidance, summary statistics and spatial plots were prepared. Additionally, specific data analyses requested by NDEP were conducted, as described below.

4.2.2.1 Summary Statistics

Summary statistics for the soil gas data set for Parcel H are presented in Table 4-7. For the soil gas dataset used in the Parcel H HRA, as shown in Table 4-7, 42 VOCs were detected in at least one soil gas sample, and 31 VOCs were detected in 100% of the samples collected within Parcel H. The highest detected concentrations were for acetone (39 µg/m^3), carbon disulfide (32 µg/m^3) and vinyl acetate (16 µg/m^3). No other VOC was detected at concentrations of over 10 µg/m^3, and most VOCs were detected at concentrations of less than 1 µg/m^3 in Parcel H. Chloroform was detected at a maximum concentrations of 1.3 µg/m^3. The SQLs were low (less than 1 µg/m^3).

4.2.2.2 Spatial Analysis of VOCs in Soil Gas

Only two soil gas samples are available within Parcel H and the VOC concentrations in both soil gas samples are very low and no discernable spatial distribution was identified in the soil gas VOC data in Parcel H.

4.3 Groundwater

4.3.1 Data Usability Evaluation

In response to NDEP comments (NDEP 2017b), groundwater data were used in this HRA to evaluate potential risks for the vapor intrusion pathway. In the previous draft HRA report for the vapor intrusion pathway (Ramboll Environ 2016b), risks were evaluated using soil gas data, with a screening-level evaluation using groundwater data presented in an appendix. Considering USEPA's recent vapor intrusion guidance (USEPA 2015), which states that both soil gas and groundwater data should be considered in a line-of-

evidence approach, risks for the vapor intrusion pathway were evaluated using both soil gas and groundwater results.

Consistent with previous USEPA guidance and NERT project work plans, only soil gas samples were collected to support evaluation of the vapor intrusion pathway. The objectives of groundwater sampling at the Site have been primarily to characterize SRCs in groundwater near suspected source areas and plume delineation; that is, no groundwater investigation was conducted to specifically provide data to evaluate the vapor intrusion pathway. Further, the majority of groundwater sampling on the Site has focused on perchlorate and hexavalent chromium, with limited sampling for VOCs and SVOCs.[16]

To provide groundwater data for this HRA, the NERT project database (discussed in Section 4.1.1.1) and the BMI database[17] were queried to identify wells within or near Parcel H and for which VOC and/or SVOC results were available for shallow groundwater. The identified wells include wells owned and sampled by NERT. The wells meeting these criteria and relevant information, including well owners and sampling dates, are listed in Table 3-2.

Considering the approach for identifying groundwater data for evaluation in the HRA, the groundwater DUE addresses those DUE elements that are relevant and practicable to evaluate. Specifically, it is not practicable to conduct a comprehensive DUE for data collected by NERT predecessors and other BMI entities that have been reported in multiple work plans and DVSRs that span a period of approximately 10 years. Ramboll understands that groundwater data and the associated DVSRs would have been reviewed and approved by NDEP prior to entry into the NERT and BMI databases.

4.3.1.1 Groundwater Data Set

As noted above, groundwater wells were identified by querying the NERT and the BMI databases. VOC results were identified from four (4) wells within Parcel H. The x,y coordinates for each well were plotted to verify that the wells are located within or near the parcel. A complete set of the groundwater analytical results is included in Appendix M.

Similar to the data processing steps described in Section 4.1.1.1 for soils, the combined groundwater data from the NERT and BMI databases were reviewed to 1) identify and correct inconsistencies in data field entries and 2) create additional fields to support data management and interpretation. The following steps of data processing were completed:

[16] Any chemicals labelled as SVOCs that are included in the USEPA definition of volatile compounds are also included in the vapor intrusion analysis. The volatile compounds are currently identified using the following criteria consistent with recommendation from the USEPA Regional Screening Levels Table (USEPA 2017b): 1) vapor pressure greater than 1 mm Hg or 2) Henry's Law constant greater than 0.00001 atm-m^3/mole.

[17] The BMI Database, or the BMI Complex, Common Areas and Vicinity Database (BMIdbase) version 2 BETA, us a database maintained by NDEP. The purpose of this site is to provide access to data from a variety of parties located within and near the BMI Complex and Common Areas in Henderson, Nevada. In addition to access to data, this site provides access to certain tools which can be used to manipulate and depict the data. http://ndep.neptuneinc.org/ndep_gisdt/home/index.xml

- Standardize chemical names and CAS registry numbers;
- Standardize analytical method names;
- Correct errors in data entry (e.g. errors in sample identification codes);
- Identify a unique result for use in the HRA for sample/analyte pairs for which more than one result was reported. For example, if two results were reported for BaP in the same sample – one by USEPA Method 8270 and the second by USEPA Method 8270 SIM – the result to be used in the HRA was identified as that from the 8270 SIM analysis because of the greater sensitivity (lower reporting limits) of this method.
- Develop database queries and confirm that queries returned the correct output.

The above steps were necessary due to the approximately 10-year period over which the groundwater data was collected and the differences in sampling, analysis, and data entry across investigations.

4.3.1.2 Criterion I – Reports to Risk Assessor

Criterion I requires confirmation that the reports relied upon are complete and appropriate for use in the HRA. As noted previously, Ramboll relied upon the information presented in the NERT project database and the BMI Database. Specifically, this information included location ID, x,y coordinates, sample ID, sample type, sampling date, sampling depth, analyte, analytical method, analysis date and time, result, unit, data qualifiers, dilution factor, filtered flag, reanalysis flag, source of data, and available DVSR IDs.

4.3.1.3 Criterion II – Documentation

The objective of the documentation review is to ensure that all analytical data can be associated with a specific sample location and appropriate sample collection procedure.

The NERT and BMI databases provide adequate information regarding sampling results relative to sampling location, sampling date, and time and date of sample analysis. Information on sampling procedures is not available in the databases and has not been reviewed.

4.3.1.4 Criterion III – Data Sources

The review of data sources is performed to ensure that adequate sample coverage of source areas has been obtained and that the analytical methods are appropriate to identify COPCs and estimate exposure concentrations.

For the groundwater data, the review of sample coverage included consideration of both spatial and temporal coverage. The findings of the review are summarized for Parcel H as follows:

Parcel H: There are four (4) shallow to middle zone wells in Parcel H (M-103, M-120, M-121, and TR-10). M-120 was sampled in January 2015 with the highest detected chloroform concentration of 3.8 µg/L in this parcel. Parcel H is located outside of the known area of high concentrations of chloroform in groundwater (Figure 3-2). Limited VOCs were detected in these wells, all at low concentrations. Along with the soil gas data, these data are adequate for evaluation of the vapor intrusion pathway.

Information on analytical methods was available in the NERT and BMI databases. Standard USEPA methods were used, specicifically USEPA Method SW-8260 or SW-8260 SIM for VOCs and SW-8270 or SW-8270 SIM for SVOCs.

4.3.1.5 Criterion IV – Analytical Method and Detection Limits

Under Criterion IV, the SQLs were evaluated to confirm that they were sufficiently sensitive for risk characterization. Because NDEP has not derived groundwater BCLs for the vapor intrusion pathway, groundwater RBCs were derived corresponding to the more stringent of (1) a cancer risk of 1×10^{-6} or (2) a noncancer HQ of 1. The RBCs were derived using outputs from the Johnson and Ettinger (1991) model and the values for exposure assumptions and toxicity criteria presented in Section 5.

For each groundwater analyte for which the detection frequency was less than 100%, the maximum SQL was compared to the RBC. Tables 4-8 lists the maximum SQL, the most stringent groundwater RBC, the ratio of the maximum SQL to 1/10th of the RBC, and the number of samples with SQLs greater than 1/10th of the RBC. For all analytes, the maximum SQL was less than 10% of the respective RBC (i.e. no non-detects were greater than 10% of the RBC) except that the SQLs for bromomethane and 1,2-dibromo-3-chloropropane for groundwater samples collected in 2006, 2009 and 2010 are higher than 10% of their respective RBCs. Maximum detected concentrations from the most recent two years' groundwater samples were used in the HRA, and the SQLs for all the recent groundwater samples collected in 2015 are below 10% of their RBCs. This result is generally consistent with the QAPP goal that SQLs are less than 1/10th of the screening level, as established by NDEP for the BMI Complex and Common Areas (NDEP 2010b). The SQLs achieved were confirmed to be adequate for risk assessment. The uncertainties associated with the SQLs for the older groundwater samples that are over 10% of the RBCs are discussed in Section 6.1.2.

4.3.1.6 Criterion V – Data Review

The majority of the groundwater data included in the HRA have DVSRs identified and summarized in Appendix N. The data review included evaluation of completeness, instrument calibration, laboratory precision, laboratory accuracy, blanks, adherence to method specification and QC limits, and method performance in sample matrix based on available DVSRs and the information from the NERTR and BMI databases. The laboratory results of the groundwater samples included for this HRA were subjected to formal data validation consistent with (1) USEPA guidance on data validation (USEPA 1999a; 2001; 2004a; 2005a,b; 2008; 2009a), (2) the BMI Plant Site Specific Supplemental Guidance on Data Validation (NDEP 2009), and (3) BRC SOP 40 and Data Review/Validation (BRC 2009). The specific data validation procedures are summarized in the DVSRs listed in Appendix N.

The available DVSRs for groundwater data included in the HRA are provided in Appendix N, in which the names and qualifications of the reviewers, the specific data validation procedures, and the qualification findings are presented. Each DVSR includes the following summaries of the data qualifications:

- Summary of data qualified due to holding time exceedances
- Summary of data qualified due to detection below quantitation limit
- Summary of data qualified due to laboratory blank contamination
- Summary of data qualified due to field blank contamination
- Summary of data qualified due to MS/MSD recovery exceedances
- Summary of data qualified due to LCS recovery exceedances
- Summary of data qualified due to field/laboratory duplicate
- Summary of data qualified due to surrogate recovery exceedances
- Summary of data qualified due to calibration violations
- Summary of data qualified due to calibration range exceedances
- Summary of data qualified due to internal standard recovery exceedances
- Summary of data qualified due to serial dilutions
- Summary of qualified data results
- Summary of rejected data results

These data qualifications are further discussed below as a component of Criterion VI.

4.3.1.7 Criterion VI – Data Quality Indicators

This section presents the DQI review; the specific criteria for assessing DQIs were identified in the NDEP-approved QAPPs (BRC, ERM and MWH 2007b; ENSR 2008c; AECOM and Northgate 2009).

Completeness

The completeness criterion (an evaluation of field completeness and laboratory completeness) was not evaluated for the groundwater dataset given the data selection criteria. That is, well locations for inclusion in the HRA data set were selected because relevant data were available and not specific to being part of an investigation. Completeness is typically evaluated based on a single study and not for data drawn from multiple studies.

Comparability

Comparability is a qualitative characteristic expressing the confidence with which one data set can be combined with another for purposes of estimating exposure. A limited evaluation of this DQI is presented based on the information available in the NERT and BMI databases.

The same analytical methods were used across most investigations; specifically, USEPA Method SW-8260 for VOCs and SW-8270 for SVOCs. In some investigations, the more sensitive SW-8260 SIM was used for VOCs; SW-8270 SIM was used for PAHs across all analytical programs. All groundwater sampling results were reported in µg/L.

Because maximum detected concentrations from the most recent two years' groundwater samples were used in the HRA (and SQLs were sufficiently low in those

samples, as discussed in Section 4.3.1.5), the differences in detection limits does not impact the results of the HRA.

The VOCs concentrations detected in the wells in Parcel H have consistently been low from 2006 to 2015. Therefore temporal factors were not considered in the comparability evaluation.

Representativeness

Spatial representativeness was discussed previously in Section 4.3.1.4.

Precision

Precision is a measure of the degree of agreement between replicate measurements of the same source (field precision) or sample (analytical precision). Precision is expressed by the RPD between replicate measurements. Replicate measurements can be made on the same sample or on two samples from the same source.

Field precision was assessed by evaluating the field duplicate results for the HRA groundwater data. Although field duplicate samples were collected in the groundwater investigation events, none of the duplicate samples were collected from locations in Parcel H. The information on the field duplicate results are summarized in DVSRs included in Appendix N. The associated uncertainties are discussed further in Section 6.1.5.

Accuracy

This DQI includes an evaluation of field accuracy and laboratory accuracy. Accuracy in the field is assessed through the use of trip and equipment blanks and through adherence to all sample handling, preservation, and holding time requirements. The QAPP goal is for the trip and equipment blanks is for no analyte to be present at levels greater than the laboratory PQL.

For the groundwater data set for Parcel H, no analytical results were qualified as estimated (J or J+) due to contamination in trip or equipment blanks in accordance with the most recent NDEP guidance (NDEP 2012).

Accuracy in the laboratory analytical data is a measure of the overestimation or underestimation of reported concentrations. Accuracy is quantitated for each laboratory data batch using data for method blanks, LC samples and/or MS samples. Qualifications based on contamination in method blanks were reviewed. For the groundwater dataset, no results was qualified as estimated (J) due to contamination in method blanks associated with the groundwater samples identified for Parcel H.

4.3.1.8 Data Usability Summary

The groundwater HRA dataset includes a total of 13 samples in Parcel H. The included groundwater wells are all located within the parcel, with analytical results reported for VOCs and/or SVOCs. The dataset includes results for samples collected since January 2006. All J-qualified data were considered usable and were retained for purposes of the HRA (Table N-1); all R-qualified data were excluded from the dataset (Table N-2). The impact of qualified data on the HRA risk results is discussed in Section 6.1.

4.3.2 Data Analysis

As described by NDEP (2010c), the purpose of the data analysis step is to "use simple exploratory data analysis to compare data to the expectations of the CSM, to determine if the data adequately represent the source terms and exposure areas or evaluation areas." Consistent with the NDEP guidance, summary statistics and spatial plots were prepared. Additionally, specific data analyses requested by NDEP were conducted, as described below.

4.3.2.1 Summary Statistics

Summary statistics for the groundwater data set for Parcel H are presented in Table 4-9. As shown on Table 4-9, 23 of the 99 VOCs analyzed were detected in at least one sample, with detection frequencies ranging from 7.7 to 69 percent. No chemical was detected in 100% from these samples. All VOCs were detected at very low concentrations, i.e., less than or equal to 5 µg/L.

4.3.2.2 Spatial Analysis of VOCs in Groundwater

Four shallow groundwater wells are available in Parcel H. The VOC concentrations in all shallow groundwater samples collected at these wells between 2006 and 2015 are very low and no discernable spatial distribution was identified in the shallow groundwater VOC data in Parcel H.

4.3.2.3 Temporal Changes in VOC Groundwater Concentrations

In NDEP's January 29, 2013 comment letter (NDEP 2013, Comment #9b), NDEP requested a comparison of the groundwater VOC concentrations presented in the 2010 Site-Wide Soil Gas HRA (Northgate and Exponent 2010c) with the most recent groundwater sampling results for the same wells to evaluate temporal changes in concentration.

Each of the four well in Parcel H were sampled in 2 or 3 investigations between 2006 and 2015. The VOC concentrations in all shallow groundwater samples collected in Parcel H are very low and no discernable temporal trend was identified.

4.4 Study Area CSM

The following presents an overall summary of the soil data in the context of our understanding of current and former land use and operations within Parcel H and the CSM (also see Tables 4-4 and 4-5).

- Chloroxyanions. Chlorate and perchlorate manufacturing operations have been conducted at the Site since approximately 1945 (Ramboll Environ 2016e), although the former manufacturing and disposal areas were not located in Parcel H. Although these compounds are detected throughout Parcel H soils (Figures J-3 and J-7), concentrations in Parcel H (<0.22 mg/kg to 10 mg/kg for chlorate and <0.0019 mg/kg to 22 mg/kg for perchlorate, see Table 4-2) are generally substantially lower than the concentrations reported in former manufacturing areas (above 1,000 mg/kg for chlorate and perchlorate).
- Metals. The 2011 NDEP Action Memorandum (NDEP 2011) identified "metals" as possible SRCs at many of the LOUs within the Operations Area, but not in Parcel H. Results of the background evaluation of metals (Appendix I) show that post-removal soil concentrations were greater than background (as compared with the RZ-A

background dataset) for arsenic, beryllium, calcium, chromium (total), and uranium (total) in Parcel H.

- Other Inorganics. This group of inorganic compounds includes common industrial chemicals that are used as chemical feedstocks and/or expected to be present in process waste streams. With the exception of fluoride and nitrate, all compounds were historically identified as SRCs at the Operations Area. These compounds are generally highly soluble when present as free anions or cations. Many of these compounds are physiological electrolytes and/or occur naturally in foods. Although all of the listed inorganics occur naturally in soil, RZ-A background data sets are not available to conduct a background analysis. At the concentrations detected in soil, these inorganics do not present human health concerns. Generally, these inorganics are of greater concern when detected as contaminants in groundwater than when present at elevated concentrations in soil.
- Radionuclides. Radionuclides are not known to be associated with any of the former operations identified in Parcel H (or in the Operations Area). Although no specific source areas were identified, the parcel soil investigations included analyses for radionuclides in the U-238 and Th-232 decay series and for U-235. Although several radionuclides failed the statistical testing for background soil (Appendix I), the validity of the statistical testing is confounded by several analytical and other issues (see detailed discussion in Section 5.1.1.2).
- Dioxins/Furans. Dioxins/furans are formed during various combustion processes (in the presence of a source of hydrocarbons and chlorine) and are by-products of the production of certain chlorinated chemicals, including pesticides. Dioxins/furans are typically detected in shallow surface soils as a result of airborne deposition. They are extremely persistent in soils and over time will accumulate in the presence of a continuing source. The post-removal soil concentrations in Parcel H are below the site-specific action level of 0.0027 mg/kg.
- PAHs. PAHs are ubiquitous environmental contaminants and formed during incomplete combustion of organic materials. The detection frequencies of PAHs in Parcel H were generally very low.
- Organochlorine Pesticides. The detections of organochlorine pesticides is consistent with former site operations, including the manufacture of chlorobenzenes and dichlorodiphenyltrichloroethane (DDT) by Hardesty /AMECCO from 1946 to 1949 (Ramboll Environ 2016e), as well as with the manufacture of chlorinated compounds at the adjacent OSSM facility. Stauffer produced lindane at the former Lindane Plant from 1946 through 1958.
- SVOCs. Only two SVOCs were detected in Parcel H with very low detection frequencies. Bis(2-ethylhexyl)phthalate and butylbenzylphthalate were not historically listed as SRCs, and are common field/laboratory contaminants.
- VOCs. Consistent with results observed in investigations at other industrial facilities, a range of VOCs were detected in soils, but at low frequencies and low

concentrations. Several of the VOCs are common field/laboratory contaminants, including acetone, 2-butanone, methylene chloride, and toluene.

A review of the spatial quartile plots (Appendix J) did not identify a particular spatial pattern of the chemicals in soils or the presence of hot spots or potential point sources of contamination.

As part of the ongoing RI/FS, Ramboll completed an extensive review of existing information and data generated previously at the Site and developed a preliminary CSM, as presented in the RI/FS Work Plan (ENVIRON 2014a). More recently, Ramboll conducted a comprehensive review and analysis of historical and recently collected sampling results to assess the magnitude and extent of chloroform impacts to soil, soil gas, and groundwater at the Site, including groundwater sampling results within the

Study Area (Ramboll Environ 2015b, 2016a). The conclusions of the review considering the RI data gap investigation results are presented below.

- Chloroform impacts to shallow groundwater, both on-Site and in the downgradient plume area to the north, appear related in part to historical wastewater discharges to the former Beta Ditch. The highest concentrations of chloroform found in shallow groundwater at the Site have consistently been associated with the area where the former Beta Ditch extended across the property.
- Chloroform is migrating onto the Site from the adjacent OSSM site located to the west. Chloroform in the dissolved phase is present in shallow groundwater beneath the western portion of Parcel F and below the western portion of Parcel C upgradient of the OSSM extraction wells. In the deeper Middle Water Bearing Zone (WBZ), Montrose is investigating a lobe of dense non-aqueous phase liquid (DNAPL) that originates at the OSSM site and extends into the western portion of the NERT Site. However, the DNAPL in the Middle WBZ has not been found beneath the Study Area parcels.
- As shown on Figure 3-2, Parcel H is located outside the main chloroform plume area (as defined by <70 ug/L chloroform concentration) and the VOC concentrations in soil, soil gas, groundwater are all very low, and below their respective soil BCLs or RBTCs for soil gas or groundwater, therefore no additional investigation is necessary in Parcel H.

There is no evidence to suggest that soils within Parcel H are acting as a source of groundwater VOC contamination; further, concentrations in soil are not indicative of historic releases of chloroform to soils.

5. POST-REMEDIATION HEALTH RISK ASSESSMENT

This section presents the post-remediation HRA, which includes the following elements:

- Identification of COPCs;
- Exposure assessment;
- Toxicity assessment; and
- Risk characterization.

The post-remediation HRA follows the basic procedures outlined in the USEPA's Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual (USEPA, 1989). Other guidance documents consulted in preparing the HRA include:

- Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual (Part A) (USEPA 1989);
- Guidelines for Exposure Assessment (USEPA 1992c);
- Exposure Factors Handbook (USEPA 2011);
- Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) (USEPA 2004b);
- Soil Screening Guidance: Technical Background Document (USEPA 1996);
- Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA 2002b);
- Soil Screening Guidance for Radionuclides (USEPA 2000);
- Technical Support Document for a Protocol to Assess Asbestos-Related Risk, Final Draft (USEPA 2003);
- Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment) (USEPA 2009b);
- Office of Solid Waste and Emergency Response (OSWER) Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance) (USEPA 2002c);
- User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings (USEPA 2004c);
- OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air (USEPA 2015);
- Technicle amd Regulatory Guidance, Vapor Intrusion Pathway: A Practical Guiline (ITRC 2007); and
- Soil Physical and Chemical Property Measurement and Calculation Guidance, BMI Plant Sites and Common Areas Projects, Henderson, Nevada (NDEP 2010d).

5.1 Identification of COPCs

5.1.1 Soil COPCs

Soil COPCs for quantitative evaluation in the post-remediation HRA were identified from the risk assessment data set discussed in Section 4 for Parcel H based on the following three-step approach:

1. Concentration/toxicity screen;
2. Background evaluation for metals and radionuclides; and
3. Chemical-specific considerations.

The chemicals that "fail" these steps are retained as COPCs and those that "pass" are excluded as COPCs[18], as described in Sections 5.1.1.1 through 5.1.1.3 and shown on Figure 5-1.

5.1.1.1 Step 1 – Concentration/Toxicity Screen

The concentration/toxicity screen is conducted to identify those chemicals that could contribute significantly to the cancer risk and/or non-cancer hazard estimate (i.e., the hazard index [HI]). The screen considers the maximum detected concentration in soils in Parcel H and chemical-specific toxicity, as reflected in the BCL (or other criteria established for the Site); specifically, a chemical is excluded as a COPC if the maximum detected concentration is less than 0.1 times the BCL (0.1×BCL). Chemicals that pass this screen are eliminated as COPCs. Chemicals that fail this screen (i.e., are present at concentrations greater than or equal to 0.1×BCL) are further screened under Step 2 and/or Step 3.

The post-remediation soil HRA data set identified in Section 4 is the starting point for the concentration/toxicity screen. This data set includes the results for all analytes detected in one or more samples from the 0 to 10 ft depth interval[19], with the exception of the analytical results excluded based on the DUE, as discussed in Section 4. For most analytes, the BCL used for the concentration/toxicity screen is the minimum of the indoor and outdoor commercial/industrial worker BCL (NDEP 2017a). Because BCLs have not been established for all analytes in Parcel H soils, surrogate values were identified where possible. Surrogates and other chemical-specific exceptions as well as the results of the screen are presented in Table 5-1 and discussed in the following sections.

Surrogates

The concentration/toxicity screen can be implemented only for chemicals for which a BCL or appropriate surrogate is available. Surrogates were identified as follows:

Analyte	Surrogate
• Chromium (total)	• Chromium III
• 2,4'-dichlorodiphenyldichloroethylene (DDE)	• 4,4'-DDE
• Phosphorus (total)	• Phosphoric acid

[18] The three screening steps are consistent with the COPC identification steps outlined in the Baseline Health Risk Assessment Work Plan for Operations Area (ENVIRON 2014b). However, as agreed upon by NDEP (Ramboll Environ 2015c), the order of the steps has been changed.

[19] An underlying assumption is that soils from depths of up to 10 ft could be brought to the surface during excavation or other activities, leading to potential worker exposures.

Surrogates were identified for all but seven analytes (calcium, palladium, potassium, silicon, sodium, sulfate, and sulfur). By default, these analytes are carried forward to Step 2 (metals) and Step 3 (all other analytes) of the COPC selection process.

Chemicals with Non-Health Based BCLs

NDEP has established a non-health based upper-limit soil concentration or a "not-to-exceed" concentration of 100,000 mg/kg for metals and for inorganic and organic compounds with low toxicity. That is, if the calculated health-based BCL is greater than 100,000 mg/kg, a limit value of 100,000 mg/kg is listed in the BCL table. For all detected analytes with a NDEP-established upper limit BCL, the maximum concentration is less than 100,000 mg/kg (see Table 5-1). Thus, these compounds were not identified as COPCs based on concentration considerations.

For health-based considerations (i.e., COPC identification), it is appropriate to use the NDEP-calculated health-based BCL (and not the concentration-limit value of 100,000 mg/kg). The health-based BCLs were taken from the BCL calculation tables (NDEP 2017a). Due to the very low toxicity, the calculated health-based BCL for some chemicals is greater than one million parts per million. The chemicals for which health-based BCLs are used in place of non-health based BCLs are identified in Table 5-1.

Arsenic, Dioxin TEQs, and Lead

As presented in the HRA work plan (Northgate and Exponent 2010b), site-specific screening values are used for arsenic and dioxin TEQs:

- For arsenic, the maximum detected concentration is compared to the site-specific remediation goal of 7.2 mg/kg (NDEP 2010e), which is the maximum arsenic concentration reported for the BRC/TIMET background data set (BRC and TIMET 2007); arsenic is eliminated as a COPC if the maximum concentration is less than this screening value. This screening value has been used as the soil remediation goal in removal actions completed at the Site (BEC 2008a).
- For dioxin TEQs, the maximum detected value is compared to the site-specific action level of 0.0027 mg/kg; this value was derived based on an in vitro soil bioaccessibility study conducted using Site soils (Northgate 2010a); NDEP (2010b) approved this value based on the information presented in the study.

USEPA has not established toxicity values (i.e., a cancer slope factor [CSF] or reference dose [RfD]) for lead (USEPA 2017a). Instead, USEPA used a blood-lead model to establish a regional screening level (RSL) of 800 mg/kg, which NDEP has adopted as the BCL for commercial/industrial workers. Because the health endpoint for lead (i.e., a blood lead concentration) is not a cancer risk or non-cancer HI, the maximum detected concentration is compared directly to the commercial/industrial worker BCL of 800 mg/kg, and not to 0.1×BCL.

Asbestos

BCLs have not been established for asbestos (long amphibole and long chrysotile fibers). Exposure and risk assessments for asbestos are highly dependent on sample size (see discussion in Section 6.2.2.2). Even for the case where fibers are not identified (i.e., zero fibers), upper-bound cancer risk estimates can be greater than 1×10^{-6}, depending on sample size. One long chrysotile fiber was observed in five out of 25 post-abatement samples in

Parcel H. Therefore, long chrysotile fiber was identified as a COPC. Although not observed in any of the samples analyzed for asbestos, long amphibole fiber was also included as a COPC per NDEP guidance (Neptune 2015).

Results of Concentration/Toxicity Screen

The concentration/toxicity screen is presented in Table 5-1 for Parcel H. For each listed chemical, the maximum detected concentration and the BCL (or other screening value) are presented. The final column indicates whether the chemical "passed" or "failed" the screen.

Of the 77 analytes listed in Table 5-1, 60 chemicals passed, 10 chemicals failed based on the BCL (or other screening criteria) comparison, and seven chemicals (calcium, palladium, potassium, silicon, sodium, sulfate, and sulfur) did not have a screening level. Chemicals that failed or that did not have a screening level are carried forward to Steps 2 and/or 3.

5.1.1.2 Step 2 – Background Evaluation

The background evaluation step is consistent with USEPA (1989) and NDEP (2009d) guidance, which indicate that metals and radionuclides can be eliminated as COPCs if site concentrations are consistent with background levels. Metals and radionuclides that are present at concentrations greater than background and those for which a background data set are not available are then further screened under Step 3.

The metals and radionuclides that either failed the concentration/toxicity screen or for which a BCL was not available for screening are listed in Tables 5-2 and 5-3, respectively. The results of the background evaluation presented in Section 4.1.2.2 and Appendix I are also included.

Of the seven metals carried forward from Step 1, potassium and sodium[20] were present at concentrations consistent with background and are eliminated as COPCs. Calcium was present at concentrations greater than background, and background data were not available for four metals (palladium, silicon, sulfur, and zirconium). Of the eight radionuclides carried forward from Step 1, seven radionuclides (U-238, U-234, Th-232, Th-230, Th-228, Ra-228, and Ra-226) failed the statistical testing for background consistency, while activities of U-235 were consistent with background.

For radionuclides, as presented in the NDEP flowchart (Appendix O), when approximate secular equilibrium is exhibited in an isotope decay chain, in theory radionuclides in the same decay chain should yield similar background comparison results; if any radionuclide is greater than background, all the radionuclides in that decay chain would be carried forward in the risk assessment. When approximate secular equilibrium is not exhibited in an isotope decay chain, those radionuclides that fail the background evaluation would be carried forward in the risk assessment. As indicated in Table 5-3, secular equilibrium is exhibited in all the decay chains, and radionuclides in the same decay series failed the background comparisons.

However, several issues associated with sample preparation and analytical methods of the radionuclide data in Parcel H and RZ-A were identified, similar to those issues identified by NDEP in the radionuclide analytical data sets for soil samples collected across the BMI Complex (NDEP 2009b). The Trust submitted a radionuclide data packet prepared by

[20] NDEP (2017a) notes that calcium, potassium, and sodium are essential nutrients and do not need to be evaluated in a HRA.

Ramboll Environ to NDEP via email on September 17, 2015, including a comparison of sample preparation and analytical methods between the parcel data sets and the RZ-A background data set. RZ-A background samples were collected and analyzed in 2009, while the Parcel H samples were collected and analyzed between 2006 and 2009, i.e, both before and after NDEP issued guidance for evaluating radionuclide data (NDEP 2009b). Over this time period, samples were submitted for analysis to different analytical laboratories and analyzed using different preparation and analytical methods. For example, the analytical methods for Ra-228 included beta spectroscopy and gamma spectroscopy, depending on the laboratory, which may be the reason for the lack of correlation with Ra-228 in the Th-232 decay chain (Table I-6). It is also an unexpected finding that for the RZ-A background data set, the Th-232 decay chain was not in secular equilibrium (Table I-5B).

Given that the validity of the statistical testing is confounded by several issues identified above, it is difficult to interpret the results of background evaluation for radionuclides and consider them as a reliable basis for the COPC selection. In order to provide a point of comparison from a health risk perspective between radionuclides in Parcel H soils and in site and regional background soils, the total estimated cancers risks from all the radionuclides were calculated by taking the ratio of soil activities to the commercial/industrial worker BCLs corresponding to a cancer risk of 10^{-6}. The 95% upper confidence limit (UCL) on the mean soil activity, calculated by the ProUCL software (Version 5.1), was used in the cancer risk calculation for Parcel H, RZ-A background, and BRC/TIMET regional background[21]. The results of radionuclide cancer risks are presented in Table 5-4, and the ProUCL output files are included in Appendix P. As indicated in Table 5-4, the total radionuclide cancer risk for Parcel H was 2×10^{-4}; the total radionuclide cancer risks for RZ-A background and BRC/TIMET regional background were also 2×10^{-4}. Although the total radionuclide cancer risk for Parcel H was slightly above the NDEP acceptable risk range of 10^{-6} to 10^{-4}, it is consistent with background in the area. Radionuclides are not known to be associated with any of the former operations within Parcel H. Based on the above discussion, radionuclides were not identified as COPCs. The impact of excluding radionuclides as COPCs on the HRA results and conclusions is further discussed in the uncertainties in Section 6.2.1.

5.1.1.3 Step 3 – Chemical-specific Evaluations

For the final step of COPC identification, chemicals commonly recognized as having low toxicity and for which a BCL was not available (such that a concentration/toxicity screen could not be conducted) were further reviewed. These chemicals include macronutrients or essential micronutrients and/or are listed on the Generally Recognized as Safe (GRAS) list developed by the U.S. Food and Drug Administration[22]:

[21] The radionuclide data used in the 95% UCL calculation were not censored based on NDEP guidance (NDEP 2008c).

[22] http://www.ecfr.gov/cgi-bin/text-idx?SID=e956d645a8b4e6b3e34e4e5d1b690209&mc=true&node=pt21.3.184&rgn=div5

- **Calcium** (essential macronutrient, required in large quantity; high consumption from foods; GRAS); NDEP (2017a) identifies calcium as an element that typically does not need to be included in a risk assessment because of its low toxicity;
- **Silicon** (essential nutrient; present in foods, with a typical dietary intake of over 20 mg/day in adults); and
- **Sulfur, Sulfate** (essential macronutrients, required in large quantities; high consumption from foods; GRAS).

Calcium, silicon, sulfur, and sulfate were eliminated as COPCs based on their low toxicity.

5.1.1.4 Summary of Soil COPCs

The COPCs identified for soils in Parcel H are listed in Table 5-5. The four COPCs identified for Parcel H include two metals (palladium and zirconium), hexachlorobenzene, and asbestos (long amphibole and long chrysotile fibers).

BCLs (and associated toxicity values) are not available for paladium; in absence of toxicity values, this COPC was evaluated qualitatively in Section 6.2.4. Also, RZ-A background data are not available for palladium and zirconium and therefore a background evaluation cannot be conducted. The parcel data for these two metals were compared to BRC/TIMET regional background data in Section 6.2.4.

Spatial intensity plots were developed for zirconium, hexachlorobenzene, and long chrysotile fibers (Figures 5-2 through 5-4).[23] Since BCLs are not available for palladium, no spatial intensity plot was prepared for this COPC and its spatial distribution is presented in the spatial quartile plot (Figure J-6). No spatial intensity plot was prepared for long amphibole fiber since it was not observed in any soil sample collected in Parcel H.

Each COPC spatial intensity plot presents the following information:

- Sample locations;
- COPC concentrations. The concentration shown at each sample location is the maximum detected concentration for all samples collected at that location for soils from 0-10 ft bgs, unless results for all samples at that location were reported as less than the detection limits; concentrations are binned relative to BCLs, as shown on the individual plots. Results for samples reported as less than the detection limit are colored dark green.

As indicated in the spatial intensity plots, possible "hot spots"[24] or other spatial patterns were not identified.

[23] In addition to the spatial quartile plots discussed in Section 4.1.2.3 (and included in Appendix J) as part of Data Analysis, additional spatial intensity plots were developed for all major COPCs. The two sets of plots differ in the concentration bins used for plotting. The concentration bins used for the Appendix J plots are based on quartiles of the distribution of detected concentrations. The concentration bins used for the COPC plots are based on the BCLs or other screening criteria.

[24] "Hotspot" refers to a localized area in which concentrations tend to be at the upper end of the distribution. These areas are identified based on review of the spatial intensity plots; a statistical hotspot analysis has not been conducted.

5.1.2 Soil Gas COPCs

All chemicals detected in one or more validated soil gas sample were selected as COPCs, as recommended by NDEP in their April 9, 2013 comment letter (NDEP 2013, Comment #3). Using this selection criterion, 42 VOCs[25] were identified as COPCs in soil gas (Table 5-6).

5.1.3 Groundwater COPCs

All VOCs detected in one or more validated groundwater samples from the most recent two years were selected as COPCs (USEPA 2015). Using this selection criterion, 10 VOCs were identified as COPCs in shallow groundwater (Table 5-6).

5.2 Exposure Assessment

5.2.1 Conceptual Site Model and Exposure Scenarios

To evaluate the human health risks posed by a site, it is necessary to identify the populations that may potentially be exposed to the chemicals present and to determine the pathways by which these exposures may occur. A CSM was developed in order to characterize exposure potential in Parcel H. The CSM outlines information relevant to conducting the exposure assessment for Parcel H by (1) evaluating potential chemical sources and releases, (2) identifying populations that could potentially be exposed to chemicals present in Parcel H, and (3) identifying exposure pathways and routes through which human exposure might occur. The CSM can be an important tool in guiding site characterization, evaluating data quality in the context of potential risks to exposure populations, and developing exposure scenarios. The CSM for Parcel H is presented in Figure 5-5, and its elements are discussed below.

5.2.1.1 Potential Chemical Sources and Release Mechanisms

Historically, NDEP concurred with a list of SRCs that had been identified based on a review of historical site operations and practices, as well as those at neighboring facilities. Based on the CSM, many of the SRCs identified for the Site as a whole were not related to the more limited operations in Parcel H and were therefore not expected to be detected in Parcel H soils. Specifically, as summarized in Section 3.1, much of the parcel property has never been developed, and no LOUs were identified in Parcel H. However, as a conservative investigation approach, samples collected in Parcel H were analyzed for the same chemicals identified for analysis in samples collected within the Operations Area, including chlorine oxyanions (chlorate and perchlorate), metals and other inorganics, radionuclides, asbestos, dioxins/furans, organic acids, PAHs, PCBs, OCPs, OPPs, SVOCs, and VOCs.

As discussed previously in Section 3.2, soil samples were collected at both random and judgmental locations, with the latter targeting possible source areas or potentially-impacted areas within Parcel H.

As indicated in the CSM (Figure 5-5), SRCs were released from potential on-site/off-site sources to surface soils and groundwater through several primary release mechanisms, such as spills and leaks/infiltration, water level fluctuation, and groundwater transport. In addition to the potential primary release mechanisms, secondary/tertiary release mechanisms included resuspension of SRCs in surface soils into ambient air, migration of VOCs in

[25] Any chemicals labelled as SVOCs that are included in the USEPA definition of volatile compounds are also included in the vapor intrusion analysis. The volatile compounds are currently identified using the following criteria consistent with recommendation from the USEPA Regional Screening Levels Table (USEPA 2017b): 1) vapor pressure greater than 1 mm Hg or 2) Henry's Law constant greater than 0.00001 atm-m^3/mole.

subsurface through soil column to indoor air, outdoor air, or trench air, and leaching of SRCs in soils to groundwater.

5.2.1.2 Potentially Exposed Human Populations and Exposure Pathways

The identification of potentially exposed populations and exposure pathways is supported by the CSM. For a complete exposure pathway to exist, all 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 exposure medium; and
- A route of exposure (e.g., inhalation, ingestion, dermal contact).

As noted previously, the land within Parcel H is mostly vacant. Future land use will be restricted to industrial and/or commercial purposes through a land-use covenant. Accordingly, future on-site receptors identified for the post-remediation HRA were long-term indoor industrial/ commercial workers, long-term industrial/ commercial outdoor workers, and short-term construction workers, consistent with USEPA guidance (2002b). Other potential on-site receptors, such as visitors or trespassers, do not warrant assessment; as discussed by USEPA (2002b), evaluation of exposures to members of the public under a non-residential land-use scenario is generally not warranted, based on the following considerations:

- Public access is generally restricted at industrial sites; and
- While the public may have access to commercial sites, on-site workers have a much higher exposure potential because they spend substantially more time at a site.

In accordance with the NDEP-approved HRA Work Plan (Northgate and Exponent 2010b, ENVIRON 2013b), off-site receptors were not quantitatively evaluated in the HRA. Current and future off-site receptors include indoor and outdoor commercial/industrial workers and residents located outside the Site boundaries who could be exposed to airborne chemicals (vapors and particulates) emitted during, e.g., routine operations or construction projects (USEPA 2002b). The Site is located within the BMI complex, surrounding by several industrial facilities. For Parcel H, there are Tronox and Tronox sub-tenant workers to the north, Western Area Power Association to the north/northwest, and various industrial facilities to the west. There is a commercial shopping center to the east, and various commercial businesses to the south. The nearest residents are located approximately 500 ft south of Parcel H. A qualitative discussion of the potential risks to off-site populations is presented in Section 6.2.2.1.

Based on the source and release mechanisms presented in the CSM, the following receptor populations and exposure pathways were identified for quantitative evaluation:

- Indoor commercial/industrial workers[26]
  - *Incidental soil ingestion*[27]
  - *Inhalation of airborne dust particulates*[27,28]
  - *External exposure from soil*[29]
  - *Inhalation of vapors migrating from soil gas/groundwater to indoor air*
- Outdoor commercial/industrial workers
  - *Incidental soil ingestion*[27]
  - *Dermal contact with soil*
  - *Inhalation of airborne soil particulates*[27,28]
  - *External exposure from soil*[29]
  - *Inhalation of vapors migrating from soil gas/groundwater to outdoor air*
- Construction workers
  - *Incidental soil ingestion*[27]
  - *Dermal contact with soil*
  - *Inhalation of airborne soil particulates*[27,28]
  - *External exposure from soil*[29]
  - *Inhalation of vapors migrating from soil gas/groundwater to trench air*

Future commercial/industrial workers were assumed to have direct contact with shallow soils (0–2 ft bgs) when minimum soil excavation occurs that could bring subsurface soil to the surface, or with surface and subsurface soils (0–10 ft bgs) when soils from depths of up to 10 ft bgs could be brought to the surface during excavation or other activities. Construction workers were assumed to have direct contact with surface and subsurface soils (0–10 ft bgs) during excavation or other activities.

To be conservative, construction workers were assumed to be exposed to vapors migrating from soil gas/groundwater while standing in a 10-foot trench in the unsaturated zone, placing them closer to the potential sources.

Exposure via domestic use of groundwater was not evaluated because Site groundwater is not used as a domestic water supply. Incidental ingestion of groundwater and dermal contact

[26] In accordance with USEPA (2002b) guidance, dermal absorption is not considered to be a complete exposure pathway for indoor worker. Soil ingestion is identified by USEPA (2002b) as a potentially complete exposure pathway for an indoor worker due to the potential for contact through ingestion of soil tracked indoors. Inhalation of indoor dust (particulates) is identified by NDEP (2017a) as a potentially complete exposure pathway for an indoor worker.

[27] Includes radionuclide exposures; however, as noted in Section 5.1.1.4, radionuclides were not selected as soil COPCs for Parcel H.

[28] Includes asbestos exposures.

[29] Only radionuclide exposures; however, as noted in Section 5.1.1.4, radionuclides were not selected as soil COPCs for Parcel H.

with groundwater during short-term construction activities were not considered complete exposures pathways due to the groundwater depth being greater than 10 ft bgs.

5.2.2 Exposure Point Concentrations

An EPC of a COPC is the estimated concentration of that chemical in an environmental medium to which a receptor (i.e., a member of a potentially exposed population) is exposed over an assumed duration of exposure. EPCs are used in the dose equation for evaluating the potential exposure (dose) of each receptor and exposure pathway. The derivation of EPCs for soil, airborne soil particulates, and VOCs migrating from soil gas and groundwater to indoor, outdoor, or trench air are described in the following sections.

5.2.2.1 Soil

Soil EPCs were used to estimate direct-contact soil exposures (i.e., incidental ingestion and dermal contact) for future on-site indoor and outdoor commercial/industrial workers and construction workers. The soil EPCs were also used to derive airborne particulate and vapor concentrations for the COPCs, as presented in Section 5.2.2.2.

The soil EPC was set to be the maximum detected concentration among all soil samples collected at 0-2 ft depth interval and all soil samples collected at 0-10 ft depth interval within Parcel H for each identified COPC. This assumption likely overestimates potential health risks, because receptor populations are unlikely to be exposed to the maximum detected concentrations for all COPCs over the whole exposure period. The soil EPCs for Parcel H are presented in Tables 5-7A and 5-7B.

5.2.2.2 Air: Airborne Soil/Dust Particulates

Exposure to COPCs bound to soil/dust particles was evaluated using USEPA's particulate emission factor (PEF) approach (USEPA 2002b). The PEF relates COPC concentrations in soil to the COPC concentrations in airborne soil/dust particles. The site-specific dispersion factor (Q/C) used in the calculations is based on information for Las Vegas, Nevada, as presented in Appendix E of USEPA (2002b). The calculation of a PEF is also a function of the areal extent of site surface contamination, which is assumed to correspond to the area of Parcel H.

For long-term commercial/industrial indoor and outdoor workers, the PEF is estimated based on emissions from wind erosion of surface soils and was calculated using the equations presented by Neptune (2015). The PEF for short-term construction workers includes two components: (1) emissions from unpaved roads and (2) emissions from wind erosion, excavation, dozing, grading, and tilling (USEPA 2002b). These two components were calculated and then combined into a single PEF using the equations presented in Neptune (2015). The parameters used to estimate the PEFs are presented in Table 5-8.

Air EPCs for Chemicals

The air EPCs for COPCs bound to soil/dust particles were derived from soil EPCs by applying the PEFs, as follows:

$$EPC_{air} = EPC_{soil} \times CF \times \left(\frac{1}{PEF}\right)$$

where:

EPC_{air} = Air Exposure Point Concentration (µg/m^3)

EPC_{soil} = Soil Exposure Point Concentration (mg/kg)

CF_1 = Conversion Factor (1000 µg/mg)

PEF = Particulate Emission Factor (m^3/kg)

Air EPCs for Asbestos

Exposures to asbestos are evaluated for the inhalation pathway only. Air EPCs for asbestos were derived based on the concentration of asbestos in surface soils (only surface samples were analyzed for asbestos), consistent with the NDEP guidance (Neptune 2015) which is based on the protocols described in USEPA (2003) and has been modified for application to the BMI Complex. Asbestos concentrations in surface soils were estimated for fibers identified as carcinogenic, specifically, fibers of dimensions >10 µm long and <0.4 µm wide, using the following equation:

$$C_{soil} = f \times \text{Pooled } AS$$

$$Pooled\ AS = 1 \times \frac{1}{\sum_{i=1}^{n} AS_n}$$

where:

C_{soil} = Soil Concentration (fiber [f]/g)

f = Number of long fibers observed in soil samples (unitless)

AS = Analytical Sensitivity (f/g) [30]

n = Sample Size

Two types of the asbestos soil concentrations were estimated, i.e., a best estimate and an upper-bound estimate, as defined in USEPA (2003) and Neptune (2015). The best-estimate concentration is similar to a central-tendency exposure (CTE) estimate, whereas the upper-bound concentration is comparable to a reasonable maximum exposure (RME) estimate. For the best estimate, the number of long fibers observed in all the soil samples was incorporated into the calculation above. The upper bound estimate was calculated as the 95% UCL of the number of long fibers from a Poisson distribution as follows (Neptune 2015):

$$f_{UCL} = \frac{\chi^2_{0.95}\left(2 \times (f+1)\right)}{2}$$

where:

f_{UCL} = 95% UCL of the number of long fibers observed in soil samples from a Poisson distribution (unitless)

f = Number of long fibers observed in soil samples (unitless)

$\chi^2_{0.95}$ = Chi-squared distribution at 95%

The f_{UCL} was then multiplied by the pooled AS to estimate the upper-bound soil concentration.

The air EPCs were derived from soil concentrations by applying the PEFs, as follows:

$$EPC_{air} = C_{soil} \times CF \times \left(\frac{1}{PEF}\right)$$

where:

[30] The laboratory results are reported as "structures"; however, the term "fibers" is used herein for simplicity.

EPC_{air} = Air Exposure Point Concentration (f/m^3)

C_{soil} = Soil Concentration (f/g)

PEF = Particulate Emission Factor (m^3/kg)

The air EPCs for particulates are presented in Tables 5-7A and 5-7B. For asbestos, the soil concentrations and air concentrations (and associated health risks) were calculated using NDEP's "asbestos guidance riskcalcs.xls" spreadsheet, and are presented in Appendix Q.

5.2.2.3 Indoor, Outdoor, and Trench Air: VOCs Migrating from Soil Gas, Groundwater, and Soil

The following subsections describe the derivation of the exposure concentrations and includes descriptions of the source terms and fate and the transport modeling conducted to estimate the exposure concentrations.

Source Terms

Chemicals detected in soil gas (sourcing from groundwater and/or soil) can potentially migrate through the unsaturated zone to ambient or indoor air (USEPA 2004c). For this evaluation, the groundwater, soil, and soil gas data are used as the source term to model the indoor and outdoor concentrations (i.e., the exposure concentrations in the exposure medium or air). For all volatile COPCs evaluated for Parcel H, the exposure concentrations in air used in risk characterization for vapors migrating from soil gas, soil, and groundwater are conservatively modeled using the maximum concentrations detected in soil gas, soil, or in the most recent two years of groundwater, respectively, within Parcel H.

Fate and Transport Modeling

The migration of chemicals detected in soil gas (sourcing from soil and groundwater), soil, or groundwater is quantified for the purposes of this assessment through an intermedia transfer factor. When the transfer factor is multiplied by the source concentration of a chemical in soil gas (in $\mu g/m^3$), soil (in µg/kg) or groundwater (in µg/L), the product is the predicted steady-state concentration in indoor, outdoor, or construction trench air (in $\mu g/m^3$).

For the receptors evaluated in this HRA (future onsite workers), transfer factors for vapors of volatile compounds migrating to indoor air, outdoor air, and trench air were derived based on migration of groundwater vapors from the shallow groundwater table or soil gas from 5 ft bgs to a commercial slab-on-grade building, outdoor air, and trench air, respectively. The transfer factors were estimated using the screening-level model described by Johnson and Ettinger (1991); this model was developed to predict vapor migration into buildings using a combination of diffusion and advection. Specifically, Version 3.1 of the spreadsheet implementation developed by the USEPA was used (USEPA 2004c). Additional transfer factors for voliatile compounds in soil migrating to outdoor and trench air were derived based the Jury model as described in the Soil Screening Users Guidance (USEPA 2002b).

The physical/chemical properties for volatile COPCs are presented in Table 5-10. The source of all physical/chemical properties is noted in the table. In general, priority is given to the most recent physical/chemical data as well as the most relevant for a site located in Nevada. As such, the hierarchy for selecting physical/chemical properties was: 1) NDEP values from the BCL tables (NDEP 2017); 2) USEPA values from the RSLs tables (USEPA 2017); 3) USEPA values from the original Johnson and Ettinger model (USEPA 2004); and 4) USEPA

values from EPISuite (2012) combined with using surrogate chemicals for chemical diffusivities.

Soil gas, soil, or groundwater concentrations were used as the source term for modeling the following scenarios:

- Soil gas from five ft bgs migrating to indoor air in a commercial building and outdoor air at Parcel H;
- Soil gas migrating from one centimeter (cm) below the base of a 10 foot construction trench in Parcel H;
- Groundwater from 55 ft bgs migrating to commercial indoor air, outdoor air, or a 10 foot construction trench from Parcel H; and
- Soil from ground surface to outdoor air or a 10 foot construction trench in Parcel H.

As reported in the 2010 Site-Wide Soil Gas HRA (Northgate and Exponent 2010c), soil samples were collected to determine site-specific soil properties representative of the unsaturated zone. Samples were collected at 16 locations at depths of 9 to 15 ft bgs (mostly at 10 ft) across the Site (sampling locations and boring logs in included in Appendix R) to determine volumetric water content, total porosity, dry bulk density, and grain density in accordance with NDEP guidance (NDEP 2010d). The soil property results (shown in Table 5-11) were used for modeling purposes and are the average of 15 site-specific values measured from 9-10 ft bgs. One sample collected at a depth of 15 ft bgs was not included as it represents wetter than average conditions at the site. A map showing the location of these soil samples is shown in Appendix R.

A review of site stratigraphy and boring logs indicated that these samples collected at 9-10 ft bgs should be representative of the entire stratigraphic unit Qal and there is not expected to be significant variation laterally or with depth in that stratigraphic unit. In general, the Qal extends from the ground surface to the groundwater table over the site as well as Parcel H. In places, the groundwater table occurs as much as 10 feet below the base of the Qal in the underlying fine-grained UMCf. For simplicity and to be conservative, the entire vadose zone was modeled as Qal with no UMCf included. Each sample was also plotted on a ternary diagram to determine soil typing for Johnson and Ettinger modeling as well. The samples clustered well near the sand to loamy sand border, with the average soil type being loamy sand. A careful review of boring logs from the on-site area where soil properties were collected (including Parcel H) was used to confirm these soil properties and this soil type would be representative of conditions at Parcel H. Boring logs used in this analysis are also included in Appendix R. Soil types identified in the on-site soil borings include poorly sorted gravel, silty gravel, poorly sorted sand, well sorted sand, and silty sand (ENSR 2005) and are consistent with an average soil type of loamy sand in Parcel H. Based on that evaluation, it was concluded that the on-site soil samples would be representative of conditions expected to be seen at Parcel H.

Depth to groundwater for Parcel H was determined by evaluating both current and historic groundwater elevations for non-artisanal wells within the Parcel. The depth to groundwater was selected to be a conservative estimate given both current and recent historic measurements.

Depth to the top and base of soil contamination was determined based on conservative worst-case assumptions. It was assumed that the soil could be contaminated with VOCs from one cm bgs all the way down to the water table.

A conservative default building (with building characteristics shown on Table 5-9), was assumed for modeling. The default building size of 100 meters by 100 meters (USEPA2004c) was selected. The default building has an assumed vapor flow rate of 5 liters/minute into the building (USEPA 2004c). California's default air exchange rate of one air change per hour (California Environmental Protection Agency [Cal/EPA] 2011) was used in the absence of a default rate from NDEP or USEPA. A conservative building height of 10 ft was assumed.

When modeling the above-ground outdoor air scenarios, the Q/C model described in the Soil Screening Users Guidance (USEPA 2002b) was used with parcel-specific site area. For trench scenarios, a box model was used to simulate dispersion. Trench dimensions of 10 ft deep, 20 ft long, and 5 ft wide were assumed. For this box model, the air flow through the trench was controlled by a site-specific windspeed that was reduced by a factor of 10 to ensure it would be conservative for a trench scenario where the breathing zone may be a few ft bgs. Additionally, soil gas samples were assumed to be within one cm of the base of the trench and VOCs were emitted from all the trench walls in addition to the base of the trench.

Benzene is well known to degrade naturally due to aerobic respiration at many sites. Measured concentrations of benzene at shallow depths are consistently lower than would be predicted from deeper sources (soil gas and groundwater) using typical diffusion modeling with no biodegradation providing evidence for biodegradation at the Site. To account for this, the software bioVapor (American Petroleum Institute [API] 2012) was used to calculate the relative impact of biodegradation between the samples collected at depth and the surface for all soil gas and groundwater scenarios. The input parameters for this calculation are also presented in Table 5-9 and were consistent with the input parameters for the rest of the modelling.

Table 5-12A summarizes the transfer factors from soil gas to indoor air, outdoor air and trench air for Parcel H. Table 5-12B summarizes the transfer factors from groundwater to indoor air, outdoor air and trench air for Parcel H. Table 5-12C summarizes the transfer factors from soil to outdoor air and trench air for Parcel H. The conservative nature of the model input parameters and modeling uncertainties are discussed in Section 6.3.

Exposure Point Concentrations

Using the maximum soil gas, soil, or groundwater concentration of each volatile COPC within the parcel as the source term, indoor air, outdoor air and trench air concentrations were modeled using the Johnson and Ettinger model/Jury model and a basic diffusion model, respectively. The contaminant concentration in air, rather than contaminant intake, is used as the basis for estimating chemical inhalation risks based on guidance described in *Part F, Supplemental Guidance for Inhalation Risk Assessment* (USEPA 2009b). The EPCs for noncarcinogens and carcinogens are estimated as follows:

$$EPC_{air} = EPC_{S/SG/GW} \times TF$$

where:

EPC_{air} = Air Exposure Point Concentration ($\mu g/m^3$)

$EPC_{S/SG/GW}$ = Exposure Point Concentration (µg/kg for soil, µg/m^3 for soil gas, µg/L for groundwater)
TF = Transfer Factor (µg/m^3 per µg/kg for soil, µg/m^3 per µg/m^3 for soil gas, µg/m^3 per µg/L for groundwater)

Tables 5-7A and 5-7B present the source term concentrations in soil, which are the maximum detected concentrations at 0-2 ft and 0-10 depth interval in Parcel H, and calculated vapor EPCs in outdoor air and trench air. Table 5-13 presents the source term concentrations in soil gas, calculated EPCs in indoor air, outdoor air and trench air based on the maximum detected concentration in Parcel H. Table 5-14 presents the source term concentrations in shallow groundwater, the calculated EPCs in indoor air, outdoor air and trench air based on the maximum detected concentration in groundwater for Parcel H in the most recent two years groundwater data.

5.2.3 Exposure Assumptions and Calculations

The magnitude of exposure for any given receptor is a function of the amount of chemical in the exposure medium, and the frequency, intensity, and duration of contact with that medium. In order to quantify exposures, an upper-bound estimate of the theoretical intake was developed for each of the potentially exposed human populations via each of the exposure pathways identified in the CSM, and the exposure dose could be calculated by multiplying the EPC in the exposure medium by the intake factor. For carcinogens, lifetime average daily dose (LADD), based on chronic lifetime exposure averaged over a 70-year lifetime, is used in the risk characterization, while non-carcinogens, average daily dose (ADD), based on exposure averaged over the exposure period, is used (USEPA 1989). This section provides the equations and assumptions used to develop the intake factors used in the risk characterization.

5.2.3.1 Chemicals

As shown in Table 5-15, exposure assumptions recommended by NDEP (2017a) were used for the indoor and outdoor commercial/industrial workers. For the construction workers, exposure assumptions recommended by USEPA (USEPA 2017a) were used for soil ingestion, dermal contact, and particulate inhalation pathways, except that a utility trench scenario was also evaluated for the construction workers assuming that they could be exposed to volatile compounds migrating from subsurface soil, soil gas, and groundwater to air in a utility trench. The construction workers are assumed to be conducting excavation activities for four hours per day, 30 days per year for one year per NDEP's comment (NDEP 2017b, General Comment #3).

Soil Ingestion

The intake factor for soil ingestion was calculated using the following equation (USEPA 1989):

$$IF_{soil.ing} = \frac{IR_S \times EF \times ED \times CF}{BW \times AT}$$

where:

$IF_{soil.ing}$ = Intake Factor for soil ingestion (kg of soil/kg body weight-day)
IR_s = Soil Ingestion Rate (mg of soil/day)
EF = Exposure Frequency (day/year)
ED = Exposure Duration (year)

BW = Body Weight (kg)
AT = Averaging Time (day)
CF = Conversion Factor (kg of soil/mg of soil)

Dermal Contact with Soil

The intake factor for dermal contact with soil was calculated using the following equation (USEPA 2004b):

$$IF_{soil.derm} = \frac{AF \times SA_s \times EF \times ED \times CF}{BW \times AT}$$

where:

$IF_{soil.derm}$ = Intake Factor for dermal contact with soil (kg of soil/kg body weight-day)
AF = Adherence Factor (mg of soil/square centimeter [cm^2])
SA_s = Skin Surface Area for soil contact (cm^2/day)
EF = Exposure Frequency (day/year)
ED = Exposure Duration (year)
BW = Body Weight (kg)
AT = Averaging Time (day)
CF = Conversion Factor (kg of soil/mg of soil)

Inhalation of Airborne Soil Particulate or Vapor Migrating from Soil, Soil Gas, or Groundwater to Air

The intake factor for inhalation of airborne particulates or vapor migrating from soil, soil gas, or groundwater to air was calculated using the following equation (USEPA 2009b):

$$IF_{inh} = \frac{ET \times EF \times ED}{AT \times CF}$$

where:

IFinh = Intake Factor for air inhalation (unitless)
ET = Exposure Time (hour/day)
EF = Exposure Frequency (day/year)
ED = Exposure Duration (year)
AT = Averaging Time (day)
CF = Conversion Factor (hour/day)

5.2.3.2 Asbestos

The exposure assumptions for asbestos are presented in NDEP's "asbestos guidance riskcalcs.xls" spreadsheet (Appendix Q), and the intake equation was analogous to that presented above for evaluating inhalation exposures to chemicals with carcinogenic effect (averaged over a 70-year lifetime), with an exception that an indoor attenuation factor was incorporated as follows:

$$IF_{inh} = \frac{[ET_{out} + (ET_{in} \times ATT_{in})] \times EF \times ED}{AT \times CF}$$

where:

ET_{out} = Outdoor Exposure Time (hour/day)
ET_{in} = Indoor Exposure Time (hour/day)
ATT_{in} = Indoor Attenuation Factor (unitless)
EF = Exposure Frequency (day/year)
ED = Exposure Duration (year)
AT = Averaging Time (day)
CF = Conversion Factor (hour/day)

5.3 Toxicity Assessment

The purpose of a toxicity assessment is to present the weight-of-evidence regarding the potential for a chemical to cause adverse effects in exposed individuals, and to quantitatively characterize, where possible, the relationship between exposure to a chemical and the increased likelihood and/or severity of adverse effects (i.e., the dose-response assessment). Well conducted epidemiological studies that show a positive association between exposure to a chemical and a specific health effect are the most convincing evidence for predicting potential hazards for humans. However, human data that would be adequate to serve as the basis for the dose-response assessment are available for only a few chemicals. In most cases, toxicity assessment for a chemical has to rely on information derived from experiments conducted on non-human mammals, such as the rat, mouse, rabbit, guinea pig, hamster, dog, or monkey.

Chemicals are usually evaluated for their potential health effects in two categories, carcinogenic and non-carcinogenic. Different methods are used to estimate the potential for carcinogenic and non-carcinogenic health effects to occur. Several chemicals produce non-carcinogenic effects at sufficiently high doses but only some chemicals are associated with carcinogenic effects. Most regulatory agencies consider carcinogens to pose a risk for cancer at all exposure levels (i.e., a "no-threshold" assumption); that is, any increase in dose is associated with an increase in the probability of developing cancer. In contrast, non-carcinogens generally are thought to produce adverse health effects only when some minimum exposure level is reached (i.e., a threshold dose).

Oral CSFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, and inhalation unit risks (IURs), which are expressed in units of $(\mu g/m^3)^{-1}$, are chemical specific and experimentally derived potency values that are used to calculate the risk of cancer resulting from exposure to potentially carcinogenic chemicals. The CSFs and IURs are defined as upper-bound estimates of the probability of an individual developing cancer per unit intake of a potential carcinogen over a lifetime. With CSFs and IURs, a higher value implies a more potent carcinogenic potential.

Non-cancer oral RfDs, which are expressed in units of mg/kg-day, and inhalation reference concentrations (RfCs), which are expressed in units of $\mu g/m^3$, are experimentally derived “no-effect” levels that are used to quantify the extent of toxic effects other than cancer due to exposure to chemicals. The RfDs and RfCs are intended to represent the dose or concentration of a chemical that is not expected to cause adverse health effects, assuming daily exposure over the exposure duration, even in sensitive individuals, with a substantial margin of safety. With RfDs and RfCs, a lower value implies a more potent toxicant.

The toxicity values used for chemicals and asbestos are discussed in the following subsections.

5.3.1 Chemicals

For COPCs, an initial list of chronic toxicity values was developed based on the values used by NDEP for the derivation of the 2017 BCLs (NDEP 2017a). For most chemicals in the BCL table, NDEP selected toxicity values from the USEPA's Integrated Risk Information System (IRIS); however, on a case-by-case basis, values provided by other sources, e.g., California, were selected over the IRIS values. Also, for chemicals not included in IRIS, NDEP relied on other sources for toxicity values. Ramboll checked the chronic toxicity values from the 2017 BCL table against the identified source to confirm that the most current values were being used. Particularly, the most recent toxicity values from the USEPA RSL table (USEPA 2017b) were used for PAHs.

For COPCs not listed in the 2017 BCL table, the following approach was used:

- Toxicity values from IRIS were selected; if not in IRIS, toxicity values from the USEPA RSL table (USEPA 2017b) were used; and
- For COPCs for which toxicity values were not available from any of the sources listed, Ramboll used the toxicity values from surrogate chemicals (chemicals with similar chemical structure).

For construction workers who were assumed to be present at Parcel H for one year, subchronic toxicity values were used whenever available for the evaluation of adverse non-cancer effects in accordance with recommendations by USEPA (USEPA 2017a). The general hierarchy of sources used for the subchronic toxicity values are as below:

- USEPA Provisional Peer Reviewed Toxicity Values for Superfund (PPRTV) (USEPA 2017c);
- Agency for Toxic Substances & Disease Registry (ATSDR). Minimal Risk Levels (MRLs) (ATSDR 2016); and
- USEPA's Health Effects Assessment (HEAST) Summary Tables (USEPA 1997).

Specific dermal route toxicity values have not yet been developed for any chemicals. Consistent with NDEP and USEPA guidance, potential health effects associated with dermal exposure were calculated using the oral toxicity values.

Also, the USEPA weight-of-evidence classification was identified for each carcinogenic COPC.

The toxicity values are presented in Table 5-16 for soil COPCs. Tables 5-17A and 5-17B present chronic and subchronic toxicity values for all chemicals analyzed in the soil gas and groundwater samples included in the Parcel H HRA, respectively. The uncertainties in the selection of toxicity values are further discussed in Section 6.2.3.

5.3.2 Asbestos

The IURs for asbestos are based on the estimated additional deaths from lung cancer or mesothelioma due to constant lifetime exposure, which are calculated using the following equation (Neptune 2015):

$$R = 0.5 \times \Big(\big(0.786 \times (NSM + NSF)\big) + \big(0.214 \times (SM + SF)\big) \Big)$$

where:

R = Estimated additional deaths from lung cancer or mesothelioma per 100,000 persons from constant lifetime exposure to 0.0001 transmission electron

microscopy fiber per cubic centimeter (f/cm^3) longer than 10 µm and thinner than 0.4 µm

NSM = Risk coefficient for population of non-smoking males

NSF = Risk coefficient for population of non-smoking females

SM = Risk coefficient for population of smoking males

SF = Risk coefficient for population of smoking females

The parameter values for NSM, NSF, SM, and SF, which are "optimized" risk coefficients for pure fiber types obtained from Berman and Crump (2003) and presented in Neptune (2015), are used in the calculation of R, representing a weighted average of the combined risks to the general population with the assumption that 50% of the fibers will be longer than 10 um. The R values are calculated separately for long amphibole and long chrysotile fibers, reflecting the difference in potency between fiber types. Then, the R value is used to calculate the IUR as follows:

$$IUR = \frac{10^{-5}}{0.0001} \times R = \frac{1}{10} \times R$$

where:

IUR = Inhalation Unit Risk (f/cm^3)$^{-1}$

R = Estimated additional deaths from lung cancer or mesothelioma per 100,000 persons from constant lifetime exposure to 0.0001 f/cm^3 longer than 10 µm and thinner than 0.4 µm

The resulting IURs for lung cancer and mesothelioma are 6.3206 (f/cm^3)$^{-1}$ for long amphibole fibers and 0.0569 (f/cm^3)$^{-1}$ for long chrysotile fibers. These values were used to estimate inhalation risks associated with exposure to asbestos in parcel soils (see Appendix Q).

5.4 Risk Characterization

Risk characterization represents the final step in the risk assessment process. In this step, the results of exposure and toxicity assessments are integrated into quantitative or qualitative estimates of potential health risks. In each environmental medium (i.e., soil, soil gas, groundwater), potential excess lifetime cancer risks and non-cancer adverse health effects for each COPC were characterized separately. In addition, potential cancer risks associated with exposure to asbestos in soil are characterized separately from other carcinogenic soil COPCs.

The National Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] § 300) is cited as the basis for target risk and hazard levels by NDEP (2017a). According to the NCP, lifetime incremental cancer risks posed by a site should not exceed 1 x 10^{-6} to one hundred in a million (1 x 10^{-4}), and non-carcinogenic chemicals should not be present at levels expected to cause adverse health effects (i.e., a HI greater than one). The NDEP generally considers a cumulative incremental cancer risk of 1 x 10^{-6} to be a point of departure for purposes of making risk management decisions (NDEP 2017a).

It should be noted that the cancer risk and non-cancer hazard estimated in this HRA do not represent absolute estimates in Parcel H, since generic and conservative assumptions were used, which are likely to overestimate actual exposures and calculated risks. Exceedance of the target cancer risk range of 10^{-6} to 10^{-4} or the target non-cancer HI of greater than one

does not indicate that adverse impacts to human health are occurring or will occur but suggests that further evaluation may be warranted.

5.4.1 Soil

5.4.1.1 Cancer Risks: Chemicals

The excess lifetime cancer risk is estimated as the upper-bound incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen at a given concentration. The equation used to calculate cancer risk for indoor commercial/industrial workers due to exposure via incidental soil ingestion and inhalation of airborne dust particulates and vapor is as follows:

$$\textit{Cancer Risk} = EPC_{soil} \times IF_{soil.ing} \times CSF_{oral} + EPC_{air} \times IF_{inh} \times IUR$$

where:

EPC_{soil} = Soil Exposure Point Concentration (mg/kg)

EPC_{air} = Air Exposure Point Concentration (µg/m^3)

$IF_{soil.ing}$ = Intake Factor for soil ingestion (kg of soil/kg body weight-day)

IF_{inh} = Intake Factor for air inhalation (unitless)

CSF_{oral} = Oral Cancer Slope Factor (mg/kg body weight-day)$^{-1}$

IUR = Inhalation Unit Risk (µg/m^3)$^{-1}$

The equation used to calculate cancer risk for outdoor commercial/industrial workers and construction workers due to exposure via incidental soil ingestion, dermal contact, and inhalation of airborne soil particulates and vapor is as follows:

$$\textit{Cancer Risk} = EPC_{soil} \times (IF_{soil.ing} + IF_{soil.derm} \times ABS) \times CSF_{oral} + EPC_{air} \times IF_{inh} \times IUR$$

where:

EPC_{soil} = Soil Exposure Point Concentration (mg/kg)

EPC^{air} = Air Exposure Point Concentration (µg/m^3)

$IF_{soil.ing}$ = Intake Factor for soil ingestion (kg of soil/kg body weight-day)

$IF_{soil.derm}$ = Intake Factor for dermal contact with soil (kg of soil/kg body weight-day)

IFinh = Intake Factor for air inhalation (unitless)

ABS = Soil Absorption Factor (unitless)

CSF_{oral} = Oral Cancer Slope Factor (mg/kg body weight-day)$^{-1}$

IUR = Inhalation Unit Risk (µg/m^3)$^{-1}$

Soil absorption factors (ABS) used in the risk calculation are presented in Table 5-16.

The detailed calculation of cancer risks for each receptor population is presented in Appendix Q. The estimated excess lifetime cancer risk for each COPC was conservatively summed, regardless of the type of cancer, to estimate the total cancer risk from soil COPCs for an

exposed individual. The cancer risk results for Parcel H are summarized in Table 5-18. The excess lifetime cancer risks due to exposure to chemicals in soil in Parcel H were 4×10^{-7} (both 0-2 ft bgs and 0-10 ft bgs) for future indoor and outdoor commercial/industrial workers, and 2×10^{-8} (0-10 ft bgs) for future construction workers, which were below the lower end of the NDEP acceptable risk range of 10^{-6} to 10^{-4}. Therefore, potential exposure to COPCs in soil in Parcel H is not expected to pose an unacceptable carcinogenic health risk under the conditions evaluated.

5.4.1.2 Non-Cancer Health Effects: Chemicals

The likelihood of non-cancer adverse effects is quantified by the development of an HQ. The HQ represents the ratio of the estimated exposure to a non-carcinogen at a given concentration to a value that is believed not to produce non-cancer adverse health effects. The equation used to calculate non-cancer HQ for indoor commercial/industrial workers due to exposure via incidental soil ingestion and inhalation of airborne dust particulates and vapor is as follows:

$$HQ = EPC_{soil} \times IF_{soil.ing}/RfD_{oral} + EPC_{air} \times IF_{inh}/RfC_{inh}$$

where:

HQ = Hazard Quotient

EPC_{soil} = Soil Exposure Point Concentration (mg/kg)

EPC_{air} = Air Exposure Point Concentration (µg/m^3)

$IF_{soil.ing}$ = Intake Factor for soil ingestion (kg of soil/kg body weight-day)

IF_{inh} = Intake Factor for air inhalation (unitless)

RfD_{oral} = Oral Reference Dose (mg/kg body weight-day)

RfC_{inh} = Inhalation Reference Concentration (µg/m^3)

The equation used to calculate non-cancer HQ for outdoor commercial/industrial workers and construction workers due to exposure via incidental soil ingestion, dermal contact, and inhalation of airborne soil particulates and vapor is as follows:

$$HQ = EPC_{soil} \times (IF_{soil.ing} + IF_{soil.derm} \times ABS)/RfD_{oral} + EPC_{air} \times IF_{inh}/RfC_{inh}$$

where:

HQ = Hazard Quotient

EPC_{soil} = Soil Exposure Point Concentration (mg/kg)

EPC_{air} = Air Exposure Point Concentration (µg/m^3)

$IF_{soil.ing}$ = Intake Factor for soil ingestion (kg of soil/kg body weight-day)

$IF_{soil.derm}$ = Intake Factor for dermal contact with soil (kg of soil/kg body weight-day)

IF_{inh} = Intake Factor for air inhalation (unitless)

ABS = Soil Absorption Factor (unitless)

RfD_{oral} = Oral Reference Dose (mg/kg body weight-day)

RfC_{inh} = Inhalation Reference Concentration (µg/m^3)

The detailed calculation of non-cancer HQs for each receptor population is presented in Appendix Q. The estimated non-cancer HQs for each COPC were conservatively summed, regardless of the target organ, to estimate the total non-cancer HI from soil COPCs for the exposed individual. The non-cancer HI results for Parcel H are summarized in Table 5-18. The non-cancer HIs due to exposure to chemicals in soil in Parcel H were 0.1 (both 0-2 ft bgs and 0-10 ft bgs) for future indoor commercial/industrial workers, 0.2 (0-2 ft bgs) and 0.3 (0-10 ft bgs) for future outdoor commercial/industrial workers, and 1 (0-10 ft bgs) for future construction workers, which were below the NDEP significant threshold of greater than one. Therefore, potential exposure to COPCs in soil in Parcel H is not expected to pose an unacceptable non-carcinogenic health effect under the conditions evaluated.

5.4.1.3 Cancer Risks: Asbestos

The equation for assessing inhalation cancer risk for asbestos is analogous to that used for other inhalation carcinogens (Neptune 2015), as follows:

$$Cancer\ Risk = EPC_{air} \times IF_{inh} \times IUR$$

where:

EPC_{air} = Air Exposure Point Concentration (f/m^3)

IF_{inh} = Intake Factor for air inhalation (unitless)

IUR = Inhalation Unit Risk (f/cm^3)$^{-1}$

The inhalation cancer risks for asbestos (combined risks associated with death from lung cancer and mesothelioma) were calculated using the NDEP's "asbestos guidance riskcalcs.xls" spreadsheet, and are presented in Appendix Q. The best estimate and upper-bound estimate of asbestos cancer risks for Parcel H are summarized in Table 5-19. The best estimates and upper-bound estimates for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers from potential inhalation exposure to chrysotile long fibers were all less than 1×10^{-6} in Parcel H, which were below the lower end of the NDEP acceptable risk range of 10^{-6} to 10^{-4}. For amphibole long fibers, the best estimate was zero. The upper-bound estimates for indoor and outdoor commercial/industrial workers were less than 1×10^{-6}, and was 2×10^{-6} for construction workers. It should be noted that the upper-bound risk estimates for long amphibole fibers were based on an observed count of zero fibers in 25 post-abatement soil samples in Parcel H.[31] Overall, potential exposure to asbestos in soil in Parcel H is not expected to pose an unacceptable carcinogenic health risk under the conditions evaluated. Uncertainties in the risk estimates for asbestos, including the impact of sample size, are discussed in Section 6.2.2.2.

[31] For asbestos, risks are estimated even in the case of zero fiber counts. As discussed in detail in Neptune (2015), the risk assessment results are affected by the calculation of 95% UCL, which for a fiber count of zero in soil samples, yields a value of three fibers per gram of soil (also see the discussion in Section 6.2.2.2).

5.4.2 Soil Gas VOCs

5.4.2.1 Assessment of Cancer Risks

Carcinogenic risks were estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the Parcel H COPCs. The following equations were used to calculate chemical-specific risk and total risk:

$$Chemical\text{-}Specific\ Risk_{inhalation} = EPC_{air} \times IFinh \times UR$$

where:

EPC_{air} = Exposure Point Concentration in air (µg/m^3)

IF_{inh} = Inhalation Intake Factor (unitless)

UR = Unit Risk (µg/m^3)$^{-1}$

and

$$Total\ Risk = \sum Chemical\text{-}Specific\ Risk$$

The cancer risk estimates were calculated for Parcel H based on maximum chemical concentrations detected in the approximately 5 ft bgs soil gas samples, regardless of whether they were co-located.

The estimated excess lifetime cancer risks associated with exposures of indoor, outdoor commercial/industrial workers, and construction workers to COPCs migrating from approximately 5 ft soil gas to indoor and outdoor air in Parcel H are summarized in Table 5-20. The associated maximum parcel-specific excess lifetime cancer risks for all COPCs detected in approximately 5 ft soil gas samples are presented in Appendix Q-2 (Tables Q-2-1). As shown in Table 5-20, the total excess lifetime cancer risks estimated for Parcel H are 2×10^{-9} for an indoor commercial/industrial worker, 5×10^{-11} for an outdoor commercial/industrial worker, and 3×10^{-11} for a construction worker. Therefore, potential exposure to COPCs in soil gas in Parcel H is not expected to pose an unacceptable carcinogenic health effect under the conditions evaluated.

5.4.2.2 Assessment of Noncancer Health Effects

For each COPC, the potential for noncancer adverse health effects were estimated as follows:

$$Hazard\ Quotient_{inhalation} = \frac{EC \times IFinh}{RfC}$$

where:

EPC_{air} = Exposure Point Concentration in air (µg/m^3)

IF_{inh} = Inhalation Intake Factor (unitless)

RfC = Reference Concentration (µg/m^3)

The HQs for each COPC are summed to obtain the HI:

$$Hazard\ Index = \sum Hazard\ Quotients$$

The estimated total HIs associated with exposures of indoor, outdoor commercial/industrial workers, and construction workers to COPCs migrating from 5 ft soil gas to indoor and

outdoor air in Parcel H are summarized in Tables 5-20. The associated maximum HQs for all COPCs detected in 5 ft soil gas in Parcel H are presented in Appendix Q-2 (Tables Q-2-2). As shown in Table 5-20, the total HI estimated for Parcel H are 0.00005 for an indoor commercial/industrial worker, 0.000001 for an outdoor commercial/industrial worker, and 0.00002 for a construction worker. Therefore, potential exposure to COPCs in soil gas in Parcel H is not expected to pose an unacceptable non-carcinogenic health effect under the conditions evaluated.

5.4.3 Groundwater VOCs

5.4.3.1 Assessment of Cancer Risks

Carcinogenic risks were estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the Parcel H COPCs. The following equations were used to calculate chemical-specific risk and total risk:

$$Chemical\text{-}Specific\ Risk_{inhalation} = EPC_{air} \times IFinh \times UR$$

where:

EPC_{air} = Exposure Point Concentration in air ($\mu g/m^3$)

IF_{inh} = Inhalation Intake Factor (unitless)

UR = Unit Risk $(\mu g/m^3)^{-1}$

and

$$Total\ Risk = \sum Chemical\text{-}Specific\ Risk$$

The cancer risk estimates were calculated based on maximum chemical concentrations detected in the shallow groundwater in Parcel H, regardless of whether they were co-located.

The estimated excess lifetime cancer risks associated with exposures of indoor, outdoor commercial/industrial workers, and construction workers to COPCs migrating from shallow groundwater to indoor and outdoor air in Parcel H are summarized in Table 5-21. The associated maximum excess lifetime cancer risks for all COPCs detected in shallow groundwater for Parcel H are presented in Appendix Q-3 (Tables Q-3-1 through Q-3-3). As shown in Table 5-21, the excess lifetime cancer risks estimated for Parcel H are 2×10^{-8} for an indoor commercial/industrial worker, 3×10^{-10} for an outdoor commercial/industrial worker, and 1×10^{-12} for a construction worker. Therefore, potential exposure to COPCs in groundwater in Parcel H is not expected to pose an unacceptable carcinogenic health effect under the conditions evaluated.

5.4.3.2 Assessment of Noncancer Health Effects

For each COPC, the potential for noncancer adverse health effects were estimated as follows:

$$Hazard\ Quotient_{inhalation} = \frac{EC \times IFinh}{RfC}$$

where:

EPC_{air} = Exposure Point Concentration in air ($\mu g/m^3$)

IF_{inh} = Inhalation Intake Factor (unitless)

RfC = Reference Concentration ($\mu g/m^3$)

The HQs for each COPC are summed to obtain the HI:

$$Hazard\ Index = \sum Hazard\ Quotients$$

The estimated total HIs associated with exposures of indoor, outdoor commercial/industrial workers, and construction workers to COPCs migrating from groundwater to indoor and outdoor air for Parcel H are summarized in Table 5-21. The associated maximum HQs for all COPCs detected in shallow groundwater are presented in Appendix Q-3 (Tables Q-3-1 through Q-3-3). As shown in Table 5-21, the total HI estimated for Parcel H are 0.00002 for an indoor commercial/industrial worker, 0.0000003 for an outdoor commercial/industrial worker, and 0.00000002 for a construction worker. Therefore, potential exposure to COPCs in groundwater in Parcel H is not expected to pose an unacceptable non-carcinogenic health effect under the conditions evaluated.

6. UNCERTAINTY ANALYSIS

The process of risk assessment has inherent uncertainties associated with the calculations and assumptions used in the HRA, resulting from lack of knowledge and variability of site conditions as well as chemical toxicity and exposure. The approach used in the HRA is health protective and tends to overestimate potential exposure, resulting in estimated cancer risks and hazard levels that are likely to be higher than the actual risks or hazards experienced by the potentially exposed populations. These uncertainties are generally difficult to quantify. A qualitative discussion of key uncertainties associated with the available data and the methodology used in the HRA is presented below.

6.1 Uncertainties Identified in the Data Usability Evaluation

6.1.1 Site Characterization Data

For field sampling, it is impossible to collect samples from every possible location; therefore, there is always some uncertainties associated with the representativeness of site characterization data.

Soil data used in the post-remediation HRA came from investigations following both judgmental and random sampling approaches, with judgmental samples collected at locations targeting specific features within Parcel H, including the debris piles, pad mounted transformer, and drainage features. Soil samples collected from these locations were analyzed for the full suite of SRC chemicals. Also, adequate soil samples were collected at 0-10 ft bgs. Overall, the placement of the soil sample locations was deemed representative to evaluate the soil conditions of Parcel H in the context of the CSM, and the relative uncertainty in the Site characterization data was considered to be low.

Soil gas samples collected in 2008 (five ft bgs samples from 2 locations) within Parcel H were used to estimate cancer risks and noncancer hazards in the HRA. The 2008 Site-Wide Soil Gas Work Plan (ENSR 2008a) states that the majority of sampling locations were selected to (1) sample near or within one of the 18 LOUs identified as being a potential source of VOCs; (2) co-locate with groundwater wells; and/or (3) sample areas where VOCs had been detected in soil or groundwater. This sample placement is consistent with the CSM in which groundwater is identified as the primary source of VOCs in soil gas. The soil gas samples were analyzed for the full suite of VOCs using USEPA Method TO-15, as proposed in the soil gas investigation work plans (ENSR 2008a). Further, the analyses included both (1) VOCs associated with historical operations and (2) those VOCs that had been detected in soil or groundwater. Given that (1) in the absence of a building footprint, risks associated with the vapor intrusion pathway are typically evaluated for each individual sampling location (i.e., statistical averages are not estimated); and (2) chloroform concentrations in the underlying groundwater plume were used to inform selection of the soil gas sampling locations, the available samples are considered adequate to characterize soil gas concentrations in Parcel H.

The DVSRs for the 2008 soil gas analytical data are included in Appendix L. As noted in Section 4.2 and discuss in more detail in Section 6.1.2 through 6.1.7, two data points were qualified based on minor method blank, and quantitation issues, but were deemed acceptable and were not biased low. All soil gas data were deemed usable for risk assessment. Discussions of the impact on the risk results from helium detections in the

sampling train and the findings for blank contamination and precision are provided in Section 6.1.6.

Consistent with previous USEPA guidance and NERT project work plans, only soil gas samples were collected to support evaluation of the vapor intrusion pathway. The objectives of groundwater sampling at the Site have been primarily to characterize SRCs in groundwater near suspected source areas and plume delineation; that is, no groundwater investigation was conducted to specifically provide data to evaluate the vapor intrusion pathway. Further, the majority of groundwater sampling on the Site has focused on perchlorate and hexavalent chromium, with limited sampling for VOCs and SVOCs. In response to NDEP comments (NDEP 2017b), groundwater data was also incorporated in this HRA to evaluate potential risks for the vapor intrusion pathway to provide an additional line of evidence for the analysis. To provide groundwater data for this HRA, the NERT project database (discussed in Section 4.1.1.1) and the BMI database were queried to identify wells within or near Parcel H and for which VOC and/or SVOC results were available for shallow groundwater. The identified wells to include in the Parcel H HRA are all owned and sampled by NERT on the Site (Table 3-2). The findings of the review of sample coverage included consideration of both spatial and temporal coverage are summarized as follows: There are four wells in Parcel H. Parcel H is located outside of the known area of high concentrations of chloroform in groundwater (Figure 3-2). Limited VOCs were detected in these wells from 2006 to 2015, all at low concentrations. M-120 was sampled in January 2015 with the highest detected chloroform concentration of 3.8 µg/L in this parcel. Along with the soil gas data, these data are adequate for evaluation of the vapor intrusion pathway.

6.1.2 Detection Limit

For soil analytes for which the detection frequency was less than 100%, the SQLs from the soil HRA data set were compared to 0.1xBCL (or other screening criteria) to confirm that they were sufficiently low for risk characterization (see Section 4.1.1.5). As presented in Table 4-1, most of the SQLs in Parcel H were less than the screening levels, with the a few exceptions. The impacts of elevated SQLs on the soil COPC selection and risk estimates are discussed below.

- BaPEqs: The SQLs exceeded 0.1xBCL in most samples reported as nondetects, with a maximum SQL of 0.039 mg/kg. BaPEq was not identified as a soil COPC for Parcel H. The estimated cancer risk associated with the maximum SQL would be 1×10^{-7}, which is below the NDEP acceptable risk range of 10^{-6} to 10^{-4}. Therefore, even if BaPEq was identified as a soil COPC for Parcel H, it would have little impact on the overall risk evaluation.
- Hexachlorobenzene: The SQLs exceeded 0.1xBCL in most samples reported as nondetects, with a maximum SQL of 0.033 mg/kg. Hexachlorobenzene was not identified as a soil COPC for Parcel H.The estimated cancer risk associated with the maximum SQL would be 1×10^{-7}, which is below the NDEP acceptable risk range of 10^{-6} to 10^{-4}. Therefore, even if hexachlorobenzene was identified as a soil COPC for Parcel H, it would have little impact on the overall risk evaluation.
- Bis(2-chloroethyl) ether, dieldrin, 2,6-dinitrotoluene, n-nitroso-di-n-propylamine, and toxaphene: these five chemicals were not detected in any samples; the SQLs exceeded 0.1 x BCL in one or two of the non-detected samples. The maximum SQLs of these chemicals would correspond to the estimated cancer risks of 2×10^{-7} to 1×10^{-6}, which

are below or at the low end of the NDEP acceptable risk range of 10^{-6} to 10^{-4}. Therefore, even if these chemicals were identified as soil COPCs for Parcel H, there would be little impact on the overall risk evaluation.

For soil gas analytes for which the detection frequency was less than 100%, the SQLs for the soil gas dataset included in this HRA were compared to 0.1xRBC to confirm that they were sufficiently low for risk characterization (see Section 4.2.1.5). As presented in Table 4-6, the maximum SQLs were all less than 10% of the respective RBCs for all analytes except for one analyte (1,2-Dibromo-3-chloropropane) in the soil gas sample collected at SB50 is slightly higher than 10% of the RBC. This result is in general consistent with the QAPP goal that SQLs are less than 1/10th of the screening level, as established by NDEP for the BMI Complex and Common Areas (NDEP 2010b). The SQLs achieved were confirmed to be adequate for risk assessment, and the uncertainty associated with the detection limits for the soil gas dataset is considered low.

For each groundwater analyte for which the detection frequency was less than 100%, the maximum SQL was compared to the RBC. Table 4-8 lists the maximum SQL, the most stringent groundwater RBC, the ratio of the maximum SQL to 1/10th of the RBC, and the number of samples with SQLs greater than 1/10th of the RBC. For all analytes, the maximum SQL was less than 10% of the respective RBC (i.e. no non-detects were greater than 10% of the RBC) except that the SQLs for bromomethane and 1,2-dibromo-3-chloropropane for groundwater samples collected in 2006, 2009 and 2010 are higher than 10% of their respective RBCs. Because maximum detected concentrations from the most recent two years' groundwater samples were used in the HRA, and the SQLs for all the recent groundwater samples collected in 2015 are below 10% of their RBCs. This result is generally consistent with the QAPP goal that SQLs are less than 1/10th of the screening level, as established by NDEP for the BMI Complex and Common Areas (NDEP 2010b). The SQLs achieved were confirmed to be adequate for risk assessment for the 2015 groundwater data used in the risk calculations for Parcel H, and the uncertainty associated with the detection limits for the groundwater dataset used in the risk evaluations for groundwater in Parcel H is considered low.

6.1.3 Completeness

The rejected ("R" qualified) data associated with post-remediation soil samples at 0-10 ft bgs in Parcel H are summarized in Appendix E, Table E-3. The percent completeness for the soil HRA data set is 99.9%. Given the small percentage of rejected data and that there is no apparent spatial grouping of rejected data, these rejected data have little impact on the spatial coverage of the soil HRA data set. Additionally, none of the rejected data were above 0.1xBCL. Therefore, the rejected data do not significantly impact the overall risk evaluation.

There are no rejected ("R" qualified) data associated with soil gas samples in Parcel H.

The rejected ("R" qualified) data associated with shallow groundwater samples in Parcel H are summarized in Appendix N, Table N-1. The percent completeness for the groundwater dataset included for the Parcel H is over 99%. Given the small percentage of rejected data and that there is no apparent spatial grouping of rejected data, these rejected data have little impact on the spatial coverage of the groundwater HRA data set. Additionally, none of the rejected data were detected and the detection limits were all well below 0.1xRBC. Therefore, the impact of the rejected data on the risk evaluation for Parcel H is considered low.

6.1.4 Comparability

As discussed in Section 4.1.1.7, different reporting limits for the same analyte in soil may impact the comparability of the data sets. The ranges of the SQLs for each soil analyte for which the detection frequency was less than 100% are presented in Table 4-1. For most of the soil analytes, the SQLs are well below 0.1xBCL (or other screening criteria); there are a few soil analytes with SQLs exceeding 0.1xBCL, and their impacts on the COPC selection and risk estimates are discussed in Section 6.1.2. In summary, different reporting limits for the same soil analyte would not affect the overall risk evaluation.

Also, differences in sample preparation and analytical methods exist between the Parcel H data set and the RZ-A background data set for both metals and radionuclides, which may affect the statistical testing results of background evaluation. However, as discussed in Section 5.1.1, no metal or radionuclide was identified or eliminated as a soil COPC based solely on the statistical testing results of background evaluation. Therefore, potential changes of statistical testing results of background evaluation due to the incomparability issues of analytical methods would not have any impact on the overall risk calculation.

Because the soil gas samples collected in Parcel H were from the 2008 site-wide soil gas survey, the temporal comparability evaluation was not performed for the soil gas data.

For the same reason, temporal trends of the soil gas concentrations in Parcel H were not evaluated. Spatial representativeness was discussed previously in Section 4.2.1.4. Locations sampled in 2008 soil gas survey were placed at five ft bgs near or within LOUs where VOCs may have been used in past operations; in areas overlying trespassing (western site boundary) groundwater plumes; and/or co-located with groundwater monitoring wells. For Parcel H, the two soil gas samples, SG49 and SG50, were co-located with monitoring wells M-121 and M-103, respectively, consistent with the investigation objective. Addtionally, Parcel H is located outside the main chloroform plume area in groundwater (defined by <70 ug/L chloroform concentration), the VOC concentrations detected in both soil gas samples are all very low, which is in line with the VOC concentrations detected in the groundwater samples collected in Parcel H. Collectively, the soil gas data set provides adequate coverage of Parcel H, and the use of the maximum detected concentrations for the exposure estimates is considered conservative.

For the groundwater data used in the HRA, as discussed in Section 4.3, a limited evaluation of this DQI is presented based on the information available in the NERT and BMI databases.

The same analytical methods were used across most investigations; specifically, USEPA Method SW-8260 for VOCs and SW-8270 for SVOCs. In some investigations, the more sensitive SW-8260 SIM was used for VOCs; SW-8270 SIM was used for PAHs across all analytical programs. All groundwater sampling results were reported in µg/L.

Because maximum detected concentrations from the most recent two years of groundwater data were used in the HRA (and SQLs were sufficiently low in the most recent investigation in 2015, as discussed in Section 4.3.1.5), the differences in detection limits does not impact the results of the HRA.

All four wells have been sampled over time in two to three investigations for VOCs and/or SVOCs but the detected concentrations were consistently low across the sampling events between 2006 and 2015 in Parcel H.

6.1.5 Precision

Precision is a measure of the degree of agreement between replicate measurements of the same source (field precision) or sample (analytical precision). Precision is expressed by the RPD between replicate measurements. Replicate measurements can be made on the same sample or on two samples from the same source.

As presented in Table E-4, in the soil HRA data set, a total of 27 pairs of primary and field duplicate results were qualified due to RPD or reporting limit exceedance. Soil samples with qualified primary and field duplicate results were treated as independent samples in the HRA. None of the soil analytes qualified due to RPD or reporting limit exceedance was identified as soil COPCs. Therefore, the precision issues for the duplicate samples do not impact on the overall risk calculation.

For the soil gas and shallow groundwater dataset used in the HRA, field precision for the Study Area samples was assessed by evaluating the field duplicate results. None of the duplicate samples were collected from locations in or near Parcel H.

6.1.6 Accuracy

The soil analytical data were evaluated in DVSRs presented in Appendix E, with a subset of the data qualified with a J qualifier (J, J-, or J+) based on method blank, field duplicate, and/or other quantitation issues (855 out of 12,324 data points, see Table F-1); that is, the reported value was estimated, with no (J), low (J-), or high (J+) bias. The potential impact of the J qualified data on the HRA results was evaluated:

- J and J+ Qualified Data: A review of the J and J+ qualified data indicated that the estimated results were either below the 0.1xBCL (or other screening criteria) or below/equal to the maximum detected concentration used in the COPC selection (Table 6-1). Only palladium and zirconium were identified based on the maximum detected concentrations with J/J+ qualifiers. No toxicity value is available for palladium, and this chemical is qualitatively discussed in Section 6.2.4. The non-cancer HQs associated with zirconium in Parcel H were below the significant threshold of greater than one (see Appendix Q). Therefore, the J and J+ qualified data do not have any impact on the overall risk evaluation.
- J- Qualified Data: A review of the J- qualified data indicated that the results estimated with low bias were either significantly below the 0.1xBCL or below/equal to the maximum detected concentration used in the COPC selection (Table 6-1), and no soil COPC was identified based on a maximum detected concentration with a J- qualifier. Therefore, correction for the low bias would not change the selection of COPCs, and the J- qualified data have little impact on the overall risk evaluation.

As discussed in Section 4.1.1.7, Ramboll noticed that several discrepancies in the data associated with blank contamination exist between the project database and the amended tables of the DVSRs Northgate prepared in the Soil HRA Report Revision 3 (Northgate 2014), especially for the reported concentrations. Data consistent with the project database are included in this HRA, and the impacts of such discrepancies on the soil results were evaluated (Table 6-2). All the reported concentrations associated with blank contamination were either below 0.1xBCL (or other screening criteria) or lower than the maximum detected concentrations used in the COPC selection. In addition, the data associated with blank contamination may result in the selection of additional metals (e.g., boron, cadmium, molybdenum, silver, sodium, thallium, tin, and tungsten) as being above background;

however, these metals either passed the concentration/toxicity screen or are essential macronutrients, and would not be identified as soil COPCs. Therefore, the data associated with blank contamination do not have any impact on the overall risk evaluation.

For asbestos, several data quality issues were identified in the DVSRs (Neptune 2014), ranging from unsigned chain of custody forms to inability to verify fiber counts on the bench sheet data reports due to poor legibility. A memorandum responding to the specific issues identified in the DVSRs along with the agreed data set for risk assessment purposes in the EDD was submitted to NDEP (ENVIRON 2014c). In the case of illegible bench sheet data, information (fiber counts and analytical sensitivity [AS]) presented in the laboratory reports was used. It is anticipated that the information in the laboratory reports would have been correct, or would not have deviated from the bench data sheet reports by more than one or two fiber counts. Further, bench data sheets were illegible for only two samples. Therefore, the overall impact of asbestos data quality issues on the risk estimates is relatively small.

The soil gas dataset, as presented in Appendix L, has a subset of the data qualified with a J qualifier (J, or J+) based on method blank, field duplicate, and/or other quantitation issues (35 out of 142 data points, see Table L-2); that is, the reported value was estimated, with no (J), or high (J+) bias. The potential impact of the J qualified data on the HRA results was evaluated. The maximum detected concentrations for each COPC in Parcel H were used in the risk evaluations. A review of the J and J+ qualified soil gas data indicated that none of the maximum detected concentrations for the primary contributors to the total estimated risk (i.e., chloroform, naphthalene and 1,4-dichlorobenzene) were based on the estimated results with no bias (J) or the bias high (J+) results for Parcel H. Therefore, the J and J+ qualified data are not expected to have any significant impact on the overall risk evaluation.

Also, as noted in Section 4.2.1.7, helium gas was used as part of the leak-check procedure for the 2008 soil gas sampling events. The primary advantage of using helium as a gaseous tracer is that leakage can be readily quantified by comparing laboratory results for helium with concentrations measured within the sampling shroud. Laboratory results are used because field results are less reliable at the low end of the concentration range. The field measurements are used to allow personnel to take corrective action in the field in response to potential leaks. Helium was not detected in any of the 2008 soil gas samples.

The groundwater analytical data were evaluated in DVSRs presented in Appendix N, with a subset of the data qualified with a J qualifier (J) based on method blank, field duplicate, and/or other quantitation issues (24 out of 1004 data points used in the groundwater risk evaluations, see Table N-3); that is, the reported value was estimated, with no (J) bias. The potential impact of the J qualified data on the HRA results was evaluated.

The maximum detected concentrations for each COPC in Parcel H were used in the risk evaluations. A review of the J qualified groundwater data indicated that the maximum detected concentration used in the groundwater risk estimations for Parcel H for the primary contributor to the total estimated risk (i.e., chloroform) was not based on the estimated results with no bias (J). Therefore the impact of the estimated results with no bias (J) are considered low in the groundwater risk evaluations for Parcel H.

6.1.7 Duplicate Treatment

In the HRA, soil samples with primary and field duplicate results were treated as independent samples, although the variance of the duplicate and primary samples was not tested. The impacts are discussed as follows:

- First, no soil COPC was identified based on the maximum concentration detected in a sample with a duplicate, and the treatment of duplicate samples does not have any effect on the soil EPCs (the maximum detected concentrations) used in the risk calculation.
- Second, although the treatment of duplicate samples may affect the results of background evaluation, no metals or radionuclides were identified as soil COPCs based solely on the background evaluation.
- Finally, the asbestos risk calculations employed both original and field duplicate samples, resulting in increase of sample size and fiber count as well as decrease of pooled AS. As indicated in Appendix Q, Parcel H contained one field duplicate sample. Excluding this field duplicate sample would slightly decrease the calculated asbestos cancer risks, but the best estimates and upper-bound estimates would still be less than 1×10^{-6} for all the receptor populations in Parcel H, except for the upper-bound estimate for construction workers due to zero fibers and sample size issues (see discussion in Section 6.2.2.2).

In summary, there is little impact of duplicate treatment on the overall soil risk evaluation.

No soil gas or groundwater field duplicate samples were collected within Parcel H. Therefore the field duplicates do not have any impact on the soil gas and groundwater risk evaluations for Parcel H.

6.2 Uncertainties Identified in the Risk Assessment

6.2.1 Identification of COPCs

Chemicals detected in at least one soil sample were included in the COPC selection process. Three out of 77 detected chemicals in Parcel H were identified as soil COPCs. For most of the chemicals that were not selected as soil COPCs, the maximum detected concentrations were generally a factor of 10, if not a factor of 100 or more, lower than the screening levels; therefore, exclusion of these chemicals from the quantitative risk assessment may slightly underestimate the potential health risks posed by Parcel H, but to such a small degree as to be inconsequential to the overall results of the HRA. It should be noted that, for a few chemicals, the SQLs were higher than the screening levels in a few soil samples (see Table 4-1). The impacts of elevated SQLs on the risk evaluation are discussed in Section 6.1.2.

Surrogate BCLs were used for the toxicity screen and COPC selection for chromium (total), 2,4'-DDE, and phosphorus (total) in the absence of NDEP-derived BCLs for these compounds. As shown in Table 5-1, these compounds were excluded as soil COPCs based on the toxicity screen. The surrogates identified are considered to be toxicologically representative of these compounds, and given that the ratios of the BCLs to the maximum detected concentrations were at least a factor of 100, the detected concentrations of these compounds would not be expected to contribute significantly to the total risk estimates.

Besides the essential nutrients (calcium, potassium, silicon, sodium, sulfate, and sulfur), no representative surrogate was identified for palladium. This chemical was identified as a soil COPC, and is discussed qualitatively in Section 6.2.4.

Based on comparison to RZ-A background, some metals were identified as being above background, while for others, there are insufficient detections in the background and/or Parcel H soil data sets to make a determination (see Appendix I). However, except for palladium and zirconium for which RZ-A background data are not available, no metal was identified as a soil COPC. That is because most metals passed the concentration/toxicity

screen and some metals are essential nutrients. Also, for the majority of metals, there is no reason to believe they are related to historical parcel activities, based on the CSM. Therefore, although there were some uncertainties with the background evaluation for metals, such uncertainties do not have any impact on the selection of soil COPCs and overall risk evaluation.

Several radionuclides failed the statistical testing of background consistency, but given that the validity of the statistical testing is confounded by several issues (see discussion in Section 5.1.1.2), radionuclides were excluded as soil COPCs based on a comparison of cancer risks between Parcel H soils and site/regional background soils. As indicated in Table 5-4, although the radionuclide cancer risk for Parcel H was slightly above the NDEP acceptable risk range of 10^{-6} to 10^{-4}, it was consistent with the cancer risks in both the RZ-A background soil and the BRC/TIMET regional background soil. Excluding radionuclides as soil COPCs only have little impact on the overall risk evaluation.

A total of 50 VOCs and volatile SVOCs were detected in soil gas or groundwater dataset selected for the risk evaluations, 42 were detected in at least one soil gas sample, and 23 were detected in at least one groundwater sample. As a conservative approach, all detected analytes were identified as COPCs (Table 5-6). For the chemicals reported as "not detected" in all samples, the SQLs were less than their respective RBCs (Tables 4-6, and 4-8). Thus, it is unlikely the risks estimated in the HRA were underestimated as a result of the COPC selection process.

6.2.2 Exposure Assessment

6.2.2.1 Exposure Scenarios

The exposure assessment in this HRA is based on a RME scenario, which is defined by USEPA as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site (USEPA 1989). To achieve this goal, the RME scenario uses highly conservative exposure assumptions. For example, this HRA assumes that a on-site outdoor commercial/industrial worker incidentally ingests 100 mg of parcel soil per day, 225 days per year, for 25 years. These and other upper-bound, default exposure assumptions most likely overestimate the potential health risks associated with Parcel H.

Other potential receptors that were not quantitatively evaluated in the HRA include off-site indoor and outdoor commercial/industrial workers, off-site residents, and visitors and trespassers. The uncertainty associated with the exclusion of these receptors from the quantitative HRA is discussed below.

In accordance with the NDEP-approved Health Risk Assessment Work Plan (Northgate and Exponent 2010b), off-site receptors were not quantitatively evaluated in the HRA. Off-site receptors could be exposed to airborne chemicals (vapors and particulates) emitted during onsite activities, e.g., routine operations or construction projects (USEPA 2002b).

For inhalation of airborne particulates, the PEF for the on-site construction worker (on the order of 10^{+6} cubic meter per kilogram [m^3/kg]) is much higher (approximately 1,000 fold) than the PEF during and after construction for off-site receptors (on the order of 10^{+9} m^3/kg) (see NDEP's "asbestos guidance riskcalcs.xls" spreadsheets presented in Appendix Q). Therefore, off-site receptors would be exposed to much lower airborne particulate concentrations than on-site construction workers. As compared with other exposure factors that may be higher (but much lower than 1,000 fold) for the off-site receptors, the

exposures through inhalation of airborne particulates by off-site receptors are expected to be lower than the exposures by on-site construction workers.

As discussed in USEPA's Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (2002b), evaluation of exposures to members of the public entering an operating facility is generally not warranted for two reasons: (1) public access is restricted or controlled at industrial sites and (2) while the public may have access to a property, exposures of an on-site worker would be much higher than those of a visitor because workers spend substantially more time at a site. Accordingly, on-site visitors and trespassers were not quantitatively evaluated in the HRA. The potential health risks for on-site workers were estimated to be below the levels of concern, the potential health risks for visitors and trespassers would also be below the levels of concern.

6.2.2.2 EPCs

The soil EPCs for non-asbestos soil COPCs were set to be the maximum detected concentrations at 0-2 ft depth interval and 0-10 ft depth interval. This assumption likely overestimates potential health risks, because receptor populations are unlikely to be exposed to the maximum detected concentrations for all COPCs over the whole exposure period.

Consistent with NDEP guidance (Neptune 2015), asbestos EPCs are estimated using a methodology that differs from that used to estimate the EPCs for other soil COPCs. For asbestos, the estimated EPCs are highly dependent on sample size. As described in Section 5.2.2.2, the soil concentration used to estimate asbestos air EPC is equal to the number of long fibers detected multiplied by the pooled AS. For the best estimate, the number of long fibers observed in the soil samples collected in a parcel is used in the calculation. For the upper bound estimate, the 95% UCL on the number of long fibers observed in the soil samples collected in a parcel assuming a Poisson distribution is used in the calculation. Pooled AS, which was used in both calculations, is a function of sample size. Specifically, pooled AS decreases with increasing sample size (the equation for calculating pooled AS is presented in Section 5.2.2.2), resulting in a lower estimate of soil concentration and hence, a lower asbestos air EPC as sample size increases.

For the special case in which no fibers were detected, as was the case for amphibole long fibers in Parcel H, the best estimate risk was zero (i.e., amphibole long fibers were not detected in any sample, so that both the soil concentration and air EPC were zero); while for the upper-bound estimate, the 95% UCL of the Poisson distribution for the case in which no fibers were detected was three fibers, and the risk was is a function of sample size. As shown in Table 5-19, although amphibole long fibers were not detected in any sample in Parcel H, the estimated risk to construction workers was 2×10^{-6} with a sample size of 25.

Soil gas and groundwater concentrations were used as the source term for modeling volatile chemical concentrations in indoor air, outdoor air and trench air. As a screening-level approach, the maximum detected COPC concentrations in soil gas and groundwater were used as the model source terms in the soil gas and groundwater risk evaluations, respectively. This approach is expected to overestimate the exposure concentrations (and associated risks), and the maximum concentration is not likely representative for an entire building footprint. Furthermore, this may be an overly conservative procedure for purposes of estimating potential health risks associated with inhalation of vapors in outdoor air and utility trench, because it is unlikely that an outdoor worker or an construction worker would

stay at only a single location. The undertainties associated with fate and transporting modeling are discussed in detail in Section 6.2.2.3.

6.2.2.3 Fate-and-Transport Modeling

The fate-and-transport modeling for soil is limited to estimating PEFs of airborne particulates and transfer factors of soil vapor for construction workers and commercial/industrial workers. PEFs were estimated according to USEPA guidance (2002b) based on a combination of site-specific and default input parameters. For non-asbestos soil COPCs, inhalation of airborne particulates did not contribute significantly to the overall risk estimates, because exposures via inhalation of vapor from soil and incidental ingestion were much higher (see Appendix Q-1); therefore, the uncertainty in the PEFs does not affect the conclusions of the HRA. However, for asbestos, which was evaluated as a carcinogen only for the inhalation route of exposure, the potential uncertainty in the PEFs could contribute substantially to the overall risk estimates. This is particularly important for the construction worker scenario because the estimated PEF was large relative to the commercial/industrial scenario (see Table 5-8). The PEF for construction accounted for several potential sources of particulates, including wind erosion, excavation, dozing, grading, and tilling; however, the largest contributor to the overall PEF was driving over unpaved roads. In this case, the majority of the input parameters were based on default values recommended by USEPA (2002b). USEPA provides the basis for most of these default values, except the average weight of the vehicle (eight tonnes) and the number of vehicles that will drive across the area every day (30). The applicability of these and other assumptions to future construction at the individual parcels is unknown; however, it is believed that, in combination, these assumptions are more likely to overestimate than underestimate potential health risks, potentially to a significant degree, especially when dust control measures will be implemented during construction.

Fate-and-transport models were used to estimate indoor and outdoor air concentrations from measured soil gas concentrations. For indoor air, the USEPA Johnson and Ettinger (1991) model spreadsheet was used. As discussed in Section 5.2.3, the Johnson and Ettinger model has numerous assumptions and limitations, each of which may over- or under estimate the predicted indoor air concentration. In this case, site-specific soil physical parameters were used in the modeling, which should reduce the uncertainty in the model estimates. For outdoor air, an approach analogous to that used by USEPA to estimate outdoor air concentrations from chemicals in soil was used. This model also has assumptions that may over- or underestimate the predicted concentrations. Similarly, the Jury model has assumptions that may over- or underestimate predicted concentrations modeling the transport of volatile components from soil to outdoor air.

The soil properties used for the Johnson and Ettinger model and Jury model were conservatively selected assuming that the entire unsaturated zone in the Study Area is Qal. This is a conservative assumption in that for areas where the UMCf is part of the unsaturated zone, the finer-grained UMCf would act to reduce vapor transport of COPCs. Further, the site-specific soil properties used in the model (Table 5-11) were based on samples collected in the Qal. Additionally to be conservative the one sample collected from below 10 ft bgs was not used in our evaluation due to extraordinarily wet soil properties measured at that location.

If default soil properties were used in the evaluation of the 5 ft bgs samples, the results would increase by approximately a factor of 2. Currently, estimated excess lifetime cancer

risk of 2 x 10^{-9}. The use of default soil properties would raise these to 4 x 10^{-9}, still well below the lower end of the NDEP acceptable cancer risk range of 10^{-6} to 10^{-4}.

Soil gas sampling depths are based on site-specific values for evaluating indoor and outdoor above-ground commercial scenarios. When evaluating outdoor trench scenarios, we conservatively assumed that the trench would be located only 1 cm above the soil gas sample, allowing for maximum potential exposure. We also conservatively assumed that air containing VOCs would be migrating from the walls of the trench in addition to the base to maximize exposure potential. Depth to groundwater was site-specific and selected to be conservative considering both current and historical data for each parcel. The extent of soil contamination was conservatively chosen to extend from 1 cm bgs all the way down to the groundwater table. This is very conservative because it is assumed that entire depth is filled with soil at the maximum detected concentration.

A conservative default building (with building characteristics shown on Table 5-9), was assumed for modeling. The default building size was selected although many commercial buildings are larger. However, larger buildings are often partitioned into smaller areas or offices that represents an exposure zone. A conservative height of 10 ft was assumed, although many commercial buildings have higher first floor ceilings.

When modeling the dispersion in the trench scenarios, a box model was used to simulate dispersion, and the air flow through the trench was controlled by a site-specific windspeed that was reduced by a factor of 10 to ensure it would be conservative for a trench scenario were the breathing zone may be a few ft below ground surface. This is especially conservative because many construction trenches include a fan increasing airflow through the trench or are shallower than 10 ft, potentially increasing the breathing zone to above the ground surface.

6.2.3 Toxicity Assessment

One of the largest sources of uncertainty in any risk assessment is the limited understanding of toxicity to humans who are exposed to lower concentrations generally encountered in the environment than those used in the toxicity studies. The majority of the available toxicity data are from animal studies; these data are extrapolated using mathematical models or multiple uncertainty factors to predict what might occur in humans. Sources of uncertainty and/or conservatism in the toxicity criteria used in this HRA include:

- The use of conservative methods and assumptions to extrapolate from high-dose animal studies to predict the possible response in humans at exposure levels far below those administered to animals;
- The assumption that chemicals considered to be carcinogens do not have thresholds (i.e., for all doses greater than zero, some risk is assumed to be present); and
- The fact that epidemiological studies (i.e., human exposure studies) are limited and are not generally considered in a quantitative manner in deriving toxicity values.

Chemical-specific uncertainties in toxicity criteria are provided below for zirconium and asbestos in soil, followed by a discussion regarding soil gas and groundwater COPCs for which surrogate criteria were used.

Zirconium

The oral RfD for zirconium is a screening toxicity value taken from an appendix of a PPRTV assessment, which was based on two drinking water and feed studies over lifetime to rats and mice (USEPA 2012). The critical effect considered in the derivation of oral RfD is higher cholesterol levels in male rats which is not an adverse effect; therefore, basing the oral RfD on this endpoint is a more conservative approach than traditional hazard assessment. USEPA applied a composite uncertainty factor of 10,000 to the lowest-observed-adverse-effect level (LOAEL) to account for interspecies extrapolation between rats and humans, no acceptable two-generation reproductive or developmental toxicity studies, intraspecies differences for potentially susceptible individuals, and using LOAEL as the point of departure. USEPA concluded that insufficient data were available to derive provisional toxicity values for zirconium, and there is considerably more uncertainty associated with the appendix screening oral RfD.

Asbestos

The potential risk associated with exposure to long amphibole and chrysotile fibers in soil was assessed based on methodology from USEPA (2003), as specified in NDEP's asbestos risk assessment guidance (Neptune 2015). The methodology distinguishes between different fiber types (chrysotile and amphiboles) and sizes (greater than 10 µm in length and less than 0.4 µm in width). USEPA (2003) developed two sets of risk coefficients—one set is "optimized" based on the entirety of the available data, and the other set is "conservative" based on data from a single epidemiology study. Per NDEP guidance (Neptune 2015), the optimized risk coefficients were used in this HRA. In addition, the risk coefficients are intended to assess long-term average exposure, such as on-site commercial/industrial workers. Applying this methodology to short-term workers such as construction workers, as was done in this HRA, increases uncertainty in the risk estimates (USEPA 2003).

VOCs

As identified in Tables 5-17A and 5-17B, surrogate toxicity criteria were used to estimate HQs (for the noncancer endpoint) for 17 of the 50 soil gas and groundwater COPCs. Of these, 14 surrogates are those identified by NDEP BCLs Table (NDEP 2017c) and as identified in Appendix B of the Users' Guide for BCLs (NDEP 2017a). Freon 113 was specified by NDEP as a surrogate for 1,2-dichloro-1,1,2,2-tetrafluoroethane (Freion 114) in its response to the *Revised Technical Memorandum: Screening-Level Indoor Air Health Assessment for the 2008 Tronox Parcels A/B Soil Gas Investigation* (NDEP 2010f). The surrogates used for the two remaining COPCs are as follows: for 1,3,5-trimethylbenzene, the RfC for 1,2,4-trimethylbenzene is used as a surrogate; and for m,p-xylene, the RfC for xylenes (total) is used as a surrogate.

The use of surrogate RfCs for evaluating soil gas and groundwater COPCs may overestimate or underestimate the potential for noncancer health effects. However, recognizing the very low HQs estimated for these COPCs (<0.00001 in indoor air and less than 0.0000002 in outdoor air), use of surrogate RfCs is unlikely to have significantly impacted the noncancer evaluation or conclusions.

6.2.4 Risk Characterization

The uncertainties associated with risk characterization are generally the result of combined uncertainties in the site characterization data, COPC selection, exposure assessment, and toxicity assessment. In addition, risks cannot be quantitatively characterized for chemicals

for which toxicity criteria have not been established. In this HRA, potential health risks were quantified for future on-site indoor and outdoor commercial/industrial workers and construction workers associated with direct contact with soil, inhalation of airborne particulates, and inhalation of vapors migrating from soil, soil gas, or groundwater to indoor, outdoor, or trench air. Given the highly conservative nature of the exposure parameters used to characterize these pathways, especially for the RME scenario, it is highly unlikely that the same receptor would be exposed at that level over the entire duration of exposure. These conservative estimates of exposure were then combined with even more conservative estimates of toxicity values to estimate the magnitude (non-cancer) or likelihood (cancer) of potential effects. This methodology is believed to not underestimate the true risk, but could overestimate the true risk by a considerable degree, and the true risk could be as low as zero.

One source of uncertainty that is unique to risk characterization is the assumption that the total risk associated with exposure to multiple chemicals is equal to the sum of the individual risks for each chemical (i.e., the risks are additive). Other possible interactions include synergism, where the total risk is higher than the sum of the individual risks, and antagonism, where the total risk is lower than the sum of the individual risks. Relatively few data are available regarding potential chemical interactions following environmental exposure to chemical mixtures. Some studies have been carried out in rodents that were given simultaneous doses of multiple chemicals. The results of these studies indicated that no interactive effects were observed for mixtures of chemicals that affect different target organs (i.e., each chemical acted independently), whereas antagonism was observed for mixtures of chemicals that affect the same target organ, but by different mechanisms (Risk Commission 1997). While there are no data on chemical interactions in humans exposed to chemical mixtures at the dose levels typically observed in environmental exposures, animal studies suggest that synergistic effects will not occur at levels of exposure below their individual effect levels (Seed et al. 1995). As exposure levels approach the individual effect levels, a variety of interactions may occur, including additive, synergistic, and antagonistic interactions (Seed et al. 1995).

USEPA guidance for risk assessment of chemical mixtures (USEPA 1986) recommends assuming an additive effect following exposure to multiple chemicals. Subsequent recommendations by other parties, such as the National Research Council (NRC 1988) and the Presidential/Congressional Commission on Risk Assessment and Risk Management (Risk Commission 1997), have also advocated a default assumption of additivity. As currently practiced in this HRA, risk assessments of chemical mixtures summed cancer risks regardless of tumor type, and summed non-cancer HIs regardless of toxic endpoint or mode of action. Given the available experimental data, this approach likely overestimates potential risks associated with simultaneous exposure to multiple chemicals. Asbestos risks were evaluated separately from other chemical risks, consistent with approach outlined in the HRA Work Plan (Northgate and Exponent 2010b). These risk estimates are not additive because of differences in the basis for the carcinogenic toxicity criteria between chemicals and asbestos. For chemicals, the oral CSFs and IURs are defined as the 95% UCLs of the probability of a carcinogenic response, whereas the IURs for asbestos are based on the estimated number of additional deaths from lung cancer and mesothelioma.

For one soil COPC (palladium), toxicity values are not available; in absence of toxicity values, palladium was not evaluated quantitatively. Palladium had a higher detection frequency of 98% in Parcel H; however, RZ-A background data are not available for this soil COPC. When

compared to BRC/TIMET regional background data (ranging from 0.14 mg/kg to 1.5 mg/kg), the maximum detected concentration of palladium in Parcel H (1.0 mg/kg) fell within the range of regional background concentrations. Therefore, palladium concentrations in Parcel H were consistent with regional background, and the exclusion of this soil COPC from quantitative risk assessment is not expected to impact the risk estimates or overall conclusions of the HRA.

Although zirconium was identified as a soil COPC for Parcel H, RZ-A background data are not available for this soil COPC. When compared to BRC/TIMET regional background data (ranging from 60 mg/kg to 180 mg/kg), the maximum detected concentration of zirconium in Parcel H (26 mg/kg) fell below the lower end of the range of regional background concentrations. Therefore, zirconium concentrations in Parcel H were consistent with (or even below) regional background, and conservatively retaining this chemical as a soil COPC in the quantitative risk assessment is likely to overestimate the overall risk.

As discussed in Section 6.2.1, radionuclides were excluded as soil COPCs in the quantitative risk evaluation due to consistency with background and minimal risk reduction for remediation. Another source of uncertainty for radionuclides risk is the inhalation of radon gas (radon-222) within a commercial building, which is not addressed in the radionuclide BCLs (NDEP 2017a). This exposure pathway could be a significant contributor to potential human health risks, potentially of greater concern than exposure to Ra-226 via soil ingestion, inhalation of particulates, and external irradiation, particularly if activities of Ra-226 are elevated in soils beneath a building. However, as indicated in Table 5-4, the cancer risk for Ra-226 in Parcel H was only slightly higher than the site and regional background; therefore, activities of Ra-226 are not considered elevated in soils beneath a building in Parcel H, and the risk associated with inhalation of radon-222 within a commercial building should not be a concern. Overall, excluding radionuclides as soil COPCs only have little impact on the overall risk evaluation.

In summary, assumptions used in each step of risk assessment contribute to the overall uncertainty in the HRA results. However, given that the largest sources of uncertainty generally cause overestimates of exposure or risk, the results presented in this HRA are considered to represent conservative estimates of the carcinogenic and non-carcinogenic risks, if any, posed by residual chemicals in Parcel H.

7. DATA QUALITY ASSESSMENT

Data quality assessment is an analysis that is performed after the risk assessment to determine whether enough data have been collected to support the risk-based decisions that are recommended by the risk assessment. The results of data quality assessment for soil, soil gas, and groundwater data are discussed below.

7.1 Soil Data

For soils, the evaluation of the cancer risk or non-cancer HI was based on the maximum detected soil concentrations, rather than on a measure of mean concentrations. Therefore, the data quality assessment was conceptualized as a statistical test of the proportion of the soil samples that are associated with an unacceptable risk. As summarized in Table 5-18, the cancer risk estimates are all below the target cancer risk range of 1×10^{-6} to 1×10^{-4}, and the non-cancer HIs do not exceed the significant threshold of greater than one; therefore, the proportion of samples with an unacceptable risk is zero out of the total number of samples, or 0%. The maximum sample size for the soil COPCs are 26 at depth interval of 0 to 2 ft bgs and 47 at depth interval of 0 to 10 ft bgs (Table 7-1).

In a hypothesis testing framework, a binomial test of proportions was used to evaluate the possibility that there is a greater-than-zero proportion of samples with an unacceptable risk. The null hypothesis is that the proportion of samples with an unacceptable risk is 0 (P1=0). The alternative hypothesis is that the proportion samples with an unacceptable risk is greater than P2, which is P1 plus an appropriate effect size (i.e., population proportion) that the test should be able to detect.

For the purposes of evaluating if a sufficient number of samples were collected to support the risk assessment, the number of samples required for each scenario (each combination of depth interval and effect size) was determined using the Exact – Generic Binomial Test in the software program G*Power version 3.1.9 (Faul et al. 2009). A null hypothesis with a P1 of 0 indicates that the false rejection error rate (α) is 0 and independent of the sample size and other parameters. Thus, the number of samples required depends on false acceptance rate (β), P1, and P2. The number of samples required with β at 15%, 20% to 25% for each scenario was tested.

As a starting point, an effect size of one sample over the total number of samples was considered, which would be equivalent to one sample having an unacceptable risk. Under this assumption, the null hypothesis would be rejected if more than one sample with an unacceptable risk was observed. As shown in Table 7-1, the number of samples required are larger than the samples collected, and the null hypothesis that no soil samples would have an unacceptable risk is rejected with β as large as 25%. Therefore, no soil sample having an unacceptable risk within the current sample size cannot guarantee that no more than one sample over the whole Parcel H would have an unacceptable risk.

Further, an effect size of two samples over the total number of samples was considered, which would be equivalent to two samples having an unacceptable risk. Under this assumption, the null hypothesis would be rejected if more than two samples with an unacceptable risk were observed. As shown in Table 7-1, the number of samples required are smaller than the samples collected, and the null hypothesis that no soil samples would have an unacceptable risk is accepted with β as small as 15%. Therefore, no soil sample

having an unacceptable risk within the current sample size can guarantee that no more than two samples over the whole Parcel H would have an unacceptable risk.

7.2 Soil Gas Data

The evaluation of the risk of vapor intrusion was based on maximum detected soil gas concentrations, rather than on a measure of mean concentrations. For the purposes of the data quality assessment, the risk evaluation was conceptualized as a statistical test of the proportion of the soil gas samples that are associated with an unacceptable risk of vapor intrusion. As summarized in Table 5-20, the maximum cumulative cancer risk estimates for each exposed population are all below the target cancer risk range of 1×10^{-6} to 1×10^{-4}, and the noncancer hazard does not exceed the noncancer threshold of greater than 1. The number of samples for most chemicals of concern is 2. Because the estimated risks and hazards at all the sampling locations did not exceed their respective thresholds, the proportion of samples with unacceptable risk is 0 out of the total number of samples, or 0%.

In a hypothesis testing framework, a binomial test of proportions was used to evaluate the possibility that there is a greater-than-zero proportion of samples with unacceptable risk. The null hypothesis is that the proportion of samples with an unacceptable risk is 0 (p1=0). The alternative hypothesis is that the proportion is greater than p2, which is p1 plus an appropriate effect size (i.e., population proportion) that the test should be able to detect.

For the purposes of evaluating if a sufficient number of samples were collected to support the risk assessment, the number of samples required was determined using the Exact – Generic binomial test in the software program G*Power version 3.1.9 (Faul et al. 2009). In the HRA, a null hypothesis with a proportion of 0 indicates that the false rejection error rate (α) is 0 and independent of the sample size and other parameters. Thus, the number of samples required depends on false acceptance rate (β), p1, and p2. The number of samples required for β at 15%, 20% to 25% was tested.

Because only two samples are available, an effect size of one over the number of samples (0.5) was considered, which would be equivalent to one sample having an unacceptable risk. When employing this hypothesis test, the null hypothesis would be rejected if one or more samples with unacceptable risk were observed. As shown in Table 7-2, the number of samples required are larger than corresponding number of samples (2) when β is smaller than or equal to 20%, and are equal to corresponding number of samples (2) when β is 25%. The null hypothesis that no soil gas samples would have unacceptable risk is rejected with effect size of 0.5 and β smaller than or equal to 20%, and is not rejected with effect size of 0.5 and β of 25%. Therefore, no sample having unacceptable risk within the current sample size can only guarantee that all samples would have unacceptable risk when false acceptance rate is larger than 25%.

7.3 Groundwater Data

The evaluation of the risk of vapor intrusion was based on maximum detected groundwater concentrations, rather than on a measure of mean concentrations. For the purposes of the data quality assessment, the risk evaluation was conceptualized as a statistical test of the proportion of the groundwater samples that are associated with an unacceptable risk of vapor intrusion. As summarized in Table 5-21 and discussed in Section 5.4.3, the total cancer risk estimates for all groundwater samples included in the risk evaluation are all below the target cancer risk range of 1×10^{-6} to 1×10^{-4}, and the total noncancer hazard for these groundwater samples did not exceed the noncancer threshold of greater than 1. The

number of samples for most COPCs is 5. Because the estimated risks and hazards at all the samples are within the target risk range, the proportion of samples with unacceptable risk is 0 out of the total number of samples, or 0%.

In a hypothesis testing framework, a binomial test of proportions was used to evaluate the possibility that there is a greater-than-zero proportion of samples with unacceptable risk. The null hypothesis is that the proportion of samples with an unacceptable risk is 0 (p1=0). The alternative hypothesis is that the proportion is greater than p2, which is p1 plus an appropriate effect size (i.e., population proportion) that the test should be able to detect.

For the purposes of evaluating if a sufficient number of samples were collected to support the risk assessment, the number of samples required was determined using the Exact – Generic binomial test in the software program G*Power version 3.1.9 (Faul et al. 2009). In the HRA, a null hypothesis with a proportion of 0 indicates that the false rejection error rate (α) is 0 and independent of the sample size and other parameters. Thus, the number of samples required depends on false acceptance rate (β), p1, and p2. We tested the number of samples required for β at 15%, 20%, and 25%.

As a starting point, an effect size of one over the number of samples was considered, which would be equivalent to one sample having unacceptable risk. When employing this hypothesis test, the null hypothesis would be rejected if one or more samples with unacceptable risk were observed. As shown in Table 7-3, the number of samples required are larger than corresponding number of samples. The null hypothesis that no groundwater samples would have unacceptable risk is rejected with effect size of 1 sample over number of samples and β smaller than 25%. Therefore, no sample having unacceptable risk within the current sample size cannot guarantee that all samples would have unacceptable risk.

Given the null hypothesis is rejected with effect size of one sample over number of samples, an effect size of two over the number of samples was considered, which would be equivalent to two samples having unacceptable risk. When employing this hypothesis test, the null hypothesis would be rejected if two or more samples with unacceptable risk were observed. As shown in Table 7-3, the number of samples required are smaller than corresponding number of samples. With effect size of two samples over number of samples and β smaller than 25%, the null hypothesis that no groundwater samples would have unacceptable risk is not rejected, and the alternative hypothesis that two or more than two samples having unacceptable risk is rejected. Therefore, no sample having unacceptable risk within the current sample size can guarantee that no more than one sample would have unacceptable risk.

8. CUMULATIVE RISKS

The cumulative cancer risk and non-cancer HI for each receptor population were estimated by summing the estimated excess lifetime cancer risk and non-cancer HI for chemicals from Table 5-18 for direct contact with soil and the estimated excess lifetime cancer risk and non-cancer HI for vapor migration from air. The soil gas samples were collected specifically to support evaluation of the vapor intrusion pathway. The objectives of groundwater sampling at the Site have been primarily to characterize SRCs in groundwater near suspected source areas and plume delineation; that is, no groundwater investigation was conducted to specifically provide data to evaluate the vapor intrusion pathway. Shallow groundwater data were evaluated for the vapor intrusion pathway as an additional line of evidence. The VOC plume has been present under the Site for an extended period of time and the vapor concentrations in soil gas are expected to be in equilibrium with the concentrations measured in shallow groundwater. As shown in Tables 5-20 and 5-21, the estimated excess lifetime cancer risk and non-cancer HI results for inhalation of volatile compounds from the 5 ft bgs soil gas (Table 5-20) and shallow groundwater (Table 5-21) are both very low and generally comparable. The estimated excess lifetime cancer risk and non-cancer HI for soil and soil gas are summed to represent the cumulative risk and HI estimates. The cumulative risks and non-cancer HIs are shown on Table 8-1.

As shown in Table 8-1, the cumulative cancer risks are 4×10^{-7}, 4×10^{-7}, and 2×10^{-8} for future indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers in Parcel H, respectively, which are below the acceptable cancer risk range of 1×10^{-6} to 1×10^{-4}. The cumulative HIs (0.1 to 1) are also all below the threshold of greater than one for all three worker populations in Parcel H evaluated in this HRA. The major contributor to the cumulative risk is the pathway of direct contact with soil. Vapor migration to air, whether calculated from soil gas or groundwater data, does not contribute significantly to the cumulative estimates.

9. SUMMARY AND CONCLUSIONS

The post-remediation HRA was conducted to evaluate potential risks to future onsite workers from exposures to residual levels of chemicals, radionuclides, and asbestos in soils and VOCs released from soil gas and groundwater to indoor, outdoor, and trench air.

The soil removal action completed for Parcel H, which included the excavation and disposal of approximately 887 tons of soil, was completed in accordance with the 2008 RAW (BEC 2008a), and asbestos was the only analyte that was identified for removal. Analytical results for confirmation samples collected following the soil removal action indicated that asbestos fiber counts were below the levels identified in the RAW (BEC 2008a). However, two small areas of un-remediated soil remain in Parcel H. An area of approximately 621 square feet was not excavated because of the presence of a landscaped, asphalt-covered public footpath, and an area of approximately 1,314 square feet was not excavated due to the presence of an existing asphalt-covered road area. For these areas, qualitative considerations suggest that associated risks would be insignificant due to the following factors: the soils are covered with asphalt, the areas are small, and the areas are in close proximity to a footpath or road where individuals would not spend a significant amount of time.

Soil analytical data collected as part of initial and confirmation sampling efforts were evaluated and data representative of current conditions were selected for purposes of the HRA. The soil CSM and COPCs are summarized as follows:

- Based on the CSM for Parcel H, potential exposure to soil was evaluated for future onsite indoor and outdoor commercial/industrial workers and construction workers via direct contact with soil (i.e., incidental ingestion and dermal contact) and inhalation of airborne particulates and vapors. Soil COPCs were selected according to a multi-step process, including concentration/ toxicity screen, background evaluation for metals and radionuclides, and chemical-specific consideration. Based on this process, four chemicals were identified as soil COPCs, including two metals (palladium and zirconium), hexachlorobenzene, and asbestos (long amphibole fibers and long chrysotile fibers).
- Non-cancer HIs and excess lifetime cancer risks associated with direct contact with soil and inhalation of airborne particulates and vapors were estimated for all the soil COPCs except asbestos based on the maximum soil concentration at 0-2 ft depth interval and at 0-10 ft depth interval within Parcel H. The estimated HIs and excess lifetime cancer risks were below the NDEP significant threshold of greater than one for non-cancer effects (maximum HI was one) and the NDEP acceptable cancer risk range of 10^{-6} to 10^{-4} (maximum estimated excess lifetime cancer risk was 4×10^{-7}) for future onsite indoor and outdoor commercial/industrial workers and construction workers under the conditions evaluated.
- With regard to asbestos (long amphibole and long chrysotile fibers), a best estimate and an upper-bound estimate of potential cancer risk via inhalation of airborne particulates for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers were calculated for Parcel H. The estimated combined risks for death from lung cancer and mesothelioma associated with

asbestos exposures were all less than 1×10^{-6}, except for the upper-bound risk estimate for exposure to amphibole fibers by future construction workers, which was less than 2×10^{-6}. However, the upper-bound estimate was based on an observed count of zero long amphibole[32] fiber in the post-abatement soil samples, considered representative of current conditions within Parcel H. Following completion of the asbestos abatement, zero fiber for long amphibole was less than the RAW specified level[33] of one (1) or more fibers. Similarly, for long chrysotile fibers, fiber counts were less than the level presented in the RAW (four or more long fibers per sample).

The soil gas and groundwater CSM, COPCs, and risk results are summarized as follows:

- The soil gas data collected within Parcel H were evaluated in the HRA. Potential exposure to soil gas was evaluated for future onsite indoor and outdoor commercial/industrial workers and construction workers via inhalation of vapors migrating from soil gas to indoor air, outdoor air, and trench air. All VOCs detected in at least one soil gas sample were selected as soil gas COPCs. A total of 42 VOCs were identified as soil gas COPCs for Parcel H.

  Non-cancer HIs and excess lifetime cancer risks associated with inhalation of vapors migrating from soil gas to indoor air, outdoor air, and trench air. The estimated HIs were well below the NDEP significant threshold of greater than one for non-cancer effects (maximum HI was 0.00005), and the estimated excess lifetime cancer risks were below the lower end of NDEP acceptable cancer risk range of 10^{-6} to 10^{-4} (maximum estimated excess lifetime cancer risk was 2×10^{-9}) for future onsite indoor and outdoor commercial/industrial workers and construction workers under the conditions evaluated.

- Shallow groundwater data was evaluated for the vapor intrusion pathway as an additional line of evidence for vapor migration. Shallow groundwater data collected after January 2006 within Parcel H were evaluated in the HRA. Potential exposure to groundwater was evaluated for future onsite indoor and outdoor commercial/industrial workers and construction workers via inhalation of vapors migrating from shallow groundwater to indoor air, outdoor air, and trench air. All VOCs and volatile SVOCs detected in at least one shallow groundwater sample were selected as groundwater COPCs. A total of 23 VOCs were identified as groundwater COPCs for Parcel H.

  The estimated HIs based on maximum chemical concentrations detected in the most recent two years' groundwater data for each well were below the NDEP significant threshold of greater than one for non-cancer effects (the maximum HI was 0.00002).

  The estimated excess lifetime cancer risks were well below lower end of the NDEP acceptable cancer risk range of 10^{-6} to 10^{-4} for future onsite indoor and outdoor commercial/industrial workers and construction workers under the conditions evaluated (the maximum estimated excess lifetime cancer risk was 2×10^{-8}).

[32] Although amphibole fiber counts were zero (0), upper-bound fiber concentrations in soil are estimated assuming a Poisson distribution, which yields an upper-bound risk estimate that is greater than 0.

[33] The RAW does not specifically use the term "trigger level" or identify remediation goals. However, areas identified for asbestos abatement were those in which amphibole counts in soil samples were one (1) or more fibers and chrysotile counts were four (4) or more fibers (BEC 2008a).

The cumulative cancer risk and non-cancer HI for each receptor population were estimated by summing cancer risk and non-cancer HI for direct contact with soil and cancer risk and non-cancer HI for vapor migration to air. The major contributor to the cumulative risk is direct contact with soil. Vapor migration to air, whether calculated from soil gas or groundwater data, does not contribute significantly to the cumulative estimates.

The cumulative cancer risks are 4×10^{-7}, 4×10^{-7}, and 2×10^{-8} for future indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers in Parcel H, respectively, which are below the acceptable cancer risk range of 1×10^{-6} to 1×10^{-4}. The cumulative HIs (0.1 to 1) are also all below the threshold of greater than one for all three worker populations in Parcel H evaluated in this HRA. The major contributor to the cumulative risk is the pathway of direct contact with soil. Based on the risk levels presented herein, Ramboll believes that the risk levels are acceptable for future commercial/industrial development at Parcel H.

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TABLES

TABLE ES-1. Summary of Cumulative Risks – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Exposure [1]	Indoor Commercial/Industrial Worker		Outdoor Commercial/Industrial Worker		Construction Worker	
		Cancer Risk	Non-Cancer HI	Cancer Risk	Non-Cancer HI	Cancer Risk	Non-Cancer HI
H	Cumulative Risk for Soil (0-2 ft) and Soil Gas (5 ft)	4E-07	0.1	4E-07	0.2	--	--
	Cumulative Risk for Soil (0-10 ft) and Soil Gas (5 ft)	4E-07	0.1	4E-07	0.3	2E-08	1
	Asbestos - Best Estimate	1E-09	--	3E-09	--	3E-08	--
	Asbestos - Upper-Bound Estimate	8E-08	--	2E-07	--	2E-06	--

Notes:
-- = Not applicable
ft = feet
HI = Hazard index

TABLE 3-1. Soil Gas Samples Evaluated in the HRA – Parcel H

Nevada Environmental Response Trust Site

Henderson, Nevada

Parcel	Sample ID	Investigation	Depth (feet bgs)	Sample Location	
				Within Parcel	Near Parcel
Parcel H	SG49	Phase B	5	X	
	SG50	Phase B	5	X	

Note:

bgs = below ground surface

Reference:

ENSR Corporation (ENSR), 2008. Phase B Source Area Investigation Work Plan, Soil Gas Survey, Tronox LLC Facility, Henderson, Nevada, March.

TABLE 3-2. Shallow Groundwater Wells with VOC Sampling Data Evaluated in the HRA – Parcel H

Nevada Environmental Response Trust Site

Henderson, Nevada

Parcel	Well ID	Depth to Groundwater (feet bgs)[a]	Water-Bearing Zone[a]	Dates Sampled for VOCs after 2005	Well Owner
Parcel H	M-103	66.6 - 76.33	Shallow	March 2006, July 2009	NERT
	M-120	75.43 - 84.3	Middle	July 2009 , July 2010, January 2015	NERT
	M-121	75.54 - 79.52	Middle	March 2006, July 2009, January 2015	NERT
	TR-10	57.35 - 63.1	Middle	March 2006, July 2009, January 2015	NERT

Notes:

bgs = below ground surface

NERT = Nevada Environmental Response Trust

VOC = volatile organic compound

[a] Wells with sampling results from the shallow or Middle portion of the aquifer were evaluated because the shallow and middle aquifer (in contrast to deeper aquifers) would be the primary source of VOCs in soil gas.

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TABLE 3-3. Summary of Scrape Area and Confirmation Soil Sampling Information for Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Sample Location Identified for Remediation	Analyte Detected Above Level Specifed in RAW	Confirmation Sample Identifier	Scrape Depth (feet)	Net Tonnage of Soil Removed (disposed weight)
H	TSB-HJ-09	Long Amphibole = 2 fibers	W4-PH-1-1-0.0	0.3	886.93
		Long Chrysotile = 8 fibers			
	TSB-HR-06	Long Amphibole = 1 fiber	VS-PH-1-1-0.0	0.7	

Note:

RAW = Removal Action Workplan

TABLE 4-1. Evaluation of Sample Quantitation Limits – Parcel H Soil
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Screening Level [1]	Unit	No. of Samples	No. of Detects	% Detects	Nondetects				Screening Level Note
							Minimum SQL	Maximum SQL	No. of Samples Above Screen	No. of Samples Above 10% of Screen	
Chlorine Oxyanions	Chlorate	38,900	mg/kg	47	9	19	0.22	11	0	0	--
	Perchlorate	908	mg/kg	58	47	81	0.0019	0.053	0	0	--
Metals	Antimony	519	mg/kg	57	30	53	0.052	2.1	0	0	--
	Boron	259,000	mg/kg	58	4	6.9	1.4	12	0	0	Use health-based BCL instead of non-health based upper-limit
	Cadmium	1,260	mg/kg	58	19	33	0.0050	0.0050	0	0	--
	Chromium VI	7.0	mg/kg	16	0	0	0.41	0.58	0	0	--
	Lithium	2,600	mg/kg	42	20	48	0.73	0.73	0	0	--
	Mercury	389	mg/kg	58	22	38	0.0067	0.12	0	0	Mercury compounds BCL is used
	Methyl mercury	130	mg/kg	2	1	50	0.000020	0.000020	0	0	--
	Molybdenum	6,490	mg/kg	58	36	62	0.052	0.60	0	0	--
	Niobium	130	mg/kg	42	4	9.5	0.76	0.76	0	0	--
	Palladium	N/A	mg/kg	42	41	98	0.019	0.019	N/A	N/A	--
	Platinum	649	mg/kg	58	3	5.2	0.010	0.023	0	0	--
	Selenium	6,490	mg/kg	58	13	22	0.16	4.2	0	0	--
	Silver	6,490	mg/kg	58	19	33	0.020	0.58	0	0	--
	Sodium	N/A	mg/kg	58	57	98	1.8	1.8	N/A	N/A	--
	Sulfur	N/A	mg/kg	42	2	4.8	211	211	N/A	N/A	--
	Thallium	13	mg/kg	58	7	12	0.10	0.58	0	0	--
	Tin	779,000	mg/kg	58	18	31	0.026	12	0	0	Use health-based BCL instead of non-health based upper-limit
	Tungsten	1,040	mg/kg	58	7	12	0.10	2.3	0	0	--
Other Inorganics	Ammonia	6,140	mg/kg	5	2	40	0.52	0.53	0	0	--
	Bromide	441,000	mg/kg	47	5	11	0.063	5.6	0	0	Use health-based BCL instead of non-health based upper-limit
	Chloride	113,000	mg/kg	47	45	96	0.20	0.20	0	0	Use health-based BCL instead of non-health based upper-limit (consider chloride as non-volatile)
	Cyanide (total)	179	mg/kg	5	0	0	0.27	0.98	0	0	Conservatively use BCL for CN-
	Fluoride	51,900	mg/kg	44	21	48	0.25	0.25	0	0	--
	Nitrate	2,080,000	mg/kg	47	43	91	0.086	0.086	0	0	Use health-based BCL instead of non-health based upper-limit
	Nitrite	130,000	mg/kg	47	1	2.1	0.050	1.1	0	0	Use health-based BCL instead of non-health based upper-limit
	Sulfate	N/A	mg/kg	47	44	94	0.50	0.50	N/A	N/A	--
	ortho-Phosphate	30,400,000	mg/kg	44	0	0	1.6	5.6	0	0	Use phosphoric acid as a surrogate, use health-based BCL instead of non-health based upper-limit
Dioxin/Furans	2,3,7,8-TCDD TEQ*	0.0027	mg/kg	47	23	49	0.0000029	0.000094	0	--	Site-specific action level
Other Organics	Phthalic acid	1,830,000	mg/kg	42	0	0	0.25	0.25	0	0	Use health-based BCL instead of non-health based upper-limit
PAHs	Acenaphthene	118	mg/kg	47	0	0	0.0069	0.033	0	0	--
	Acenaphthylene	118	mg/kg	47	0	0	0.0069	0.033	0	0	Use acenaphthene as a surrogate
	Anthracene	4.3	mg/kg	47	0	0	0.0069	0.033	0	0	--
	BaPEq*	0.32	mg/kg	47	2	4.3	0.0081	0.039	0	42	--
	Benzo(g,h,i)perylene	25,300	mg/kg	47	1	2.1	0.0069	0.033	0	0	--
	Fluoranthene	33,700	mg/kg	47	2	4.3	0.0070	0.033	0	0	--
	Fluorene	93	mg/kg	47	0	0	0.0069	0.033	0	0	--
	2-Methylnaphthalene	368	mg/kg	47	0	0	0.0069	0.033	0	0	--
	Naphthalene	18	mg/kg	58	0	0	0.0045	0.033	0	0	--
	Phenanthrene	25	mg/kg	47	1	2.1	0.0069	0.033	0	0	--
	Pyrene	44	mg/kg	47	2	4.3	0.0070	0.033	0	0	--
PCBs	Aroclor-1016	33	mg/kg	44	0	0	0.0060	0.056	0	0	--
	Aroclor-1221	1.1	mg/kg	44	0	0	0.0060	0.056	0	0	--
	Aroclor-1232	1.1	mg/kg	44	0	0	0.0060	0.056	0	0	--

TABLE 4-1. Evaluation of Sample Quantitation Limits – Parcel H Soil
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Screening Level [1]	Unit	No. of Samples	No. of Detects	% Detects	Nondetects				Screening Level Note
							Minimum SQL	Maximum SQL	No. of Samples Above Screen	No. of Samples Above 10% of Screen	
PCBs	Aroclor-1242	1.1	mg/kg	44	0	0	0.0060	0.056	0	0	--
	Aroclor-1248	1.1	mg/kg	44	0	0	0.0060	0.056	0	0	--
	Aroclor-1254	1.1	mg/kg	44	0	0	0.0066	0.056	0	0	--
	Aroclor-1260	1.1	mg/kg	44	0	0	0.0066	0.056	0	0	--
Pesticides - OCPs	Aldrin	0.21	mg/kg	47	0	0	0.000088	0.018	0	0	--
	alpha-BHC	0.49	mg/kg	47	0	0	0.000096	0.018	0	0	--
	beta-BHC	1.7	mg/kg	47	6	13	0.00035	0.0022	0	0	--
	delta-BHC	334	mg/kg	47	0	0	0.000083	0.018	0	0	--
	gamma-BHC	2.8	mg/kg	47	0	0	0.000083	0.018	0	0	--
	Chlordane (total)	7.3	mg/kg	45	0	0	0.0023	0.088	0	0	--
	alpha-Chlordane	7.3	mg/kg	47	0	0	0.00010	0.018	0	0	Use chlordane as a surrogate
	gamma-Chlordane	7.3	mg/kg	47	0	0	0.000086	0.018	0	0	Use chlordane as a surrogate
	2,4'-DDD	15	mg/kg	42	0	0	0.00011	0.00011	0	0	Use 4,4'-DDD as a surrogate
	4,4'-DDD	15	mg/kg	47	1	2.1	0.00016	0.035	0	0	--
	2,4'-DDE	9.5	mg/kg	42	1	2.4	0.000089	0.000089	0	0	Use 4,4'-DDE as a surrogate
	4,4'-DDE	9.5	mg/kg	47	2	4.3	0.00025	0.035	0	0	--
	4,4'-DDT	7.5	mg/kg	47	2	4.3	0.00043	0.035	0	0	--
	Dieldrin	0.16	mg/kg	47	0	0	0.000073	0.035	0	1	--
	Endosulfan I	5,500	mg/kg	47	0	0	0.000083	0.018	0	0	Use endosulfan as a surrogate
	Endosulfan II	5,500	mg/kg	47	0	0	0.00015	0.035	0	0	Use endosulfan as a surrogate
	Endosulfan sulfate	5,500	mg/kg	47	0	0	0.00012	0.035	0	0	Use endosulfan as a surrogate
	Endrin	30	mg/kg	47	0	0	0.000083	0.035	0	0	--
	Endrin aldehyde	30	mg/kg	47	0	0	0.00011	0.035	0	0	Use endrin as a surrogate
	Endrin ketone	30	mg/kg	47	0	0	0.00038	0.035	0	0	Use endrin as a surrogate
	Heptachlor	0.81	mg/kg	47	0	0	0.00059	0.018	0	0	--
	Heptachlor epoxide	0.40	mg/kg	47	0	0	0.00012	0.018	0	0	--
	Hexachlorobenzene	0.23	mg/kg	47	1	2.1	0.0018	0.033	0	42	--
	Methoxychlor	4,580	mg/kg	47	0	0	0.00070	0.18	0	0	--
	Toxaphene	2.3	mg/kg	47	0	0	0.0071	0.35	0	1	--
Pesticides - OPPs	Chlorpyrifos	916	mg/kg	2	0	0	0.035	0.037	0	0	--
	Coumaphos	N/A	mg/kg	2	0	0	0.035	0.037	N/A	N/A	--
	Dasanit	N/A	mg/kg	2	0	0	0.035	0.037	N/A	N/A	--
	Demeton-O	37	mg/kg	2	0	0	0.035	0.037	0	0	Use demeton as a surrogate
	Demeton-S	37	mg/kg	2	0	0	0.035	0.037	0	0	Use demeton as a surrogate
	Diazinon	732	mg/kg	2	0	0	0.035	0.037	0	0	--
	Dibrom	1.3	mg/kg	2	0	0	0.035	0.037	0	0	--
	Dichlorovos	8.8	mg/kg	2	0	0	0.071	0.074	0	0	--
	Dimethoate	183	mg/kg	2	0	0	0.035	0.037	0	0	--
	Disulfoton	52	mg/kg	2	0	0	0.035	0.037	0	0	--
	Ethoprop	N/A	mg/kg	2	0	0	0.035	0.037	N/A	N/A	--
	Ethyl p-nitrophenyl benzenethiophosphate	13	mg/kg	2	0	0	0.035	0.037	0	0	--
	Famphur	N/A	mg/kg	2	0	0	0.035	0.037	N/A	N/A	--
	Fenthion	N/A	mg/kg	2	0	0	0.035	0.037	N/A	N/A	--
	Guthion	2,750	mg/kg	2	0	0	0.035	0.037	0	0	--

TABLE 4-1. Evaluation of Sample Quantitation Limits – Parcel H Soil
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Screening Level [1]	Unit	No. of Samples	No. of Detects	% Detects	Nondetects				Screening Level Note
							Minimum SQL	Maximum SQL	No. of Samples Above Screen	No. of Samples Above 10% of Screen	
Pesticides - OPPs	Malathion	18,300	mg/kg	2	0	0	0.035	0.037	0	0	--
	Merphos	1.0	mg/kg	2	0	0	0.035	0.037	0	0	--
	Methyl parathion	229	mg/kg	2	0	0	0.035	0.037	0	0	--
	Mevinphos	N/A	mg/kg	2	0	0	0.035	0.037	N/A	N/A	--
	Parathion	5,500	mg/kg	2	0	0	0.035	0.037	0	0	--
	Phorate	183	mg/kg	2	0	0	0.035	0.037	0	0	--
	Prothiophos	N/A	mg/kg	2	0	0	0.035	0.037	N/A	N/A	--
	Ronnel	27	mg/kg	2	0	0	0.035	0.037	0	0	--
	Stirophos	107	mg/kg	2	0	0	0.035	0.037	0	0	--
	Sulfotepp	458	mg/kg	2	0	0	0.071	0.074	0	0	--
	Sulprofos	N/A	mg/kg	2	0	0	0.035	0.037	N/A	N/A	--
	Thionazin	N/A	mg/kg	2	0	0	0.071	0.074	N/A	N/A	--
	o-Ethyl o-2,4,5-trichlorophenyl ethyl-phosphonothioate	N/A	mg/kg	2	0	0	0.035	0.037	N/A	N/A	--
SVOCs	Acetophenone	2,520	mg/kg	42	0	0	0.033	0.033	0	0	--
	Aniline	450	mg/kg	42	0	0	0.033	0.033	0	0	--
	Azobenzene	33	mg/kg	42	0	0	0.033	0.033	0	0	--
	Benzenethiol	1,260	mg/kg	42	0	0	0.12	0.12	0	0	--
	Benzoic acid	3,670,000	mg/kg	44	0	0	0.033	0.93	0	0	Use health-based BCL instead of non-health based upper-limit
	Benzyl alcohol	91,600	mg/kg	44	0	0	0.033	0.37	0	0	--
	bis(2-Chloro-1-methylethyl) ether	1,020	mg/kg	44	0	0	0.033	0.37	0	0	--
	bis(2-Chloroethoxy)methane	2,750	mg/kg	44	0	0	0.033	0.37	0	0	--
	bis(2-Chloroethyl) ether	1.3	mg/kg	44	0	0	0.033	0.37	0	2	--
	bis(2-Ethylhexyl)phthalate	183	mg/kg	47	1	2.1	0.033	0.37	0	0	--
	bis(4-Chlorophenyl) disulfide	N/A	mg/kg	42	0	0	0.20	0.20	N/A	N/A	--
	bis(4-Chlorophenyl) sulfone	733	mg/kg	42	0	0	0.33	0.33	0	0	--
	4-Bromophenyl-phenyl ether	N/A	mg/kg	44	0	0	0.033	0.37	N/A	N/A	--
	Butylbenzylphthalate	1,350	mg/kg	47	1	2.1	0.033	0.37	0	0	--
	Carbazole	128	mg/kg	44	0	0	0.033	0.37	0	0	--
	4-Chloro-3-methylphenol	91,600	mg/kg	44	0	0	0.033	0.37	0	0	--
	4-Chloroaniline	18	mg/kg	44	0	0	0.033	0.37	0	0	--
	2-Chloronaphthalene	175	mg/kg	44	0	0	0.033	0.37	0	0	--
	2-Chlorophenol	6,490	mg/kg	44	0	0	0.033	0.37	0	0	--
	4-Chlorophenyl-phenyl ether	N/A	mg/kg	44	0	0	0.033	0.37	N/A	N/A	--
	4-Chlorothioanisole	N/A	mg/kg	42	0	0	0.0076	0.0076	N/A	N/A	--
	4-Chlorothiophenol	N/A	mg/kg	42	0	0	0.19	0.19	N/A	N/A	--
	Di-n-butylphthalate	91,600	mg/kg	47	0	0	0.033	0.37	0	0	--
	Di-n-octylphthalate	9,160	mg/kg	47	0	0	0.015	0.37	0	0	--
	Dibenzofuran	171	mg/kg	44	0	0	0.033	0.37	0	0	--
	3,3'-Dichlorobenzidine	5.7	mg/kg	44	0	0	0.033	0.37	0	0	--
	1,2-Diphenylhydrazine	3.2	mg/kg	42	0	0	0.033	0.033	0	0	--
	2,4-Dichlorophenol	3,220	mg/kg	44	0	0	0.033	0.37	0	0	--
	Diethylphthalate	733,000	mg/kg	47	0	0	0.033	0.37	0	0	Use health-based BCL instead of non-health based upper-limit
	2,4-Dimethylphenol	18,300	mg/kg	44	0	0	0.033	0.37	0	0	--
	Dimethylphthalate	9,160,000	mg/kg	47	0	0	0.033	0.37	0	0	Use health-based BCL instead of non-health based upper-limit
	4,6-Dinitro-2-methylphenol	73	mg/kg	2	0	0	0.71	0.74	0	0	--

TABLE 4-1. Evaluation of Sample Quantitation Limits – Parcel H Soil
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Screening Level [1]	Unit	No. of Samples	No. of Detects	% Detects	Nondetects				Screening Level Note
							Minimum SQL	Maximum SQL	No. of Samples Above Screen	No. of Samples Above 10% of Screen	
SVOCs	2,4-Dinitrophenol	1,830	mg/kg	44	0	0	0.33	0.74	0	0	--
	2,4-Dinitrotoluene	8.3	mg/kg	44	0	0	0.033	0.37	0	0	--
	2,6-Dinitrotoluene	2.4	mg/kg	44	0	0	0.033	0.37	0	2	--
	1,4-Dioxane	36	mg/kg	45	0	0	0.033	0.071	0	0	--
	Diphenyl disulfide	N/A	mg/kg	42	0	0	0.029	0.029	N/A	N/A	--
	Diphenyl sulfide	N/A	mg/kg	42	0	0	0.0035	0.0035	N/A	N/A	--
	Diphenyl sulfone	733	mg/kg	42	0	0	0.0067	0.0067	0	0	--
	Hexachlorobutadiene	6.1	mg/kg	58	0	0	0.0045	0.37	0	0	--
	Hexachlorocyclopentadiene	8.2	mg/kg	44	0	0	0.33	0.37	0	0	--
	Hexachloroethane	9.3	mg/kg	44	0	0	0.033	0.37	0	0	--
	Hydroxymethyl phthalimide	N/A	mg/kg	42	0	0	0.043	0.043	N/A	N/A	--
	Isophorone	2,700	mg/kg	44	0	0	0.033	0.37	0	0	--
	2-Methylphenol	45,800	mg/kg	44	0	0	0.12	0.37	0	0	--
	4-Methylphenol	91,600	mg/kg	2	0	0	0.35	0.37	0	0	--
	3&4-Methylphenol	45,800	mg/kg	42	0	0	0.067	0.067	0	0	Minimum BCL of 4-methylphenol and 3-methylphenol
	2-Nitroaniline	8,880	mg/kg	44	0	0	0.033	0.37	0	0	--
	3-Nitroaniline	3,660	mg/kg	44	0	0	0.033	0.37	0	0	Use 4-nitroaniline as a surrogate (noncancer endpoint)
	4-Nitroaniline	128	mg/kg	44	0	0	0.33	0.37	0	0	--
	Nitrobenzene	25	mg/kg	47	0	0	0.0069	0.37	0	0	--
	2-Nitrophenol	7,330	mg/kg	44	0	0	0.033	0.37	0	0	Use 4-nitrophenol as a surrogate
	4-Nitrophenol	7,330	mg/kg	44	0	0	0.33	0.74	0	0	--
	n-Nitroso-di-n-propylamine	0.37	mg/kg	44	0	0	0.033	0.37	1	2	--
	n-Nitrosodiphenylamine	524	mg/kg	44	0	0	0.033	0.37	0	0	--
	Octachlorostyrene	N/A	mg/kg	47	0	0	0.0069	0.93	N/A	N/A	--
	Pentachlorobenzene	19	mg/kg	42	0	0	0.033	0.033	0	0	--
	1,2,4,5-Tetrachlorobenzene	8.0	mg/kg	42	0	0	0.033	0.033	0	0	--
	2,4,5-Trichlorophenol	91,600	mg/kg	44	0	0	0.033	0.37	0	0	--
	2,4,6-Trichlorophenol	233	mg/kg	44	0	0	0.033	0.37	0	0	--
VOCs	Acetone	1,040,000	mg/kg	58	8	14	0.0038	0.027	0	0	Use health-based BCL instead of non-health based upper-limit
	Acetonitrile	3,750	mg/kg	42	1	2.4	0.0020	0.0020	0	0	--
	t-Amyl methyl ether	70,900	mg/kg	16	0	0	0.0045	0.0068	0	0	Use methyl tert-butyl ether as a surrogate (noncancer endpoint)
	Benzene	5.8	mg/kg	58	0	0	0.00017	0.0068	0	0	--
	Bromobenzene	679	mg/kg	58	0	0	0.00023	0.0068	0	0	--
	Bromochloromethane	692	mg/kg	58	0	0	0.00041	0.0068	0	0	--
	Bromodichloromethane	1.4	mg/kg	58	0	0	0.00033	0.0068	0	0	--
	Bromoform	104	mg/kg	58	0	0	0.00024	0.0068	0	0	--
	Bromomethane	33	mg/kg	58	0	0	0.00031	0.012	0	0	--
	2-Butanone	28,400	mg/kg	58	2	3.5	0.0014	0.012	0	0	--
	tert Butyl alcohol	21,300	mg/kg	3	0	0	0.095	0.14	0	0	--
	n-Butylbenzene	108	mg/kg	58	0	0	0.00053	0.0068	0	0	--
	sec-Butylbenzene	145	mg/kg	58	0	0	0.00025	0.0068	0	0	--
	tert-Butylbenzene	183	mg/kg	58	0	0	0.00027	0.0068	0	0	--
	Carbon disulfide	735	mg/kg	42	0	0	0.00055	0.00055	0	0	--
	Carbon tetrachloride	3.2	mg/kg	58	0	0	0.00090	0.0068	0	0	--
	Chlorobenzene	18,300	mg/kg	58	0	0	0.00012	0.0068	0	0	--
	Chloroethane	2,110	mg/kg	58	0	0	0.00035	0.0068	0	0	--

TABLE 4-1. Evaluation of Sample Quantitation Limits – Parcel H Soil
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Screening Level [1]	Unit	No. of Samples	No. of Detects	% Detects	Nondetects				Screening Level Note
							Minimum SQL	Maximum SQL	No. of Samples Above Screen	No. of Samples Above 10% of Screen	
VOCs	Chloroform	1.5	mg/kg	58	0	0	0.00014	0.0068	0	0	--
	1-Chlorohexane	N/A	mg/kg	13	0	0	0.0045	0.0061	N/A	N/A	--
	Chloromethane	510	mg/kg	58	0	0	0.00044	0.0068	0	0	--
	2-Chlorotoluene	907	mg/kg	58	0	0	0.00046	0.0068	0	0	--
	4-Chlorotoluene	18,300	mg/kg	58	0	0	0.00088	0.0068	0	0	--
	Cumene	91,600	mg/kg	58	0	0	0.00018	0.0068	0	0	--
	p-Cymene	647	mg/kg	58	0	0	0.00024	0.0068	0	0	--
	1,2-Dibromo-3-chloropropane	0.071	mg/kg	58	0	0	0.00089	0.0068	0	0	--
	Dibromochloromethane	43	mg/kg	58	0	0	0.00029	0.0068	0	0	--
	1,2-Dibromoethane	0.18	mg/kg	16	0	0	0.0045	0.0068	0	0	--
	Dibromomethane	21,000,000	mg/kg	58	0	0	0.00035	0.0068	0	0	Use health-based BCL instead of non-health based upper-limit
	1,2-Dichlorobenzene	376	mg/kg	58	0	0	0.00015	0.0068	0	0	--
	1,3-Dichlorobenzene	373	mg/kg	58	0	0	0.00013	0.0068	0	0	--
	1,4-Dichlorobenzene	475	mg/kg	58	0	0	0.00011	0.0068	0	0	--
	Dichlorodifluoromethane	403	mg/kg	58	0	0	0.00037	0.0068	0	0	--
	1,1-Dichloroethane	17	mg/kg	58	0	0	0.00095	0.0068	0	0	--
	1,2-Dichloroethane	2.3	mg/kg	58	0	0	0.00044	0.0068	0	0	--
	1,1-Dichloroethene	1,100	mg/kg	58	0	0	0.00055	0.0068	0	0	--
	1,2-Dichloroethene	2,360	mg/kg	42	0	0	0.00054	0.00054	0	0	Minimum BCL of trans-1,2-Dichloroethene and cis-1,2-Dichloroethene
	cis-1,2-Dichloroethene	2,360	mg/kg	58	0	0	0.00043	0.0068	0	0	--
	trans-1,2-Dichloroethene	18,300	mg/kg	58	0	0	0.00022	0.0068	0	0	--
	1,2-Dichloropropane	5.0	mg/kg	58	0	0	0.00037	0.0068	0	0	--
	1,3-Dichloropropane	18,300	mg/kg	58	0	0	0.00018	0.0068	0	0	--
	cis-1,3-Dichloropropene	26	mg/kg	58	0	0	0.00073	0.0068	0	0	Use 1,3-dichloropropene as a surrogate
	trans-1,3-Dichloropropene	26	mg/kg	58	0	0	0.00020	0.0068	0	0	Use 1,3-dichloropropene as a surrogate
	2,2-Dichloropropane	73	mg/kg	58	0	0	0.00017	0.0068	0	0	Use 1,2-dichloropropane as a surrogate (noncancer endpoint)
	1,1-Dichloropropene	27,500	mg/kg	58	0	0	0.00029	0.0068	0	0	Use 1,3-dichloropropene as a surrogate (noncancer endpoint)
	Diisopropyl ether	2,260	mg/kg	16	0	0	0.0045	0.0068	0	0	--
	Dimethyl disulfide	N/A	mg/kg	42	0	0	0.00021	0.00021	N/A	N/A	--
	2,2-Dimethylpentane	N/A	mg/kg	42	0	0	0.00028	0.00028	N/A	N/A	--
	2,3-Dimethylpentane	N/A	mg/kg	42	0	0	0.00022	0.00022	N/A	N/A	--
	2,4-Dimethylpentane	N/A	mg/kg	42	0	0	0.00019	0.00019	N/A	N/A	--
	3,3-Dimethylpentane	N/A	mg/kg	42	0	0	0.00020	0.00020	N/A	N/A	--
	Ethanol	15,100,000	mg/kg	42	0	0	0.19	0.19	0	0	Use health-based BCL instead of non-health based upper-limit
	Ethyl benzene	233	mg/kg	58	0	0	0.00019	0.0068	0	0	--
	Ethyl tert-butyl ether	70,900	mg/kg	16	0	0	0.0045	0.0068	0	0	Use methyl tert-butyl ether as a surrogate (noncancer endpoint)
	3-Ethylpentane	N/A	mg/kg	42	0	0	0.00021	0.00021	N/A	N/A	--
	n-Heptane	220	mg/kg	42	0	0	0.00016	0.00016	0	0	--
	2-Hexanone	1,650	mg/kg	58	0	0	0.00028	0.014	0	0	--
	Iodomethane	1,510	mg/kg	42	0	0	0.00026	0.00026	0	0	--
	Methyl tert-butyl ether	238	mg/kg	58	0	0	0.00046	0.0068	0	0	--
	4-Methyl-2-pentanone	3,360	mg/kg	58	0	0	0.0016	0.014	0	0	--
	Methylene Chloride	1,550	mg/kg	58	24	41	0.0025	0.012	0	0	--
	2-Methylhexane	N/A	mg/kg	42	0	0	0.00020	0.00020	N/A	N/A	--
	3-Methylhexane	N/A	mg/kg	42	0	0	0.00014	0.00014	N/A	N/A	--
	2-Nitropropane	0.066	mg/kg	42	0	0	0.0017	0.0017	0	0	--

TABLE 4-1. Evaluation of Sample Quantitation Limits – Parcel H Soil
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Screening Level [1]	Unit	No. of Samples	No. of Detects	% Detects	Nondetects				Screening Level Note
							Minimum SQL	Maximum SQL	No. of Samples Above Screen	No. of Samples Above 10% of Screen	
VOCs	n-Nonyl aldehyde	N/A	mg/kg	42	0	0	0.00088	0.00088	N/A	N/A	--
	Pentachlorophenol	4.5	mg/kg	44	0	0	0.021	0.33	0	0	--
	Phenol	275,000	mg/kg	44	0	0	0.033	0.37	0	0	Use health-based BCL instead of non-health based upper-limit
	n-Propylbenzene	264	mg/kg	58	0	0	0.00095	0.0068	0	0	--
	Pyridine	1,300	mg/kg	47	0	0	0.033	0.93	0	0	--
	Styrene	867	mg/kg	58	0	0	0.0012	0.0068	0	0	--
	1,1,1,2-Tetrachloroethane	10	mg/kg	58	0	0	0.00022	0.0068	0	0	--
	1,1,2,2-Tetrachloroethane	3.2	mg/kg	58	0	0	0.00014	0.0068	0	0	--
	Tetrachloroethene	117	mg/kg	58	0	0	0.00027	0.0068	0	0	--
	Toluene	817	mg/kg	58	7	12	0.00013	0.0061	0	0	--
	1,1,2-Trichloro-1,2,2-trifluoroethane	900	mg/kg	42	0	0	0.00054	0.00054	0	0	--
	1,2,3-Trichlorobenzene	151	mg/kg	58	0	0	0.00078	0.0068	0	0	--
	1,2,4-Trichlorobenzene	125	mg/kg	58	0	0	0.00073	0.0068	0	0	--
	1,3,5-Trichlorobenzene	285	mg/kg	42	0	0	0.00068	0.00068	0	0	Use 1,2,4-trichlorobenzene as a surrogate (noncancer endpoint)
	1,1,1-Trichloroethane	638	mg/kg	58	0	0	0.00015	0.0068	0	0	--
	1,1,2-Trichloroethane	5.8	mg/kg	58	0	0	0.00028	0.0068	0	0	--
	Trichloroethene	6.9	mg/kg	58	0	0	0.00036	0.0068	0	0	--
	Trichlorofluoromethane	1,210	mg/kg	58	1	1.7	0.00050	0.0068	0	0	--
	1,2,3-Trichloropropane	0.12	mg/kg	58	0	0	0.00056	0.0068	0	0	--
	1,2,4-Trimethylbenzene	218	mg/kg	58	8	14	0.00022	0.0068	0	0	--
	1,3,5-Trimethylbenzene	182	mg/kg	58	0	0	0.00021	0.0068	0	0	--
	2,2,3-Trimethylbutane	N/A	mg/kg	42	0	0	0.00021	0.00021	N/A	N/A	--
	Vinyl acetate	2,750	mg/kg	42	0	0	0.00018	0.00018	0	0	--
	Vinyl chloride	2.2	mg/kg	58	0	0	0.00024	0.0068	0	0	--
	m,p-Xylene	387	mg/kg	45	0	0	0.00057	0.0068	0	0	Minimum BCL of m-xylene and p-xylene
	o-Xylene	434	mg/kg	45	0	0	0.00031	0.0068	0	0	--
	Xylenes (total)	259	mg/kg	55	0	0	0.00086	0.012	0	0	--

Notes:

-- = Not applicable
mg/kg = milligram per kilogram
BaPEq = Benzo(a)pyrene equivalent
BCL = Basic Comparison Level
BHC = Hexachlorocyclohexane
DDD = Dichlorodiphenyldichloroethane
DDE = Dichlorodiphenyldichloroethylene
DDT = Dichlorodiphenyltrichloroethane
N/A = No screening level available
NDEP = Neveda Department of Environmental Protection
OCP = Organochlorine pesticide
OPP = Organophosphate pesticide
PAH = Polycyclic aromatic hydrocarbon
PCB = Polychlorinated biphenyl
SQL = Sample Quantitation Limit
SVOC = Semivolatile organic compound
TCDD = Tetrachlorodibenzo-p-dioxin
TEQ = Toxicity equivalent
VOC = Volatile organic compound
* Methodology for equivalent calculations explained in text
[1] Screening levels are the lowest level among the indoor worker and outdoor worker BCLs (NDEP 2017), unless noted.

Source:

NDEP. 2017. User's Guide and Background Technical Document for NDEP Basic Comparison Levels (BCLs) for Human Health for the BMI Complex and Common Areas. Revision 14, July.

TABLE 4-2. Summary Statistics for Soil Data - Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
Chlorine Oxyanions	Chlorate	mg/kg	47	9	19	0.22	11	0.42	10	2.2	3.1	3.2	1.0	TSB-HJ-06
	Perchlorate	mg/kg	58	47	81	0.0019	0.053	0.0024	22	0.17	1.0	3.3	3.2	TSB-HR-04
Metals	Aluminum	mg/kg	58	58	100	--	--	4,320	9,970	7,900	7,830	1,050	0.13	TSB-HR-07
	Antimony	mg/kg	57	30	53	0.052	2.1	0.13	0.50	0.18	0.19	0.068	0.36	RSAU7
	Arsenic	mg/kg	58	58	100	--	--	1.3	5.2	2.9	2.8	0.92	0.32	TSB-HJ-01
	Barium	mg/kg	58	58	100	--	--	97	275	166	168	34	0.20	TSB-HR-05
	Beryllium	mg/kg	58	58	100	--	--	0.35	0.74	0.55	0.56	0.081	0.14	TSB-HR-07
	Boron	mg/kg	58	4	6.9	1.4	12	3.0	14	4.7	6.5	4.8	0.74	M-121
	Cadmium	mg/kg	58	19	33	0.0050	0.0050	0.080	0.69	0.40	0.37	0.17	0.45	M-120
	Calcium	mg/kg	58	58	100	--	--	9,250	158,000	23,900	29,300	22,500	0.77	TSB-HR-05
	Chromium (total)	mg/kg	58	58	100	--	--	5.7	14	9.9	9.8	2.1	0.21	TSB-HJ-09
	Cobalt	mg/kg	58	58	100	--	--	4.7	9.5	6.9	6.9	0.98	0.14	TSB-HJ-09
	Copper	mg/kg	50	50	100	--	--	7.2	367	17	27	50	1.9	M-121
	Iron	mg/kg	58	58	100	--	--	7,930	18,200	12,800	12,700	2,100	0.17	RSAU7
	Lead	mg/kg	58	58	100	--	--	4.0	50	7.5	8.9	6.0	0.67	M-121
	Lithium	mg/kg	42	20	48	0.73	0.73	3.2	47	13	17	11	0.66	TSB-HJ-04
	Magnesium	mg/kg	58	58	100	--	--	5,680	17,000	8,820	9,050	2,130	0.24	TSB-HJ-04
	Manganese	mg/kg	57	57	100	--	--	218	684	340	355	98	0.28	M-121
	Mercury	mg/kg	58	22	38	0.0067	0.12	0.0076	0.033	0.014	0.014	0.0061	0.42	TSB-HJ-04
	Methyl mercury	mg/kg	2	1	50	0.000020	0.000020	0.000034	0.000034	0.000034	0.000034	--	--	M-120
	Molybdenum	mg/kg	58	36	62	0.052	0.60	0.16	1.0	0.47	0.49	0.17	0.34	TSB-HJ-06
	Nickel	mg/kg	58	58	100	--	--	10	22	15	15	2.0	0.13	TSB-HJ-05
	Niobium	mg/kg	42	4	9.5	0.76	0.76	5.7	12	8.9	8.8	2.5	0.28	TSB-HJ-05
	Palladium	mg/kg	42	41	98	0.019	0.019	0.16	1.0	0.42	0.46	0.21	0.45	TSB-HR-04
	Phosphorus (total)	mg/kg	47	47	100	--	--	12	2,020	1,250	1,240	388	0.31	TSB-HJ-10
	Platinum	mg/kg	58	3	5.2	0.010	0.023	0.010	0.012	0.010	0.011	0.0012	0.11	RSAU7
	Potassium	mg/kg	58	58	100	--	--	704	2,630	1,700	1,720	412	0.24	M-118
	Selenium	mg/kg	58	13	22	0.16	4.2	0.14	0.80	0.20	0.25	0.17	0.69	RSAU6
	Silicon	mg/kg	42	42	100	--	--	73	578	156	223	141	0.63	TSB-HJ-11
	Silver	mg/kg	58	19	33	0.020	0.58	0.078	0.15	0.10	0.11	0.018	0.17	M-121
	Sodium	mg/kg	58	57	98	1.8	1.8	159	1,230	490	532	268	0.50	M-118
	Strontium	mg/kg	58	58	100	--	--	77	500	188	212	86	0.40	TSB-HR-04
	Sulfur	mg/kg	42	2	4.8	211	211	1,310	2,400	1,860	1,860	771	0.42	TSB-HJ-04
	Thallium	mg/kg	58	7	12	0.10	0.58	0.092	0.34	0.13	0.18	0.094	0.52	M-118
	Tin	mg/kg	58	18	31	0.026	12	0.064	4.9	0.56	1.2	1.5	1.3	RSAU7
	Titanium	mg/kg	58	58	100	--	--	294	950	590	596	102	0.17	RSAU7
	Tungsten	mg/kg	58	7	12	0.10	2.3	0.11	0.67	0.56	0.41	0.26	0.64	M-118
	Uranium (total)	mg/kg	58	58	100	--	--	0.60	26	1.2	2.1	4.2	2.0	M-120
	Vanadium	mg/kg	58	58	100	--	--	22	56	36	36	7.6	0.21	RSAU7
	Zinc	mg/kg	58	58	100	--	--	22	67	32	34	8.7	0.26	M-120
	Zirconium	mg/kg	42	42	100	--	--	9.0	26	21	21	3.4	0.16	TSB-HJ-09

TABLE 4-2. Summary Statistics for Soil Data - Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
Other Inorganics	Ammonia	mg/kg	5	2	40	0.52	0.53	2.6	4.6	3.6	3.6	1.4	0.38	M-120
	Bromide	mg/kg	47	5	11	0.063	5.6	1.5	4.5	3.6	3.3	1.1	0.35	TSB-HR-03
	Chloride	mg/kg	47	45	96	0.20	0.20	0.79	1,640	16	153	332	2.2	TSB-HJ-10
	Fluoride	mg/kg	44	21	48	0.25	0.25	0.58	2.0	0.95	1.1	0.41	0.38	M-120
	Nitrate	mg/kg	47	43	91	0.086	0.086	0.26	39	1.9	4.8	7.6	1.6	TSB-HR-01
	Nitrite	mg/kg	47	1	2.1	0.050	1.1	0.13	0.13	0.13	0.13	--	--	TSB-HR-03
	Sulfate	mg/kg	47	44	94	0.50	0.50	3.5	640	41	100	153	1.5	TSB-HR-04
Radionuclides	Radium-226	pCi/g	58	58	100	--	--	0.43	2.5	1.2	1.3	0.44	0.35	TSB-HR-02
	Radium-228	pCi/g	58	58	100	--	--	0.88	3.0	1.6	1.6	0.36	0.22	TSB-HJ-07
	Thorium-228	pCi/g	55	55	100	--	--	1.2	3.0	1.9	1.9	0.39	0.20	M-121
	Thorium-230	pCi/g	55	55	100	--	--	0.79	3.0	1.3	1.4	0.52	0.37	TSB-HR-03
	Thorium-232	pCi/g	55	55	100	--	--	1.1	2.7	1.8	1.8	0.37	0.21	TSB-HJ-11
	Uranium-234	pCi/g	55	55	100	--	--	0.78	3.5	1.2	1.5	0.69	0.46	TSB-HR-02
	Uranium-235	pCi/g	58	58	100	--	--	-0.0089	0.20	0.054	0.063	0.042	0.67	M-117
	Uranium-238	pCi/g	58	58	100	--	--	0	2.6	1.2	1.3	0.49	0.37	TSB-HR-03
Dioxin/Furans	2,3,7,8-TCDD TEQ*	mg/kg	47	23	49	0.0000029	0.000094	0.00000000070	0.000021	0.0000053	0.0000048	0.0000042	0.86	RSAU7
PAHs	BaPEq*	mg/kg	47	2	4.3	0.0081	0.039	0.0075	0.0090	0.0083	0.0083	0.0010	0.13	RSAU7
	Benzo(g,h,i)perylene	mg/kg	47	1	2.1	0.0069	0.033	0.0028	0.0028	0.0028	0.0028	--	--	RSAU7
	Fluoranthene	mg/kg	47	2	4.3	0.0070	0.033	0.0017	0.0066	0.0042	0.0042	0.0035	0.83	RSAU7
	Phenanthrene	mg/kg	47	1	2.1	0.0069	0.033	0.0038	0.0038	0.0038	0.0038	--	--	RSAU7
	Pyrene	mg/kg	47	2	4.3	0.0070	0.033	0.0021	0.0063	0.0042	0.0042	0.0030	0.71	RSAU7
Pesticides - OCPs	beta-BHC	mg/kg	47	6	13	0.00035	0.0022	0.0020	0.040	0.0039	0.011	0.015	1.4	TSB-HJ-09
	4,4'-DDD	mg/kg	47	1	2.1	0.00016	0.035	0.0035	0.0035	0.0035	0.0035	--	--	TSB-HJ-09
	2,4'-DDE	mg/kg	42	1	2.4	0.000089	0.000089	0.014	0.014	0.014	0.014	--	--	TSB-HJ-09
	4,4'-DDE	mg/kg	47	2	4.3	0.00025	0.035	0.0036	0.060	0.032	0.032	0.040	1.3	TSB-HJ-09
	4,4'-DDT	mg/kg	47	2	4.3	0.00043	0.035	0.0019	0.089	0.045	0.045	0.062	1.4	TSB-HJ-09
	Hexachlorobenzene	mg/kg	47	1	2.1	0.0018	0.033	0.21	0.21	0.21	0.21	--	--	RSAU6
SVOCs	bis(2-Ethylhexyl)phthalate	mg/kg	47	1	2.1	0.033	0.37	0.069	0.069	0.069	0.069	--	--	TSB-HJ-01
	Butylbenzylphthalate	mg/kg	47	1	2.1	0.033	0.37	0.11	0.11	0.11	0.11	--	--	TSB-HJ-01
VOCs	Acetone	mg/kg	58	8	14	0.0038	0.027	0.0056	0.024	0.0086	0.010	0.0060	0.59	RSAU6
	Acetonitrile	mg/kg	42	1	2.4	0.0020	0.0020	0.021	0.021	0.021	0.021	--	--	TSB-HR-03
	2-Butanone	mg/kg	58	2	3.5	0.0014	0.012	0.00092	0.0018	0.0014	0.0014	0.00062	0.46	RSAU7
	Methylene Chloride	mg/kg	58	24	41	0.0025	0.012	0.00066	0.021	0.0077	0.0093	0.0055	0.59	TSB-HJ-01
	Toluene	mg/kg	58	7	12	0.00013	0.0061	0.00054	0.0028	0.0010	0.0013	0.00081	0.62	RSAU7
	Trichlorofluoromethane	mg/kg	58	1	1.7	0.00050	0.0068	0.0027	0.0027	0.0027	0.0027	--	--	M-117
	1,2,4-Trimethylbenzene	mg/kg	58	8	14	0.00022	0.0068	0.00038	0.00055	0.00040	0.00042	0.000055	0.13	TSB-HJ-04

Notes:

-- = No value
mg/kg = milligram per kilogram
pCi/g = picocurie per gram
BaPEq = Benzo(a)pyrene equivalent
BHC = Hexachlorocyclohexane
DDD = Dichlorodiphenyldichloroethane
DDE = Dichlorodiphenyldichloroethylene
DDT = Dichlorodiphenyltrichloroethane
OCP = Organochlorine pesticide
PAH = Polycyclic aromatic hydrocarbon
SVOC = Semivolatile organic compound
TCDD = Tetrachlorodibenzo-p-dioxin
TEQ = Toxicity equivalent
VOC = Volatile organic compound
* Methodology for equivalent calculations explained in text

TABLE 4-3. Soil Sampling Results for Asbestos (Long Amphibole and Chrysotile Fibers) – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Sample ID	Sample Type	Sample Date	Start Depth (ft bgs)	Long Amphibole Count (s/sample)	Long Chrysotile Count (s/sample)	Analytical Sensitivity (s/gPM10)
H	TSB-HJ-01-0_1/18/2008	N	1/18/2008	0	0	0	2999026
H	TSB-HJ-02-0_1/18/2008	N	1/18/2008	0	0	0	2991453
H	TSB-HJ-03-0_1/18/2008	N	1/18/2008	0	0	0	2986626
H	TSB-HJ-04-0_1/18/2008	N	1/18/2008	0	0	0	2999026
H	TSB-HJ-05-0_1/18/2008	N	1/18/2008	0	0	0	2960354
H	TSB-HJ-06-0_1/18/2008	N	1/18/2008	0	0	0	2960354
H	TSB-HJ-07-0_1/18/2008	N	1/18/2008	0	0	0	2310813
H	TSB-HJ-08-0_1/18/2008	N	1/18/2008	0	0	1	2974627
H	W4-PH-1-1-0.0	N	4/9/2010	0	0	0	2980000
H	TSB-HJ-09-NE-0	N	6/4/2008	0	0	0	2973432
H	TSB-HJ-10-0_1/18/2008	N	1/18/2008	0	0	0	2985422
H	TSB-HJ-11-0_1/18/2008	N	1/18/2008	0	0	1	2868318
H	TSB-HJ-12-0_7/8/2008	N	7/8/2008	0	0	0	2952092
H	TSB-HJ-13-0_7/8/2008	N	7/8/2008	0	0	0	2914900
H	TSB-HR-01-0_1/18/2008	N	1/18/2008	0	0	0	2978516
H	TSB-HR-02-0_1/18/2008	N	1/18/2008	0	0	0	2993267
H	TSB-HR-03-0_1/18/2008	N	1/18/2008	0	0	1	2985422
H	TSB-HR-04-0_1/18/2008	N	1/18/2008	0	0	0	2971046
H	TSB-HR-05-0_1/18/2008	N	1/18/2008	0	0	0	2996902
H	V5-PH-1-1-0.0	N	4/9/2010	0	0	0	2980000
H	TSB-HR-07-0_1/18/2008	N	1/18/2008	0	0	0	2956512
H	TSB-HR-07-0 FD_1/18/2008	FD	1/18/2008	0	0	1	2994477
H	TSB-HR-08-0_1/18/2008	N	1/18/2008	0	0	0	2978216
H	RSAU6-0.0B	N	8/7/2009	0.5	0	1	2980000
H	RSAU7-0.0B	N	8/7/2009	0.5	0	0	2980000

Notes:

bgs = below ground surface

ft = feet

s/g PM_{10} = fiber per gram of particulate matter (< 10 micrometer)

s/sample = fiber per sample

FD = Field Duplicate

N = Normal Sample

TABLE 4-4. Exploratory Data Analysis: Comments for Chlorine Oxyanions, Metals, Other Inorganics, and Radionuclides (0-10 ft bgs Soil – Parcel H)
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	No. of Samples	No. of Detects	Maximum Detected Conc[1]	2005 CSM SRC? [2]	Background Evaluation			Spatial Plot	Comment [3]
						Fails Statistical Testing for Background?	Table	Figure		
Chlorine Oxyanions	Chlorate	47	9	10	Yes	NA	NA	NA	J-3	Manufactured at the Site Operations Area from approximately 1945-1998; chlorate and perchlorate are frequently co-located. No manufacturing or disposal areas were located in Parcel H. Parcel soil concentrations (<0.22 mg/kg to 10 mg/kg for chlorate and <0.0019 mg/kg to 22 mg/kg for perchlorate) are substantially lower than the concentrations reported in former manufacturing areas (above 1,000 mg/kg for chlorate and perchlorate).
	Perchlorate	58	47	22	Yes	NA	NA	NA	J-7	
Metals	Aluminum	58	58	9,970	Yes	No	I2	I1-1, I2-1	NA	Although historically listed as a SRC, NDEP did not identify aluminum as a specific contaminant for Parcel H. Concentrations are consistent with background and <0.1xBCL.
	Antimony	57	30	0.50	Yes	LDF	I2	I1-2, I2-2	NA	Although historically listed as a SRC, NDEP did not identify antimony as a specific contaminant for Parcel H. Concentrations are <0.1xBCL.
	Arsenic	58	58	5.2	Yes	Yes	I2	I1-3, I2-3	J-1	Although historically listed as a SRC, NDEP did not identify arsenic as a specific contaminant for Parcel H. Arsenic concentrations are greater than background in Parcel H, with elevated concentrations detected at scattered locations. Concentrations are below the NDEP-approved remediation goal of 7.2 mg/kg.
	Barium	58	58	275	Yes	No	I2	I1-4, I2-4	NA	Although historically listed as a SRC, NDEP did not identify barium as a specific contaminant for Parcel H. Concentrations are consistent with background and <0.1xBCL.
	Beryllium	58	58	0.74	Yes	Yes	I2	I1-5, I2-5	J-2	Although historically listed as a SRC, NDEP did not identify beryllium as a specific contaminant for Parcel H. Concentrations are greater than background but <0.1xBCL.
	Boron	58	4	14	Yes	LDF	I2	I1-6, I2-6	NA	Kerr-McGee manufactured boron at the Site beginning in approximately 1994, and Tronox continues to operate a boron plant. No boron manufacturing or disposal areas have been located in Parcel H. The low detection frequency and a review of box plots and the Q-Q plots suggest that parcel concentrations are consistent with background. Concentrations are <0.1xBCL. Low detection frequency.
	Cadmium	58	19	0.69	Yes	No	I2	I1-7, I2-7	NA	Although historically listed as a SRC, NDEP did not identify cadmium as a specific contaminant for Parcel H. Concentrations are consistent with background and <0.1xBCL.
	Calcium	58	58	158,000	Yes	Yes	I2	I1-8, I2-8	NA	Used extensively or formed as a waste product (e.g., calcium is a process waste from chlorate and manganese production) at the Operations Area. However, not known to be associated with activities at Parcel H.
	Chromium (total)	58	58	15	Yes	Yes	I2	I1-9, I2-9	J-4	Although historically listed as a SRC, NDEP did not identify cadmium as a specific contaminant for Parcel H.Concentrations are greater than background but <0.1xBCL.
	Cobalt	58	58	9.5	Yes	No	I2	I1-11, I2-11	NA	Cobalt may be a by-product of manganese production and within the Operations Area, cobalt was generally found to co-locate with manganese. Cobalt is not known to have been used at Parcel H; and the parcel concentrations are consistent than background.
	Copper	50	50	367	Yes	No	I2	I1-12, I2-12	NA	Although historically listed as a SRC, NDEP did not identify copper as a specific contaminant for Parcel H. Concentrations are consistent with background and <0.1xBCL.
	Iron	58	58	18,200	Yes	No	I2	I1-13, I2-13	NA	NDEP identified iron as a potential contaminant at multiple LOUs within the Operations Area but did not identify iron as a specific contaminant for Parcel H. Concentrations are consistent with background.
	Lead	58	58	51	Yes	No	I2	I1-14, I2-14	NA	NDEP identified lead as a potential contaminant at several LOUs within the Operations Area, but did not identify lead as a specific contaminant for Parcel H. Concentrations are consistent with background and less than the lead BCL.
	Lithium	42	20	48	No	NA	NA	NA	NA	Not historically identified as a SRC. RZ-A background data are not available.
	Magnesium	58	58	17,000	Yes	No	I2	I1-15, I2-15	NA	Produced at the Site from approximately 1942 to 1944. NDEP identified magnesium as a potential contaminant associated with numerous LOUs within the Operations Area, but did not identify magnesium as a specific contaminant for Parcel H. Concentrations are consistent with background levels.
	Manganese	57	57	684	Yes	No	I2	I1-16, I2-16	NA	Produced at the Site since 1951; ongoing production by Tronox. Concentrations are consistent with background.

TABLE 4-4. Exploratory Data Analysis: Comments for Chlorine Oxyanions, Metals, Other Inorganics, and Radionuclides (0-10 ft bgs Soil – Parcel H)
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	No. of Samples	No. of Detects	Maximum Detected Conc[1]	2005 CSM SRC? [2]	Background Evaluation			Spatial Plot	Comment [3]
						Fails Statistical Testing for Background?	Table	Figure		
Metals	Mercury	58	22	0.033	Yes	No	I2	I1-17, I2-17	NA	Although historically identified as a SRC, NDEP did not identify mercury as a specific contaminant at Parcel H. Concentrations are consistent with background and <0.1xBCL.
	Methyl mercury	2	1	0.000034	Yes	NA	NA	NA	NA	Although historically identified as a SRC, NDEP did not identify methyl mercury as a specific contaminant at Parcel H. Concentrations are <0.1xBCL.
	Molybdenum	58	36	1.0	Yes	No	I2	I1-18, I2-18	NA	Concentrations are consistent with background and <0.1xBCL.
	Nickel	58	58	22	Yes	No	I2	I1-19, I2-19	NA	Although historically identified as a SRC, NDEP did not identify nickel as a specific contaminant at Parcel H. Concentrations are consistent with background and <0.1xBCL.
	Niobium	42	4	12	No	NA	NA	NA	NA	Not historically identified as a SRC. Low detection frequency. RZ-A background data are not available.
	Palladium	42	41	1.0	No	NA	NA	NA	J-6	Not historically identified as a SRC. RZ-A background data are not available.
	Phosphorus (total)	47	47	2,020	Yes	NA	NA	NA	NA	Although historically identified as a SRC, NDEP did not identify phosphorus as a specific contaminant in Parcel H. RZ-A background data are not available. *See related discussion for "phosphates."*
	Platinum	58	3	0.012	Yes	LDF	I2	I1-20, I2-20	NA	Platinum was not identified as a potential contaminant for Parcel H. Low detection frequency. Concentrations < 0.1xBCL.
	Potassium	58	58	2,630	Yes	No	I2	I1-21, I2-21	NA	Although historically listed as a SRC, NDEP did not identify potassium as associated with contamination in Parcel H. Concentrations are consistent with background.
	Selenium	58	13	0.80	Yes	LDF	I2	I1-22, I2-22	NA	Although historically identified as a SRC, NDEP did not identify selenium as a specific contaminant in Parcel H. Concentrations <0.1xBCL.
	Silicon	42	42	578	Yes	NA	NA	NA	NA	Although historically listed as a SRC, NDEP did not identify silicon as specific contaminant in Parcel H. RZ-A background data are not available.
	Silver	58	19	0.15	Yes	LDF	I2	I1-23, I2-23	NA	Although historically identified as a SRC, NDEP did not identify silver as a specific contaminant in Parcel H. Concentrations are <0.1xBCL.
	Sodium	58	57	1,230	Yes	No	I2	I1-24, I2-24	NA	NDEP identified sodium as a potential contaminant at multiple LOUs, but not in Parcel H. Concentrations are consistent with background.
	Strontium	58	58	500	Yes	No	I2	I1-25, I2-25	NA	Although historically listed as a SRC, NDEP did not identify strontium as a specific contaminant in Parcel H. Concentrations are consistent with background and <0.1xBCL.
	Sulfur	42	2	2,400	Yes	NA	NA	NA	NA	*See discussion for "Other Inorganics."*
	Thallium	58	7	0.34	Yes	LDF	I2	I1-26, I2-26	NA	Although historically listed as a SRC, NDEP did not identify thallium as a specific contaminant in Parcel H. Concentrations are <0.1xBCL. Low detection frequency.
	Tin	58	18	4.9	Yes	LDF	I2	I1-27, I2-27	NA	Although historically listed as a SRC, NDEP did not identify tin as a specific contaminant in Parcel H. Concentrations are <0.1xBCL.
	Titanium	58	58	950	Yes	No	I2	I1-28, I2-28	NA	Concentrations are consistent with background and <0.1xBCL.
	Tungsten	58	7	0.67	Yes	LDF	I2	I1-29, I2-29	NA	Low detection frequency. Concentrations are < 0.1xBCL.
	Uranium (total)	58	58	26	Yes	Yes	I2	I1-30, I2-30	J-10	Although historically identified as a SRC, NDEP did not identify uranium as a specific contaminant in Parcel H. Concentrations are greater than background but <0.1xBCL.
	Vanadium	58	58	56	Yes	No	I2	I1-31, I2-31	NA	Although historically identified as a SRC, NDEP did not identify vanadium as a specific contaminant in Parcel H. Concentrations are consistent with background and <0.1xBCL.
	Zinc	58	58	67	Yes	No	I2	I1-32, I2-32	NA	'Although historically identified as a SRC, NDEP did not identify zinc as a specific contaminant in Parcel H. Soil concentrations are consistent with background and <0.1xBCL.
	Zirconium	42	42	26	No	NA	NA	NA	J-13, 5-2	Not historically listed as a SRC. RZ-A background data are not available.

TABLE 4-4. Exploratory Data Analysis: Comments for Chlorine Oxyanions, Metals, Other Inorganics, and Radionuclides (0-10 ft bgs Soil – Parcel H)
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	No. of Samples	No. of Detects	Maximum Detected Conc[1]	2005 CSM SRC? [2]	Background Evaluation			Spatial Plot	Comment [3]
						Fails Statistical Testing for Background?	Table	Figure		
Other Inorganics	Ammonia	5	2	4.6	Yes	NA	NA	NA	NA	This group of inorganic compounds includes common industrial chemicals that are used as chemical feedstocks and/or expected to be present in process waste streams. With the exception of fluoride and nitrate, all compounds were historically identified as SRCs at the Operations Area. These compounds are generally highly soluble when present as free anions or cations. Many of these compounds are physiological electrolytes and/or occur naturally in foods. Although all of the listed inorganics occur naturally in soil, RZ-A background data sets are not available to conduct a background analysis. At the concentrations detected in soil, these inorganics do not present human health concerns. Generally, these inorganics are of greater concern when detected as contaminants in groundwater than when present at elevated concentrations in soil.
	Bromide	47	5	4.5	Yes	NA	NA	NA	NA	
	Chloride	47	45	1,640	Yes	NA	NA	NA	NA	
	Fluoride	44	21	2.0	No	NA	NA	NA	NA	
	Nitrate	47	43	39	Yes	NA	NA	NA	NA	
	Nitrite	47	1	0.13	No	NA	NA	NA	NA	
	Sulfate	47	44	640	Yes	NA	NA	NA	NA	
Radio-nuclides	Uranium-238	58	58	2.6	Yes	Yes	I-4	I1-33, I2-33	J-12	Although historically listed as SRCs, radionuclides are not known to be associated with any of the former/current operations at the Site. Although several radionuclides failed the statistical testing for background consistency, the validity of the statistical testing is confounded by several analytical and other issues.
	Uranium-234	55	55	3.5	Yes	Yes	I-4	I1-34, I2-34	NA	
	Thorium-230	55	55	3.0	Yes	Yes	I-4	I1-35, I2-35	NA	
	Radium-226	58	58	2.5	Yes	Yes	I-4	I1-36, I2-36	NA	
	Thorium-232	55	55	2.7	Yes	Yes	I-4	I1-37, I2-37	J-9	
	Thorium-228	55	55	3.0	Yes	Yes	I-4	I1-39, I2-39	NA	
	Radium-228	58	58	3.0	Yes	Yes	I-4	I1-38, I2-38	NA	
	Uranium-235	58	58	0.20	No	No	I-4	I1-40, I2-40	J-11	

Notes:

bgs = below ground surface
ft = feet
mg/kg = milligram per kilogram
pCi/g = picocurie per gram
BCL = Basic comparison level
CSM = Conceptual site model
LDF = Low detection frequency (<25%) in either site or background datasets. Background comparison results may not be applicable.
LOU = Letter of Understanding
NA = Not applicable
NDEP = Nevada Division of Environmental Protection
SRC = Site related chemical, as identified in the Conceptual Site Model (ENSR 2005)

Listed analytes are those detected in one or more samples in Parcel H.

[1] Concentrations are in mg/kg for all groups except radionuclides; radionuclide activities are in pCi/g.
[2] From Table 5 of the ENSR (2005) Conceptual Site Model report.
[3] Based on information from: ENSR 2005; ENVIRON 2011; NDEP 2011; and Ramboll Environ 2016.
Statements as to whether an analyte was historically listed as a SRC are based on the list of SRCs in Table 5 of the ENSR (2005) Conceptual Site Model report.
Statements regarding NDEP's identification of an analyte as associated with an LOU are based on the NDEP 2011 Action Memorandum.
It is recognized that a specific analyte may have been identified as a SRC in later investigations or as an LOU contaminant in other documents prepared for the Site.

Sources:

ENSR. 2005. Conceptual Site Model, Kerr-McGee Facility, Henderson, Nevada. February. NDEP requested response to comments during the next monthly meeting October 22.
ENVIRON. 2011. Phase I Environmental Site Assessment of Tronox LLC, Clark County, Nevada. January.
NDEP. 2011. Action Memorandum: Removal Actions, Nevada Environmental Response Trust Site, Clark County, Nevada. July.
Ramboll Environ. 2016. Technical Memorandum, Remedial Investigation Data Evaluation, Nevada Environmental Response Trust Site, Henderson, Nevada, dated May 2.

TABLE 4-5. Exploratory Data Analysis: Comments for Dioxins/Furans, Other Organics, PAHs, Pesticides, SVOCs, and VOCs (0-10 ft bgs Soil – Parcel H)
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	No. of Samples	No. of Detects	Maximum Detected Concentration (mg/kg)	2005 CSM SRC? [1]	Spatial Plot	Comment [2]
Dioxins/ Furans	2,3,7,8-TCDD TEQ*	47	23	0.000021	Yes	J-8	Unintentional by-product of high-temperature processes, e.g., incomplete combustion and pesticide production (a source of chlorine is required). Highly persistent. Soil concentrations are below the NDEP-approved action level of 0.0027 mg/kg.
PAHs	BaPEq*	47	2	0.0090	Yes	NA	PAHs are ubiquitous environmental contaminants, formed during incomplete combustion of organic materials. Low detection frequency. The highest concentrations <0.1xBCL.
	Benzo(g,h,i)perylene	47	1	0.0028	Yes	NA	Expected to co-locate with BaPEqs. Low detection frequency. Concentration <0.1xBCL.
	Fluoranthene	47	2	0.0066	Yes	NA	
	Phenanthrene	47	1	0.0038	Yes	NA	
	Pyrene	47	2	0.0063	Yes	NA	
Pesticides OCPs	beta-BHC	47	6	0.040	No	NA	Not listed historically as a SRC. However, the former Stauffer facility (to the west) produced gamma-BHC (lindane) from 1946 through 1958; the alpha and beta isomers are by-products of lindane production. Concentrations < 0.1xBCL.
	4,4'-DDD	47	1	0.0035	Yes	NA	Historical information indicates that Hardesty/AMECCO (1946-1949) listed DDT for production. The detected concentrations of DDT and related compounds in Parcel H are relatively low and < 0.1xBCL. 4,4'-DDT and 4,4'-DDE are mostly co-located.
	2,4'-DDE	42	1	0.014	Yes	NA	
	4,4'-DDE	47	2	0.060	Yes	NA	
	4,4'-DDT	47	2	0.089	Yes	NA	
	Hexachlorobenzene	47	1	0.21	Yes	J-5, 5-3	Historically listed as a SRC. Formed as a by-product during the manufacture of other chemicals involving chlorine, mainly solvents and pesticides.
SVOCs	bis(2-Ethylhexyl)phthalate	47	1	0.069	No	NA	A common field/laboratory contaminant. Low detection frequency. Concentrations < 0.1xBCL.
	Butylbenzylphthalate	47	1	0.11	No	NA	A common field/laboratory contaminant. Low detection frequency. Concentrations < 0.1xBCL.
VOCs	Acetone	58	8	0.024	Yes	NA	Historically, a number of individual VOCs were listed as SRCs, VOC soil contamination was not the subject of any of the interim soil removal actions completed within Parcel H following the soil investigations. Also, NDEP did not specifically identify VOCs as potential contaminants for Parcel H. However, it is noted that the initial identification of potential LOU contaminants was based on a review of historical operations and the limited sampling data available at the time of the LOU designations in 1994. Given that Parcel H are situated within the Trust's property, as well as in the vicinity of other BMI companies, it is possible that environmental media within Parcel H could have been indirectly impacted by VOCs. At the same time, an operational history for an area that included former use of VOCs does not necessarily mean that environmental media in the area were impacted. Tthe soil sampling results show that VOCs were detected at low frequencies and low concentrations, not indicative of a source. Several of the VOCs are common field/laboratory contaminants, for example, acetone, 2-butanone, methylene chloride, and toluene.
	Acetonitrile	42	1	0.021	No	NA	
	2-Butanone	58	2	0.0018	No	NA	
	Methylene chloride	58	24	0.021	Yes	NA	
	Toluene	58	7	0.0028	Yes	NA	

TABLE 4-5. Exploratory Data Analysis: Comments for Dioxins/Furans, Other Organics, PAHs, Pesticides, SVOCs, and VOCs (0-10 ft bgs Soil – Parcel H)
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	No. of Samples	No. of Detects	Maximum Detected Concentration (mg/kg)	2005 CSM SRC? [1]	Spatial Plot	Comment [2]
VOCs	1,2,4-Trimethylbenzene	58	8	0.00055	No	NA	See VOC comments above.

Notes:

bgs = below ground surface
ft = feet
mg/kg = milligram per kilogram
BaPEq = Benzo(a)pyrene equivalent
BCL = Basic comparison level
BHC = Hexachlorocyclohexane
CSM = Conceptual site model
DDD = Dichlorodiphenyldichloroethane
DDE = Dichlorodiphenyldichloroethylene
DDT = Dichlorodiphenyltrichloroethane
LOU = Letter of Understanding
NA = Not applicable
NDEP = Nevada Division of Environmental Protection
OCP = Organochlorine pesticide
PAH = Polycyclic aromatic hydrocarbon
SRC = Site-related chemical
SVOC = Semivolatile organic compound
TCDD = Tetrachlorodibenzo-p-dioxin
TEQ = Toxicity equivalent
VOC = Volatile organic compound
* Methodology for equivalent calculations explained in text

Listed analytes include only those detected in one or more samples in Parcel H.

[1] From Table 5 of the ENSR (2005) Conceptual Site Model report

[2] Based on information from: ENSR 2005; ENVIRON 2011; NDEP 2011; and Ramboll Environ 2016.
Statements as to whether an analyte was historically listed as a SRC are based on the list of SRCs in Table 5 of the ENSR (2005) Conceptual Site Model report.
Statements regarding NDEP's identification of an analyte as associated with an LOU are based on the NDEP 2011 Action Memorandum.
It is recognized that a specific analyte may have been identified as a SRC in later investigations or as an LOU contaminant in other documents prepared for the Site.

Sources:

ENSR. 2005. Conceptual Site Model, Kerr-McGee Facility, Henderson, Nevada. February. NDEP requested response to comments during the next monthly meeting October 22.
ENVIRON. 2011. Phase I Environmental Site Assessment of Tronox LLC, Clark County, Nevada. January.
NDEP. 2011. Action Memorandum: Removal Actions, Nevada Environmental Response Trust Site, Clark County, Nevada. July.
Ramboll Environ. 2016. Technical Memorandum, Remedial Investigation Data Evaluation, Nevada Environmental Response Trust Site, Henderson, Nevada, dated May 2.

TABLE 4-6. Evaluation of Sample Quantitation Limits for Soil Gas – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Risk-Based Concentration [1]	Unit	No. of Samples	No. of Detects	% Detects	Non-Detects		
						Minimum SQL	Maximum SQL	% Above 10% of RBC
Acetone	4.10E+08	µg/m^3	2	2	100	--	--	--
Acrylonitrile	6.00E+02	µg/m^3	2	1	50	0.89	0.89	0
t-Amyl methyl ether	6.50E+07	µg/m^3	2	0	0	0.82	0.89	0
Benzene	2.90E+14	µg/m^3	2	2	100	--	--	--
Benzyl chloride	1.20E+03	µg/m^3	2	0	0	0.16	0.18	0
Bromodichloromethane	3.20E+03	µg/m^3	2	0	0	0.16	0.18	0
Bromoform	9.00E+04	µg/m^3	2	0	0	0.82	0.89	0
Bromomethane	9.90E+01	µg/m^3	2	0	0	0.16	0.18	0
2-Butanone	8.20E+07	µg/m^3	2	2	100	--	--	--
n-Butylbenzene	7.70E+06	µg/m^3	2	2	100	--	--	--
sec-Butylbenzene	7.70E+06	µg/m^3	2	1	50	0.89	0.89	0
tert-Butylbenzene	7.70E+06	µg/m^3	2	0	0	0.33	0.36	0
Carbon disulfide	1.10E+07	µg/m^3	2	2	100	--	--	--
Carbon tetrachloride	8.70E+03	µg/m^3	2	2	100	--	--	--
3-Chloro-1-propene	7.60E+03	µg/m^3	2	0	0	0.16	0.18	0
Chlorobenzene	9.80E+05	µg/m^3	2	0	0	0.16	0.18	0
Chloroethane	1.50E+08	µg/m^3	2	1	50	0.16	0.16	0
Chloroform	1.80E+03	µg/m^3	2	2	100	--	--	--
Chloromethane	1.30E+06	µg/m^3	2	0	0	0.16	0.18	0
Cumene	7.70E+06	µg/m^3	2	1	50	0.89	0.89	0
p-Cymene	7.70E+06	µg/m^3	2	2	100	--	--	--
1,2-Dibromo-3-chloropropane	8.50E+00	µg/m^3	2	0	0	0.82	0.89	50
Dibromochloromethane	--	µg/m^3	2	0	0	0.16	0.18	--
1,2-Dibromoethane	9.10E+01	µg/m^3	2	0	0	0.16	0.18	0
1,2-Dichlorobenzene	4.10E+06	µg/m^3	2	0	0	0.16	0.18	0
1,3-Dichlorobenzene	4.10E+06	µg/m^3	2	0	0	0.16	0.18	0
1,4-Dichlorobenzene	5.20E+03	µg/m^3	2	2	100	--	--	--
Dichlorodifluoromethane	1.80E+06	µg/m^3	2	2	100	--	--	--
1,1-Dichloroethane	3.40E+04	µg/m^3	2	0	0	0.16	0.18	0
1,2-Dichloroethane	1.60E+03	µg/m^3	2	0	0	0.16	0.18	0
1,1-Dichloroethene	3.40E+06	µg/m^3	2	0	0	0.16	0.18	0

TABLE 4-6. Evaluation of Sample Quantitation Limits for Soil Gas – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Risk-Based Concentration [1]	Unit	No. of Samples	No. of Detects	% Detects	Non-Detects		
						Minimum SQL	Maximum SQL	% Above 10% of RBC
cis-1,2-Dichloroethene	--	µg/m^3	2	0	0	0.16	0.18	--
trans-1,2-Dichloroethene	--	µg/m^3	2	0	0	0.16	0.18	--
1,2-Dichloropropane	5.20E+03	µg/m^3	2	0	0	0.16	0.18	0
cis-1,3-Dichloropropene	1.60E+04	µg/m^3	2	0	0	0.82	0.89	0
trans-1,3-Dichloropropene	1.60E+04	µg/m^3	2	0	0	0.82	0.89	0
1,4-Dioxane	8.50E+03	µg/m^3	2	2	100	--	--	--
Ethanol	1.20E+09	µg/m^3	2	2	100	--	--	--
Ethyl benzene	2.20E+04	µg/m^3	2	2	100	--	--	--
4-Ethyltoluene	7.70E+06	µg/m^3	2	2	100	--	--	--
Freon 114	5.60E+08	µg/m^3	2	1	50	0.89	0.89	0
n-Heptane	1.60E+08	µg/m^3	2	2	100	--	--	--
Hexachlorobutadiene	5.90E+03	µg/m^3	2	0	0	0.16	0.18	0
2-Hexanone	6.10E+05	µg/m^3	2	2	100	--	--	--
Methyl tert-butyl ether	2.00E+05	µg/m^3	2	0	0	0.16	0.18	0
4-Methyl-2-pentanone	5.80E+07	µg/m^3	2	2	100	--	--	--
Methylene Chloride	4.30E+06	µg/m^3	2	2	100	--	--	--
Methylmethacrylate	1.30E+07	µg/m^3	2	1	50	0.82	0.82	0
Naphthalene	1.90E+03	µg/m^3	2	2	100	--	--	--
n-Octane	--	µg/m^3	2	1	50	0.89	0.89	--
Diisopropyl ether	1.50E+07	µg/m^3	2	0	0	0.82	0.89	0
n-Propylbenzene	1.90E+07	µg/m^3	2	1	50	0.89	0.89	0
Styrene	2.00E+07	µg/m^3	2	2	100	--	--	--
1,1,2,2-Tetrachloroethane	9.70E+02	µg/m^3	2	1	50	0.18	0.18	0
Tetrachloroethene	2.10E+05	µg/m^3	2	2	100	--	--	--
Toluene	8.60E+07	µg/m^3	2	2	100	--	--	--
1,2,4-Trichlorobenzene	8.30E+04	µg/m^3	2	1	50	0.18	0.18	0
1,1,1-Trichloroethane	9.40E+07	µg/m^3	2	0	0	0.16	0.18	0
1,1,2-Trichloroethane	3.30E+03	µg/m^3	2	0	0	0.16	0.18	0
Trichloroethene	1.30E+04	µg/m^3	2	2	100	--	--	--
Trichlorofluoromethane	1.20E+07	µg/m^3	2	2	100	--	--	--
1,2,4-Trimethylbenzene	1.20E+06	µg/m^3	2	2	100	--	--	--

TABLE 4-6. Evaluation of Sample Quantitation Limits for Soil Gas – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Risk-Based Concentration [1]	Unit	No. of Samples	No. of Detects	% Detects	Non-Detects		
						Minimum SQL	Maximum SQL	% Above 10% of RBC
1,3,5-Trimethylbenzene	1.20E+06	µg/m^3	2	2	100	--	--	--
Vinyl acetate	3.50E+06	µg/m^3	2	2	100	--	--	--
Vinyl chloride	9.50E+03	µg/m^3	2	0	0	0.16	0.18	0
o-Xylene	1.70E+06	µg/m^3	2	2	100	--	--	--
m,p-Xylene	1.90E+06	µg/m^3	2	2	100	--	--	--
Ethyl tert-butyl ether	6.50E+07	µg/m^3	2	0	0	0.82	0.89	0
alpha-Methylstyrene	2.00E+07	µg/m^3	2	1	50	0.82	0.82	0
tert Butyl alcohol	4.70E+08	µg/m^3	2	2	100	--	--	--
1,1,2-Trichloro-1,2,2-trifluoroethane	1.30E+09	µg/m^3	2	2	100	--	--	--

Notes:

-- = not available

µg/m^3 = microgram per cubic meter

SQL = Sample quantitation limit

RBC = Risk-Based Concentration

[1] Risk-Based Concentrations (RBCs) used in this evaluation are the lowest among the 5 ft bgs soil gas RBCs for indoor workers, outdoor workers and construction workers.

TABLE 4-7. Summary Statistics for Soil Gas Data – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
					Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
Acetone	µg/m^3	2	2	100	--	--	16	39	28	28	16	0.59	SG50
Acrylonitrile	µg/m^3	2	1	50	0.89	0.89	0.11	0.11	0.11	0.11	--	--	SG49
t-Amyl methyl ether	µg/m^3	2	0	0	0.82	0.89	--	--	--	--	--	--	--
Benzene	µg/m^3	2	2	100	--	--	2.9	4.1	3.5	3.5	0.85	0.24	SG50
Benzyl chloride	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
Bromodichloromethane	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
Bromoform	µg/m^3	2	0	0	0.82	0.89	--	--	--	--	--	--	--
Bromomethane	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
2-Butanone	µg/m^3	2	2	100	--	--	3.3	5.6	4.4	4.4	1.6	0.37	SG50
n-Butylbenzene	µg/m^3	2	2	100	--	--	0.39	0.61	0.5	0.5	0.16	0.31	SG50
sec-Butylbenzene	µg/m^3	2	1	50	0.89	0.89	0.12	0.12	0.12	0.12	--	--	SG49
tert-Butylbenzene	µg/m^3	2	0	0	0.33	0.36	--	--	--	--	--	--	--
Carbon disulfide	µg/m^3	2	2	100	--	--	2.5	32	17	17	21	1.2	SG50
Carbon tetrachloride	µg/m^3	2	2	100	--	--	0.12	0.32	0.22	0.22	0.14	0.64	SG50
3-Chloro-1-propene	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
Chlorobenzene	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
Chloroethane	µg/m^3	2	1	50	0.16	0.16	0.14	0.14	0.14	0.14	--	--	SG50
Chloroform	µg/m^3	2	2	100	--	--	0.83	1.3	1.1	1.1	0.33	0.31	SG49
Chloromethane	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
Cumene	µg/m^3	2	1	50	0.89	0.89	0.14	0.14	0.14	0.14	--	--	SG49
p-Cymene	µg/m^3	2	2	100	--	--	1	1.9	1.4	1.4	0.64	0.44	SG50
1,2-Dibromo-3-chloropropane	µg/m^3	2	0	0	0.82	0.89	--	--	--	--	--	--	--
Dibromochloromethane	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
1,2-Dibromoethane	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
1,2-Dichlorobenzene	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
1,3-Dichlorobenzene	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
1,4-Dichlorobenzene	µg/m^3	2	2	100	--	--	0.35	2.2	1.3	1.3	1.3	1	SG50
Dichlorodifluoromethane	µg/m^3	2	2	100	--	--	1.9	2	1.9	1.9	0.071	0.036	SG49
1,1-Dichloroethane	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
1,2-Dichloroethane	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
1,1-Dichloroethene	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
1,2-Dichloropropane	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	µg/m^3	2	0	0	0.82	0.89	--	--	--	--	--	--	--

TABLE 4-7. Summary Statistics for Soil Gas Data – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
					Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
trans-1,3-Dichloropropene	µg/m^3	2	0	0	0.82	0.89	--	--	--	--	--	--	--
1,4-Dioxane	µg/m^3	2	2	100	--	--	0.49	0.83	0.66	0.66	0.24	0.36	SG49
Ethanol	µg/m^3	2	2	100	--	--	4.1	5.5	4.8	4.8	0.99	0.21	SG50
Ethyl benzene	µg/m^3	2	2	100	--	--	0.62	1.1	0.86	0.86	0.34	0.39	SG49
4-Ethyltoluene	µg/m^3	2	2	100	--	--	0.17	0.86	0.52	0.52	0.49	0.95	SG49
Freon 114	µg/m^3	2	1	50	0.89	0.89	0.093	0.093	0.093	0.093	--	--	SG49
n-Heptane	µg/m^3	2	2	100	--	--	0.16	0.16	0.16	0.16	0	0	SG49
Hexachlorobutadiene	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
2-Hexanone	µg/m^3	2	2	100	--	--	0.34	0.47	0.41	0.41	0.092	0.23	SG49
Methyl tert-butyl ether	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
4-Methyl-2-pentanone	µg/m^3	2	2	100	--	--	0.51	0.89	0.7	0.7	0.27	0.38	SG50
Methylene Chloride	µg/m^3	2	2	100	--	--	0.15	0.19	0.17	0.17	0.028	0.17	SG50
Methylmethacrylate	µg/m^3	2	1	50	0.82	0.82	0.14	0.14	0.14	0.14	--	--	SG50
Naphthalene	µg/m^3	2	2	100	--	--	0.83	1.3	1.1	1.1	0.33	0.31	SG49
n-Octane	µg/m^3	2	1	50	0.89	0.89	0.34	0.34	0.34	0.34	--	--	SG49
Diisopropyl ether	µg/m^3	2	0	0	0.82	0.89	--	--	--	--	--	--	--
n-Propylbenzene	µg/m^3	2	1	50	0.89	0.89	0.68	0.68	0.68	0.68	--	--	SG49
Styrene	µg/m^3	2	2	100	--	--	0.15	0.2	0.17	0.17	0.035	0.2	SG50
1,1,2,2-Tetrachloroethane	µg/m^3	2	1	50	0.18	0.18	0.17	0.17	0.17	0.17	--	--	SG49
Tetrachloroethene	µg/m^3	2	2	100	--	--	0.47	0.52	0.49	0.49	0.035	0.071	SG49
Toluene	µg/m^3	2	2	100	--	--	3.2	5.1	4.2	4.2	1.3	0.32	SG50
1,2,4-Trichlorobenzene	µg/m^3	2	1	50	0.18	0.18	0.14	0.14	0.14	0.14	--	--	SG49
1,1,1-Trichloroethane	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
1,1,2-Trichloroethane	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
Trichloroethene	µg/m^3	2	2	100	--	--	0.14	0.16	0.15	0.15	0.014	0.094	SG50
Trichlorofluoromethane	µg/m^3	2	2	100	--	--	0.98	1.1	1	1	0.085	0.082	SG49
1,2,4-Trimethylbenzene	µg/m^3	2	2	100	--	--	1.5	3.1	2.3	2.3	1.1	0.49	SG49
1,3,5-Trimethylbenzene	µg/m^3	2	2	100	--	--	0.18	0.77	0.47	0.47	0.42	0.88	SG49
Vinyl acetate	µg/m^3	2	2	100	--	--	7.4	16	12	12	6.1	0.52	SG50
Vinyl chloride	µg/m^3	2	0	0	0.16	0.18	--	--	--	--	--	--	--
o-Xylene	µg/m^3	2	2	100	--	--	0.72	2.9	1.8	1.8	1.5	0.85	SG49
m,p-Xylene	µg/m^3	2	2	100	--	--	2.3	6.1	4.2	4.2	2.7	0.64	SG49
Ethyl tert-butyl ether	µg/m^3	2	0	0	0.82	0.89	--	--	--	--	--	--	--
alpha-Methylstyrene	µg/m^3	2	1	50	0.82	0.82	0.21	0.21	0.21	0.21	--	--	SG50
tert Butyl alcohol	µg/m^3	2	2	100	--	--	0.46	0.7	0.58	0.58	0.17	0.29	SG50

TABLE 4-7. Summary Statistics for Soil Gas Data – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
					Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
1,1,2-Trichloro-1,2,2-trifluoroethane	$\mu g/m^3$	2	2	100	--	--	0.45	0.49	0.47	0.47	0.028	0.06	SG49

Notes:

-- = not available

$\mu g/m^3$ = microgram per cubic meter

TABLE 4-8: Evaluation of Sample Quantitation Limits for Shallow Groundwater – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Risk-Based Concentration	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		
							Minimum SQL	Maximum SQL	% Above 10% of RBC
SVOCs	Acenaphthene	3.2E+05	µg/L	5	1	20	0.19	10	0
	Acenaphthylene	2.1E+05	µg/L	5	0	0	0.19	10	0
	Anthracene	4.6E+05	µg/L	5	1	20	0.19	10	0
	Benzo(a)anthracene	4.1E+04	µg/L	5	1	20	0.19	10	0
	Benzo(a)pyrene	--	µg/L	5	1	20	0.19	10	--
	Benzo(b)fluoranthene	--	µg/L	5	1	20	0.19	10	--
	Benzo(g,h,i)perylene	--	µg/L	5	1	20	0.19	10	--
	Benzo(k)fluoranthene	--	µg/L	5	1	20	0.19	10	--
	bis(2-Ethylhexyl)phthalate	--	µg/L	5	2	40	4.7	10	--
	Butylbenzylphthalate	--	µg/L	5	1	20	4.7	10	--
	Chrysene	--	µg/L	5	1	20	0.19	10	--
	Di-n-butylphthalate	--	µg/L	5	0	0	4.7	10	--
	Di-n-octylphthalate	--	µg/L	5	1	20	4.7	10	--
	Dibenz(a,h)anthracene	--	µg/L	5	1	20	0.19	10	--
	Diethylphthalate	--	µg/L	5	0	0	4.7	10	--
	Dimethylphthalate	--	µg/L	5	0	0	4.7	10	--
	Fluoranthene	--	µg/L	5	1	20	0.19	10	--
	Fluorene	4.4E+05	µg/L	5	1	20	0.19	10	0
	Hexachlorobenzene	1.3E+02	µg/L	5	1	20	0.19	10	0
	Hexachlorobutadiene	4.6E+02	µg/L	13	0	0	0.25	10	0
	Indeno(1,2,3-cd)pyrene	--	µg/L	5	1	20	0.19	10	--
	2-Methylnaphthalene	--	µg/L	5	1	20	0.19	10	--
	Naphthalene	2.1E+03	µg/L	13	0	0	0.19	10	0
	Nitrobenzene	2.2E+04	µg/L	5	0	0	0.19	10	0
	Octachlorostyrene	--	µg/L	5	0	0	0.19	10	--
	Phenanthrene	--	µg/L	5	1	20	0.19	10	--
	Pyrene	5.7E+06	µg/L	5	1	20	0.19	10	0
	Pyridine	3.6E+07	µg/L	4	0	0	1.9	20	0

TABLE 4-8: Evaluation of Sample Quantitation Limits for Shallow Groundwater – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Risk-Based Concentration	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		
							Minimum SQL	Maximum SQL	% Above 10% of RBC
VOCs	Acetone	3.1E+09	µg/L	10	3	30	10	20	0
	t-Amyl methyl ether	1.8E+07	µg/L	10	0	0	1.0	5.0	0
	Benzene	1.0E+14	µg/L	13	0	0	0.25	5.0	0
	Bromobenzene	1.3E+05	µg/L	13	0	0	0.25	5.0	0
	Bromochloromethane	1.7E+05	µg/L	13	0	0	0.25	5.0	0
	Bromodichloromethane	9.8E+02	µg/L	13	2	15	0.25	5.0	0
	Bromoform	8.0E+04	µg/L	13	0	0	0.40	5.0	0
	Bromomethane	8.2E+00	µg/L	13	0	0	0.25	10	77
	2-Butanone	9.6E+08	µg/L	13	0	0	2.5	10	0
	n-Butylbenzene	4.3E+05	µg/L	13	0	0	0.40	5.0	0
	sec-Butylbenzene	1.6E+07	µg/L	13	0	0	0.25	5.0	0
	tert-Butylbenzene	2.6E+05	µg/L	13	0	0	0.25	5.0	0
	Carbon tetrachloride	1.8E+02	µg/L	13	0	0	0.25	5.0	0
	Chlorobenzene	1.6E+05	µg/L	13	0	0	0.25	5.0	0
	Chloroethane	7.0E+06	µg/L	13	0	0	0.40	5.0	0
	Chloroform	2.6E+02	µg/L	13	9	69	5.0	5.0	0
	1-Chlorohexane	9.3E+04	µg/L	5	0	0	5.0	5.0	0
	Chloromethane	2.7E+04	µg/L	13	1	7.7	0.25	5.0	0
	2-Chlorotoluene	1.1E+05	µg/L	13	0	0	0.25	5.0	0
	4-Chlorotoluene	1.0E+05	µg/L	13	0	0	0.25	5.0	0
	Cumene	5.0E+03	µg/L	13	0	0	0.25	5.0	0
	p-Cymene	2.8E+03	µg/L	13	0	0	0.25	5.0	0
	1,2-Dibromo-3-chloropropane	1.5E+01	µg/L	13	0	0	0.50	5.0	77
	Dibromochloromethane	--	µg/L	13	0	0	0.25	5.0	--
	1,2-Dibromoethane	1.2E+02	µg/L	13	0	0	0.25	5.0	0
	Dibromomethane	3.9E+04	µg/L	13	0	0	0.25	5.0	0
	1,2-Dichlorobenzene	1.3E+06	µg/L	13	0	0	0.50	5.0	0
	1,3-Dichlorobenzene	1.3E+06	µg/L	13	0	0	0.25	5.0	0

TABLE 4-8: Evaluation of Sample Quantitation Limits for Shallow Groundwater – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Risk-Based Concentration	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		
							Minimum SQL	Maximum SQL	% Above 10% of RBC
VOCs	1,4-Dichlorobenzene	1.3E+03	µg/L	13	0	0	0.25	5.0	0
	Dichlorodifluoromethane	1.1E+04	µg/L	13	0	0	0.25	5.0	0
	1,1-Dichloroethane	3.4E+03	µg/L	13	0	0	0.25	5.0	0
	1,2-Dichloroethane	7.6E+02	µg/L	13	0	0	0.25	5.0	0
	1,1-Dichloroethene	7.1E+04	µg/L	13	0	0	0.25	5.0	0
	cis-1,2-Dichloroethene	--	µg/L	13	0	0	0.25	5.0	--
	trans-1,2-Dichloroethene	--	µg/L	13	0	0	0.25	5.0	--
	1,2-Dichloropropane	1.0E+03	µg/L	13	0	0	0.25	5.0	0
	1,3-Dichloropropane	1.0E+04	µg/L	13	0	0	0.25	5.0	0
	2,2-Dichloropropane	2.0E+03	µg/L	13	0	0	0.40	5.0	0
	1,1-Dichloropropene	1.4E+02	µg/L	13	0	0	0.25	5.0	0
	cis-1,3-Dichloropropene	5.8E+02	µg/L	13	0	0	0.25	5.0	0
	trans-1,3-Dichloropropene	5.8E+02	µg/L	13	0	0	0.25	5.0	0
	1,4-Dioxane	3.7E+05	µg/L	8	0	0	0.50	10	0
	Ethanol	4.6E+10	µg/L	5	0	0	1000	1000	0
	Ethyl benzene	1.8E+03	µg/L	13	0	0	0.25	5.0	0
	2-Hexanone	1.6E+06	µg/L	10	0	0	10	10	0
	Methanol	8.0E+09	µg/L	5	0	0	1000	1000	0
	Methyl tert-butyl ether	1.4E+05	µg/L	10	0	0	1.0	5.0	0
	4-Methyl-2-pentanone	1.6E+08	µg/L	10	0	0	10	10	0
	Methylene Chloride	9.3E+05	µg/L	13	0	0	0.88	10	0
	Diisopropyl ether	2.3E+06	µg/L	10	0	0	1.0	5.0	0
	n-Propylbenzene	1.0E+06	µg/L	13	0	0	0.25	5.0	0
	Styrene	4.4E+06	µg/L	13	0	0	0.25	5.0	0
	1,1,1,2-Tetrachloroethane	1.0E+04	µg/L	13	0	0	0.25	5.0	0
	1,1,2,2-Tetrachloroethane	1.3E+03	µg/L	13	0	0	0.25	5.0	0
	Tetrachloroethene	7.7E+03	µg/L	13	0	0	0.25	5.0	0
	Toluene	7.8E+06	µg/L	13	0	0	0.25	5.0	0

TABLE 4-8: Evaluation of Sample Quantitation Limits for Shallow Groundwater – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Risk-Based Concentration	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		
							Minimum SQL	Maximum SQL	% Above 10% of RBC
VOCs	1,2,3-Trichlorobenzene	1.9E+04	µg/L	13	0	0	0.40	5.0	0
	1,2,4-Trichlorobenzene	3.5E+04	µg/L	13	0	0	0.40	5.0	0
	1,1,1-Trichloroethane	3.3E+06	µg/L	13	0	0	0.25	5.0	0
	1,1,2-Trichloroethane	1.7E+03	µg/L	13	0	0	0.25	5.0	0
	Trichloroethene	7.5E+02	µg/L	13	0	0	0.25	5.0	0
	Trichlorofluoromethane	6.9E+04	µg/L	13	0	0	0.25	5.0	0
	1,2,3-Trichloropropane	1.6E+02	µg/L	13	0	0	0.0025	5.0	0
	1,2,4-Trimethylbenzene	1.4E+05	µg/L	13	0	0	0.25	5.0	0
	1,3,5-Trimethylbenzene	1.1E+05	µg/L	13	0	0	0.25	5.0	0
	Vinyl chloride	1.8E+02	µg/L	13	0	0	0.25	5.0	0
	o-Xylene	2.0E+05	µg/L	7	0	0	0.25	1.0	0
	m,p-Xylene	1.0E+05	µg/L	7	0	0	0.50	2.0	0
	Xylenes (total)	1.8E+05	µg/L	6	0	0	10	10	0
	Ethyl tert-butyl ether	1.5E+07	µg/L	13	0	0	0.25	5.0	0
	tert Butyl alcohol	1.1E+10	µg/L	5	0	0	5.000	100	0

Notes:

-- = not available

µg/L = microgram per liter

RBC = Risk-Based Concentrations

SQL = Sample quantitation limit

SVOC = Semivolatile Organic Compound

VOC = Volatile Organic Compound

[1] Risk Based Concentrations (RBCs) used in this evaluation are the lowest among the shallow groundwater RBCs for indoor workers, outdoor workers and construction workers.

TABLE 4-9: Summary Statistics for Shallow Groundwater – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
SVOCs	Acenaphthene	µg/L	5	1	20	0.19	10	0.094	0.094	0.094	0.094	--	--	M-103
	Acenaphthylene	µg/L	5	0	0	0.19	10	--	--	--	--	--	--	--
	Anthracene	µg/L	5	1	20	0.19	10	0.14	0.14	0.14	0.14	--	--	M-103
	Benzo(a)anthracene	µg/L	5	1	20	0.19	10	0.18	0.18	0.18	0.18	--	--	M-103
	Benzo(a)pyrene	µg/L	5	1	20	0.19	10	0.17	0.17	0.17	0.17	--	--	M-103
	Benzo(b)fluoranthene	µg/L	5	1	20	0.19	10	0.22	0.22	0.22	0.22	--	--	M-103
	Benzo(g,h,i)perylene	µg/L	5	1	20	0.19	10	0.19	0.19	0.19	0.19	--	--	M-103
	Benzo(k)fluoranthene	µg/L	5	1	20	0.19	10	0.23	0.23	0.23	0.23	--	--	M-103
	bis(2-Ethylhexyl)phthalate	µg/L	5	2	40	4.7	10	0.32	0.44	0.38	0.38	0.085	0.22	M-103
	Butylbenzylphthalate	µg/L	5	1	20	4.7	10	0.25	0.25	0.25	0.25	--	--	M-103
	Chrysene	µg/L	5	1	20	0.19	10	0.22	0.22	0.22	0.22	--	--	M-103
	Di-n-butylphthalate	µg/L	5	0	0	4.7	10	--	--	--	--	--	--	--
	Di-n-octylphthalate	µg/L	5	1	20	4.7	10	0.19	0.19	0.19	0.19	--	--	M-103
	Dibenz(a,h)anthracene	µg/L	5	1	20	0.19	10	0.21	0.21	0.21	0.21	--	--	M-103
	Diethylphthalate	µg/L	5	0	0	4.7	10	--	--	--	--	--	--	--
	Dimethylphthalate	µg/L	5	0	0	4.7	10	--	--	--	--	--	--	--
	Fluoranthene	µg/L	5	1	20	0.19	10	0.19	0.19	0.19	0.19	--	--	M-103
	Fluorene	µg/L	5	1	20	0.19	10	0.10	0.10	0.10	0.10	--	--	M-103
	Hexachlorobenzene	µg/L	5	1	20	0.19	10	0.13	0.13	0.13	0.13	--	--	M-103
	Hexachlorobutadiene	µg/L	13	0	0	0.25	10	--	--	--	--	--	--	--
	Indeno(1,2,3-cd)pyrene	µg/L	5	1	20	0.19	10	0.20	0.20	0.20	0.20	--	--	M-103
	2-Methylnaphthalene	µg/L	5	1	20	0.19	10	0.057	0.057	0.057	0.057	--	--	M-103
	Naphthalene	µg/L	13	0	0	0.19	10	--	--	--	--	--	--	--
	Nitrobenzene	µg/L	5	0	0	0.19	10	--	--	--	--	--	--	--
	Octachlorostyrene	µg/L	5	0	0	0.19	10	--	--	--	--	--	--	--
	Phenanthrene	µg/L	5	1	20	0.19	10	0.15	0.15	0.15	0.15	--	--	M-103
	Pyrene	µg/L	5	1	20	0.19	10	0.19	0.19	0.19	0.19	--	--	M-103
	Pyridine	µg/L	4	0	0	1.9	20	--	--	--	--	--	--	--

TABLE 4-9: Summary Statistics for Shallow Groundwater – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
VOCs	Acetone	µg/L	10	3	30	10	20	3.5	4.8	3.9	4.1	0.67	0.16	M-120
	t-Amyl methyl ether	µg/L	10	0	0	1.0	5.0	--	--	--	--	--	--	--
	Benzene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Bromobenzene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Bromochloromethane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Bromodichloromethane	µg/L	13	2	15	0.25	5.0	0.23	0.32	0.28	0.28	0.064	0.23	M-120
	Bromoform	µg/L	13	0	0	0.40	5.0	--	--	--	--	--	--	--
	Bromomethane	µg/L	13	0	0	0.25	10	--	--	--	--	--	--	--
	2-Butanone	µg/L	13	0	0	2.5	10	--	--	--	--	--	--	--
	n-Butylbenzene	µg/L	13	0	0	0.40	5.0	--	--	--	--	--	--	--
	sec-Butylbenzene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	tert-Butylbenzene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Carbon tetrachloride	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Chlorobenzene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Chloroethane	µg/L	13	0	0	0.40	5.0	--	--	--	--	--	--	--
	Chloroform	µg/L	13	9	69	5.0	5.0	0.54	3.8	2.6	2.2	1.1	0.49	M-120
	1-Chlorohexane	µg/L	5	0	0	5.0	5.0	--	--	--	--	--	--	--
	Chloromethane	µg/L	13	1	7.7	0.25	5.0	0.35	0.35	0.35	0.35	--	--	TR-10
	2-Chlorotoluene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	4-Chlorotoluene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Cumene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	p-Cymene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,2-Dibromo-3-chloropropane	µg/L	13	0	0	0.5	5.0	--	--	--	--	--	--	--
	Dibromochloromethane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,2-Dibromoethane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Dibromomethane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,2-Dichlorobenzene	µg/L	13	0	0	0.5	5.0	--	--	--	--	--	--	--
	1,3-Dichlorobenzene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--

TABLE 4-9: Summary Statistics for Shallow Groundwater – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
VOCs	1,4-Dichlorobenzene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Dichlorodifluoromethane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,1-Dichloroethane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,2-Dichloroethane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,1-Dichloroethene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	cis-1,2-Dichloroethene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	trans-1,2-Dichloroethene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,2-Dichloropropane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,3-Dichloropropane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	2,2-Dichloropropane	µg/L	13	0	0	0.40	5.0	--	--	--	--	--	--	--
	1,1-Dichloropropene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	cis-1,3-Dichloropropene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	trans-1,3-Dichloropropene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,4-Dioxane	µg/L	8	0	0	0.5	10	--	--	--	--	--	--	--
	Ethanol	µg/L	5	0	0	1000	1000	--	--	--	--	--	--	--
	Ethyl benzene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	2-Hexanone	µg/L	10	0	0	10	10	--	--	--	--	--	--	--
	Methanol	µg/L	5	0	0	1000	1000	--	--	--	--	--	--	--
	Methyl tert-butyl ether	µg/L	10	0	0	1.0	5.0	--	--	--	--	--	--	--
	4-Methyl-2-pentanone	µg/L	10	0	0	10	10	--	--	--	--	--	--	--
	Methylene Chloride	µg/L	13	0	0	0.88	10	--	--	--	--	--	--	--
	Diisopropyl ether	µg/L	10	0	0	1.0	5.0	--	--	--	--	--	--	--
	n-Propylbenzene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Styrene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,1,1,2-Tetrachloroethane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,1,2,2-Tetrachloroethane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Tetrachloroethene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Toluene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--

TABLE 4-9: Summary Statistics for Shallow Groundwater – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
VOCs	1,2,3-Trichlorobenzene	µg/L	13	0	0	0.40	5.0	--	--	--	--	--	--	--
	1,2,4-Trichlorobenzene	µg/L	13	0	0	0.40	5.0	--	--	--	--	--	--	--
	1,1,1-Trichloroethane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,1,2-Trichloroethane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Trichloroethene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Trichlorofluoromethane	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,2,3-Trichloropropane	µg/L	13	0	0	0.0025	5.0	--	--	--	--	--	--	--
	1,2,4-Trimethylbenzene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	1,3,5-Trimethylbenzene	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	Vinyl chloride	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	o-Xylene	µg/L	7	0	0	0.25	1.0	--	--	--	--	--	--	--
	m,p-Xylene	µg/L	7	0	0	0.50	2.0	--	--	--	--	--	--	--
	Xylenes (total)	µg/L	6	0	0	10	10	--	--	--	--	--	--	--
	Ethyl tert-butyl ether	µg/L	13	0	0	0.25	5.0	--	--	--	--	--	--	--
	tert Butyl alcohol	µg/L	5	0	0	5.0	100	--	--	--	--	--	--	--

Notes:

-- = not available

µg/L = microgram per liter

SVOC = Semivolatile organic compound

VOC = Volatile organic compound

TABLE 5-1. Concentration/Toxicity Screen – Parcel H Soil
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Detects		Screening Level [1]	Screening Level Note	No. of Samples > 0.1 x Screening Level	Concentration/ Toxicity Screen Result
						Maximum	Location of Maximum				
Chlorine Oxyanions	Chlorate	mg/kg	47	9	19	10	TSB-HJ-06	38,900	--	0	Pass
	Perchlorate	mg/kg	58	47	81	22	TSB-HR-04	908	--	0	Pass
Metals	Aluminum	mg/kg	58	58	100	9,970	TSB-HR-07	1,240,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
	Antimony	mg/kg	57	30	53	0.50	RSAU7	519	--	0	Pass
	Arsenic	mg/kg	58	58	100	5.2	TSB-HJ-01	7.2	Maximum BRC/TIMET background	--	Pass
	Barium	mg/kg	58	58	100	275	TSB-HR-05	238,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
	Beryllium	mg/kg	58	58	100	0.74	TSB-HR-07	2,540	--	0	Pass
	Boron	mg/kg	58	4	6.9	14	M-121	259,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
	Cadmium	mg/kg	58	19	33	0.69	M-120	1,260	--	0	Pass
	Calcium	mg/kg	58	58	100	158,000	TSB-HR-05	N/A	--	N/A	N/A
	Chromium (total)	mg/kg	58	58	100	14	TSB-HJ-09	1,950,000	Use chromium III as a surrogate, use health-based BCL instead of non-health based upper-limit	0	Pass
	Cobalt	mg/kg	58	58	100	9.5	TSB-HJ-09	385	--	0	Pass
	Copper	mg/kg	50	50	100	367	M-121	36,700	--	0	Pass
	Iron	mg/kg	58	58	100	18,200	RSAU7	908,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
	Lead	mg/kg	58	58	100	50	M-121	800	--	--	Pass
	Lithium	mg/kg	42	20	48	47	TSB-HJ-04	2,600	--	0	Pass
	Magnesium	mg/kg	58	58	100	17,000	TSB-HJ-04	5,200,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
	Manganese	mg/kg	57	57	100	684	M-121	28,100	--	0	Pass
	Mercury	mg/kg	58	22	38	0.033	TSB-HJ-04	389	Mercury compounds BCL is used	0	Pass
	Methyl mercury	mg/kg	2	1	50	0.000034	M-120	130	--	0	Pass
	Molybdenum	mg/kg	58	36	62	1.0	TSB-HJ-06	6,490	--	0	Pass
	Nickel	mg/kg	58	58	100	22	TSB-HJ-05	24,700	--	0	Pass
	Niobium	mg/kg	42	4	9.5	12	TSB-HJ-05	130	--	0	Pass
	Palladium	mg/kg	42	41	98	1.0	TSB-HR-04	N/A	--	N/A	N/A
	Phosphorus (total)	mg/kg	47	47	100	2,020	TSB-HJ-10	9,630,000	Use phosphoric acid as a surrogate, use health-based BCL instead of non-health based upper-limit, adjust BCL based on molecular weight	0	Pass
	Platinum	mg/kg	58	3	5.2	0.012	RSAU7	649	--	0	Pass
	Potassium	mg/kg	58	58	100	2,630	M-118	N/A	--	N/A	N/A
	Selenium	mg/kg	58	13	22	0.80	RSAU6	6,490	--	0	Pass
	Silicon	mg/kg	42	42	100	578	TSB-HJ-11	N/A	--	N/A	N/A
	Silver	mg/kg	58	19	33	0.15	M-121	6,490	--	0	Pass
	Sodium	mg/kg	58	57	98	1230	M-118	N/A	--	N/A	N/A
	Strontium	mg/kg	58	58	100	500	TSB-HR-04	779,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
	Sulfur	mg/kg	42	2	4.8	2,400	TSB-HJ-04	N/A	--	N/A	N/A
	Thallium	mg/kg	58	7	12	0.34	M-118	13	--	0	Pass
	Tin	mg/kg	58	18	31	4.9	RSAU7	779,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
	Titanium	mg/kg	58	58	100	950	RSAU7	5,190,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
	Tungsten	mg/kg	58	7	12	0.67	M-118	1,040	--	0	Pass
	Uranium (total)	mg/kg	58	58	100	26	M-120	3,830	--	0	Pass
	Vanadium	mg/kg	58	58	100	56	RSAU7	6,420	--	0	Pass
	Zinc	mg/kg	58	58	100	67	M-120	389,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
Metals	Zirconium	mg/kg	42	42	100	26	TSB-HJ-09	104	--	41	Fail
Other Inorganics	Ammonia	mg/kg	5	2	40	4.6	M-120	6,140	--	0	Pass
	Bromide	mg/kg	47	5	11	4.5	TSB-HR-03	441,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
	Chloride	mg/kg	47	45	96	1,640	TSB-HJ-10	113,000	Use health-based BCL instead of non-health based upper-limit (consider chloride as non-volatile)	0	Pass
	Fluoride	mg/kg	44	21	48	2.0	M-120	51,900	--	0	Pass
	Nitrate	mg/kg	47	43	91	39	TSB-HR-01	2,080,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
	Nitrite	mg/kg	47	1	2.1	0.13	TSB-HR-03	130,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
	Sulfate	mg/kg	47	44	94	640	TSB-HR-04	N/A	--	N/A	N/A
Radionuclides	Radium-226	pCi/g	58	58	100	2.5	TSB-HR-02	0.023	--	58	Fail
	Radium-228	pCi/g	58	58	100	3.0	TSB-HJ-07	0.041	--	58	Fail
	Thorium-228	pCi/g	55	55	100	3.0	M-121	0.025	--	55	Fail
	Thorium-230	pCi/g	55	55	100	3.0	TSB-HR-03	8.4	--	51	Fail

TABLE 5-1. Concentration/Toxicity Screen – Parcel H Soil
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Detects		Screening Level [1]	Screening Level Note	No. of Samples > 0.1 x Screening Level	Concentration/ Toxicity Screen Result
						Maximum	Location of Maximum				
Radionuclides	Thorium-232	pCi/g	55	55	100	2.7	TSB-HJ-11	7.4	--	55	Fail
	Uranium-234	pCi/g	55	55	100	3.5	TSB-HR-02	11	--	36	Fail
	Uranium-235	pCi/g	58	58	100	0.20	M-117	0.35	--	46	Fail
	Uranium-238	pCi/g	58	58	100	2.6	TSB-HR-03	1.4	--	57	Fail
Dioxin/Furans	2,3,7,8-TCDD TEQ*	mg/kg	47	23	49	0.000021	RSAU7	0.0027	Site-specific action level	--	Pass
PAHs	BaPEq*	mg/kg	47	2	4.3	0.0090	RSAU7	0.32	--	0	Pass
	Benzo(g,h,i)perylene	mg/kg	47	1	2.1	0.0028	RSAU7	25,300	--	0	Pass
	Fluoranthene	mg/kg	47	2	4.3	0.0066	RSAU7	33,700	--	0	Pass
	Phenanthrene	mg/kg	47	1	2.1	0.0038	RSAU7	25	--	0	Pass
	Pyrene	mg/kg	47	2	4.3	0.0063	RSAU7	44	--	0	Pass
Pesticides - OCPs	beta-BHC	mg/kg	47	6	13	0.040	TSB-HJ-09	1.7	--	0	Pass
	4,4'-DDD	mg/kg	47	1	2.1	0.0035	TSB-HJ-09	15	--	0	Pass
	2,4'-DDE	mg/kg	42	1	2.4	0.014	TSB-HJ-09	9.5	Use 4,4'-DDE as a surrogate	0	Pass
	4,4'-DDE	mg/kg	47	2	4.3	0.060	TSB-HJ-09	9.5	--	0	Pass
	4,4'-DDT	mg/kg	47	2	4.3	0.089	TSB-HJ-09	7.5	--	0	Pass
	Hexachlorobenzene	mg/kg	47	1	2.1	0.21	RSAU6	0.23	--	1	Fail
SVOCs	bis(2-Ethylhexyl)phthalate	mg/kg	47	1	2.1	0.069	TSB-HJ-01	183	--	0	Pass
	Butylbenzylphthalate	mg/kg	47	1	2.1	0.11	TSB-HJ-01	1,350	--	0	Pass
VOCs	Acetone	mg/kg	58	8	14	0.024	RSAU6	1,040,000	Use health-based BCL instead of non-health based upper-limit	0	Pass
	Acetonitrile	mg/kg	42	1	2.4	0.021	TSB-HR-03	3,750	--	0	Pass
	2-Butanone	mg/kg	58	2	3.5	0.0018	RSAU7	28,400	--	0	Pass
	Methylene Chloride	mg/kg	58	24	41	0.021	TSB-HJ-01	1,550	--	0	Pass
	Toluene	mg/kg	58	7	12	0.0028	RSAU7	817	--	0	Pass
	Trichlorofluoromethane	mg/kg	58	1	1.7	0.0027	M-117	1,210	--	0	Pass
	1,2,4-Trimethylbenzene	mg/kg	58	8	14	0.00055	TSB-HJ-04	218	--	0	Pass

Notes:

-- = Not applicable
mg/kg = milligram per kilogram
pCi/g = picocurie per gram
BaPEq = Benzo(a)pyrene equivalent
BCL = Basic Comparison Level
BHC = Hexachlorocyclohexane
COPC = Chemical of Potential Concern
DDD = Dichlorodiphenyldichloroethane
DDE = Dichlorodiphenyldichloroethylene
DDT = Dichlorodiphenyltrichloroethane
N/A = BCL (other screening value) not available for screen
NDEP = Neveda Department of Environmental Protection
OCP = Organochlorine pesticide
PAH = Polycyclic aromatic hydrocarbon
SVOC = Semivolatile organic compound
TCDD = Tetrachlorodibenzo-p-dioxin
TEQ = Toxicity equivalent
VOC = Volatile organic compound
* Methodology for equivalent calculations explained in text
[1] Screening levels are the lowest level among the indoor worker and outdoor worker BCLs (NDEP 2017), unless noted.

indicates analyte is carried forward to COPC identification Step 2. For arsenic, lead, and 2,3,7,8-TCDD TEQ, the maximum detected concentration is compared directly to the screening level. For all other analytes, the maximum detected concentration is compared to 0.1 x screening level. If the maximum detected concentration is greater than or equal to the 0.1 x screening level, the analyte "fails" and is carried forward to Step 2. If less than the 0.1 x screening level, the analyte "passes" and is eliminated as a COPC. By default, analytes for which screening levels are not available are retained for Step 2 (metals) and Step 3 (organics).

Source:

NDEP. 2017. User's Guide and Background Technical Document for NDEP Basic Comparison Levels (BCLs) for Human Health for the BMI Complex and Common Areas. Revision 14, July.

TABLE 5-2. Results of the Soil Background Evaluation for Metals Carried Forward from the Concentration/Toxicity Screen

Nevada Environmental Response Trust Site

Henderson, Nevada

Parcel	Chemical Name	Fail Statistical Testing for Background Consistency?[1]
H	Calcium	Yes
	Palladium	NA
	Potassium	No
	Silicon	NA
	Sodium	No
	Sulfur	NA
	Zirconium	NA

Notes:

NA = Background data are not available

element is present at concentrations greater than background or background data are not available.

[1] Based on background evaluation presented in Appendix I.

TABLE 5-3. Results of the Soil Background Evaluation for Radionuclides Carried Forward from the Concentration/Toxicity Screen

Nevada Environmental Response Trust Site

Henderson, Nevada

Parcel	Chain	Secular Equilibrium?	Radionuclide	Fail Statistical Testing for Background Consistency?[1]	Hydrofluoric Acid Digestion?
H	Uranium-238	in Secular Equilibrium	Uranium-238	Yes	Yes
			Uranium-234	Yes	
			Thorium-230	Yes	
			Radium-226	Yes	
	Thorium-232	In Secular Equilibrium	Thorium-232	Yes	Yes
			Radium-228	Yes	
			Thorium-228	Yes	
	Uranium-235	--	Uranium-235	No	Yes

Notes:

-- = Not evaluated

radionuclide is present at concentrations greater than background.

[1] Based on background analysis presented in Appendix I.

TABLE 5-4. Comparison of Cancer Risks for Radionuclides between Parcel H Soils and Background Soils
Nevada Environmental Response Trust Site
Henderson, Nevada

Chain	Radionuclide	Commercial/Industrial BCL (pCi/g)	Parcel H		RZ-A Background		BRC/TIMET Background	
			95% UCL (pCi/g)	Cancer Risk	95% UCL (pCi/g)	Cancer Risk	95% UCL (pCi/g)	Cancer Risk
Uranium-238	Uranium-238	1.4	1.4	1.0E-06	1.1	7.8E-07	1.1	8.2E-07
	Uranium-234	11	1.7	1.5E-07	1.2	1.0E-07	1.2	1.1E-07
	Thorium-230	8.4	1.6	1.9E-07	1.2	1.4E-07	1.3	1.6E-07
	Radium-226	0.023	1.4	5.9E-05	1.1	4.6E-05	1.2	5.1E-05
Thorium-232	Thorium-232	7.4	1.9	2.5E-07	1.6	2.1E-07	1.7	2.2E-07
	Radium-228	0.041	1.7	4.1E-05	1.4	3.5E-05	2.0	4.9E-05
	Thorium-228	0.025	2.0	8.2E-05	1.8	7.3E-05	1.7	6.9E-05
Uranium-235	Uranium-235	0.35	0.073	2.1E-07	0.065	1.9E-07	0.072	2.1E-07
Total Cancer Risk			**--**	**2E-04**	**--**	**2E-04**	**--**	**2E-04**

Notes:

-- = Not applicable

pCi/g = picocurie per gram

BCL = Basic Comparison Level

UCL = Upper Confidence Limit

TABLE 5-5. Soil COPCs Identified for Parcel H (0-10 feet bgs)

Nevada Environmental Response Trust Site

Henderson, Nevada

Chemical Group	COPC	Parcel H
Metals	Palladium [1] [2]	X
	Zirconium [2]	X
Pesticides - OCPs	Hexachlorobenzene	X
Asbestos	Long amphibole fibers	X
	Long chrysotile fibers	X

Notes:

bgs = below ground surface

BCL = Basic Comparison Level

COPC = Chemical of Potential Concern

OCP = Organochlorine pesticides

[1] Retained as a COPC in the absence of a BCL or other screening level. This COPC is discussed qualitatively in the uncertainty section.

[2] RZ-A background data are not available for this chemical. The Parcel H data are compared to BRC/TIMET regional background data in the uncertainty section.

TABLE 5-6. Soil Gas and Shallow Groundwater COPCs Identified for Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Chemical Name [a]	Soil Gas [b]	Shallow Groundwater	Volatile Compounds? [c]
VOCs	Acetone	X	X	V
VOCs	Acrylonitrile	X		V
VOCs	Benzene	X		V
VOCs	Bromodichloromethane		X	V
VOCs	2-Butanone	X		V
VOCs	n-Butylbenzene	X		V
VOCs	sec-Butylbenzene	X		V
VOCs	Carbon disulfide	X		V
VOCs	Carbon tetrachloride	X		V
VOCs	Chloroethane	X		V
VOCs	Chloroform	X	X	V
VOCs	Cumene	X		V
VOCs	p-Cymene	X		V
VOCs	1,4-Dichlorobenzene	X		V
VOCs	Dichlorodifluoromethane	X		V
VOCs	1,4-Dioxane	X		V
VOCs	Ethanol	X		V
VOCs	Ethyl benzene	X		V
VOCs	4-Ethyltoluene	X		V
VOCs	Freon 114	X		V
VOCs	n-Heptane	X		V
VOCs	2-Hexanone	X		V
VOCs	4-Methyl-2-pentanone	X		V
VOCs	Methylene Chloride	X		V
VOCs	Methylmethacrylate	X		V
VOCs	n-Octane	X		V
VOCs	n-Propylbenzene	X		V
VOCs	Styrene	X		V
VOCs	alpha-Methylstyrene	X		V
VOCs	tert Butyl alcohol	X		V
VOCs	1,1,2,2-Tetrachloroethane	X		V
VOCs	Tetrachloroethene	X		V
VOCs	Toluene	X		V
VOCs	1,2,4-Trichlorobenzene	X		V
VOCs	Trichloroethene	X		V
VOCs	Trichlorofluoromethane	X		V
VOCs	1,1,2-Trichloro-1,2,2-trifluoroethane	X		V
VOCs	1,2,4-Trimethylbenzene	X		V
VOCs	1,3,5-Trimethylbenzene	X		V
VOCs	Vinyl acetate	X		V
VOCs	o-Xylene	X		V
VOCs	m,p-Xylene	X		V
SVOCs	Acenaphthene		X	V
SVOCs	Anthracene		X	V
SVOCs	Benzo(a)anthracene		X	V
SVOCs	Benzo(a)pyrene		X	
SVOCs	Benzo(b)fluoranthene		X	
SVOCs	Benzo(g,h,i)perylene		X	

TABLE 5-6. Soil Gas and Shallow Groundwater COPCs Identified for Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Chemical Name [a]	Soil Gas [b]	Shallow Groundwater	Volatile Compounds? [c]
SVOCs	Benzo(k)fluoranthene		X	
SVOCs	bis(2-Ethylhexyl)phthalate		X	
SVOCs	Butylbenzylphthalate		X	
SVOCs	Chrysene		X	
SVOCs	Dibenz(a,h)anthracene		X	
SVOCs	Di-n-octylphthalate		X	
SVOCs	Fluoranthene		X	
SVOCs	Fluorene		X	V
SVOCs	Hexachlorobenzene		X	V
SVOCs	Indeno(1,2,3-cd)pyrene		X	
SVOCs	2-Methylnaphthalene		X	V
SVOCs	Naphthalene	X		V
SVOCs	Phenanthrene		X	
SVOCs	Pyrene		X	V

Notes:
X = Indicate a constituent was detected in a specific medium.
atm = atmosphere
m^3 = cubic meter
mm Hg = millimeter mercury
SVOC = Semivolatile organic compound
VOC = Volatile organic compound
USEPA = United States Environmental Protection Agency

[a] Based on detected constituents in soil gas and the most recent two years of shallow groundwater sampling

[b] Only 5 feet soil gas samples were collected within Parcel H.

[c] The volatile compounds were identified using the following criteria consistent with recommendation from the USEPA Regional Screening Levels Table (USEPA 2016): 1) vapor pressure greater than 1 mm Hg or 2) Henry's Law constant greater than 0.00001 atm or m3/mole.

Source:
USEPA. 2017. Regional Screening Levels. June.

TABLE 5-7A. Soil EPCs and EPCs of Airborne Particulates and Vapors for Parcel H_0-2 feet bgs

Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Chemical Group	COPC	Soil EPC [1] (mg/kg)	Airborne Particulate EPC [1] (µg/m^3)		Vapor EPC [1] (µg/m^3)	
				Indoor and Outdoor Commercial/ Industrial Worker	Construction Worker	Indoor and Outdoor Commercial/ Industrial Worker	Construction Worker
H	Metal	Palladium	0.47	0.00000049	0.00011	--	--
		Zirconium	25	0.000026	0.0059	--	--
	Pesticides - OCP	Hexachlorobenzene	0.21	0.00000022	0.000049	0.0092	0.059

Notes:

-- = Not applicable
bgs = below ground surface
mg/kg = milligram per kilogram
µg/m^3 = microgram per cubic meter
BaPEq = Benzo[a]pyrene equivalent
COPC = Constituent of potential concern
EPC = Exposure point concentration
OCP = Organochlorine pesticide
[1] The maximum detected concentration over 0-2 feet bgs was used as EPC.

TABLE 5-7B. Soil EPCs and EPCs of Airborne Particulates and Vapors for Parcel H_0-10 feet bgs

Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Chemical Group	COPC	Soil EPC [1] (mg/kg)	Airborne Particulate EPC [1] (µg/m^3)		Vapor EPC [1] (µg/m^3)	
				Indoor and Outdoor Commercial/ Industrial Worker	Construction Worker	Indoor and Outdoor Commercial/ Industrial Worker	Construction Worker
H	Metal	Palladium	1.0	0.0000010	0.00024	--	--
		Zirconium	26	0.000028	0.0062	--	--
	Pesticides - OCP	Hexachlorobenzene	0.21	0.00000022	0.000049	0.0092	0.059

Notes:

-- = Not applicable
bgs = below ground surface
mg/kg = milligram per kilogram
µg/m^3 = microgram per cubic meter
BaPEq = Benzo[a]pyrene equivalent
COPC = Constituent of potential concern
EPC = Exposure point concentration
OCP = Organochlorine pesticide
[1] The maximum detected concentration over 0-10 feet bgs was used as EPC.

TABLE 5-8. Calculation of Particulate Emission Factors
Nevada Environmental Response Trust Site
Henderson, Nevada

Parameter	Symbol	Value	Unit	Reference
		Parcel H		
Indoor and Outdoor Commercial/Industrial Worker				
Fraction of vegetative cover	V	0.5	unitless	USEPA 2002
Mean annual wind speed	U_m	4.1	m/s	[1]
Equivalent threshold value of wind speed	U_t	11.32	m/s	USEPA 2002
Function dependent on U/U_t	F(x)	0.19	unitless	USEPA 2002
Air dispersion factor for area source (calculated)	Q/C_{wind}	44.24	g/m^2-s per kg/m^3	USEPA 2002
Dispersion factor for area source - Constant A (Las Vegas, NV)	A	13.31	unitless	USEPA 2002
Dispersion factor for area source - Constant B (Las Vegas, NV)	B	19.84	unitless	USEPA 2002
Dispersion factor for area source - Constant C (Las Vegas, NV)	C	230.17	unitless	USEPA 2002
Areal extent of site surface contamination	A_{surf}	26	acre	Area of parcel
Particulate emission factor (calculated)	**PEF**	**9.5E+08**	**m^3/kg**	**Neptune 2015**
Construction Worker				
Fraction of vegetative cover	V	0	unitless	USEPA 2002
Mean annual wind speed	U_m	4.1	m/s	[1]
Equivalent threshold value of wind speed	U_t	11.32	m/s	USEPA 2002
Function dependent on U/U_t	F(x)	0.19	unitless	USEPA 2002
Areal extent of site surface contamination	A_{surf}	24.8	acre	Area of parcel
Wet soil bulk density	r_{soil}	1.87	g/cm^3	[2]
Percent of soil moisture content	M	14.8	%	[2]
Areal extent of site excavation	A_{excav}	20,842	m^2	[3]
Depth of site excavation	d_{excav}	1.0	m	USEPA 2002
Number of times soil is dumped	N_A	2	unitless	USEPA 2002
Percent of soil silt content	s	10	%	[4]
Average dozing speed	S_{doz}	11.4	km/hr	USEPA 2002
Number of times area is dozed	N_{doze}	3	unitless	USEPA 2002
Length of dozer blade	B_d	2.44	m	USEPA 2002
Average grading speed	S_{grade}	11.4	km/hr	USEPA 2002
Number of times area is graded	N_{grade}	3	unitless	USEPA 2002
Length of dozer blade	B_g	2.44	m	USEPA 2002
Areal extent of site tilling	A_{till}	5.15	acre	[3]
Number of times soil is tilled	N_A	2	unitless	USEPA 2002
Subchronic dispersion factor for area source-Constant A	A	2.45	unitless	USEPA 2002
Subchronic dispersion factor for area source-Constant B	B	17.57	unitless	USEPA 2002
Subchronic dispersion factor for area source-Constant C	C	189.04	unitless	USEPA 2002
Length of road segment	L_R	322.82	m	[5]
Width of road segment	W_R	6.1	m	USEPA 2002
Mean vehicle weight	W	8.0	ton	USEPA 2002
Percent of moisture in dry road surface	M_{dry}	0.20	%	USEPA 2002
Number of days/year with at least 0.01 inches of precipitation	p	27	day	Neptune 2015
Number of vehicles for duration of construction	N_V	30	unitless	USEPA 2002
Length of road traveled per day	L_D	322.82	m/day	[5]
Subchronic dispersion factor for road segment-Constant A	A	12.94	unitless	USEPA 2002
Subchronic dispersion factor for road segment-Constant B	B	5.74	unitless	USEPA 2002

TABLE 5-8. Calculation of Particulate Emission Factors
Nevada Environmental Response Trust Site
Henderson, Nevada

Parameter	Symbol	Value	Unit	Reference
		Parcel H		
Subchronic dispersion factor for road segment-Constant C	C	71.77	unitless	USEPA 2002
Particulate emission factor (calculated)	**PEF**	**4.3E+06**	**m^3/kg**	**Neptune 2015**

Notes:

g/cm^3 = gram per cubic centimeter

g/m^2-s per kg/m^3 = (gram per square meter per second) per (koligram per cubic meter)

km/hr = kilometer per hour

m = meter

m/day = meter per day

m/s = meter per second

m^2 = square meter

m^3/kg = cubic meter per kilogram

USEPA = United States Environmental Protection Agency

WRCC = Western Regional Climate Center

[1] Average wind speeds for Las Vegas derived from WRCC (2010).

[2] Average value of top 10-foot samples reported in (Northgate 2010).

[3] Assumed one fifth of the parcel area based upon USEPA (2002).

[4] Soil silt content varied from 5% to 10% among soil boring logs from multiple investigations at the Site. The value of 10% was selected to be conservative.

[5] Assumed the square root of the parcel area, based upon USEPA (2002).

Sources:

Neptune. 2015. Technical Guidance for the Calculation of Asbestos Related Risk in Soils for the Basic Management Incorporated (BMI) Complex and Common Areas. February.

Northgate. 2010. Site-Wide Soil Gas Human Health Risk Assessment, Tronox LLC, Henderson, Nevada. November.

USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.

WRCC (2010). Desert Research Institute: http://www.wrcc.dri.edu/htmlfiles/westwind.final.html#NEVADA.

TABLE 5-9. Johnson and Ettinger/Jury Modeling Parameters
Nevada Environmental Response Trust Site
Henderson, Nevada

Parameter	Value	Units	Notes
Source/Receptor Parameters - Indoor and Outdoor Scenarios			
Depth to groundwater: Parcel H	55	feet	Site-specific estimate
Soil gas sampling depth (shallow)	5	feet	Site-specific estimated based on sampling depth
Depth to top of soil contamination	1	cm	Conservative estimate
Depth to base of soil contamination	55	ft	Conservative estimate that assumes VOCs in soil extend until the water table depth.
Soil temperature at source	17	Celsius	Site-specific measurement
Soil Parameters			
USDA soil type	Loamy Sand	--	Site-specific estimate based on soil boring logs and site measurements. See text for further discussion.
Bulk density	1.722	g/cm^3	Site-specific measurement
Total porosity	0.358	unitless	Site-specific measurement
Water-filled porosity	0.148	unitless	Site-specific measurement
Parameters used for benzene degradation			
Fraction organic carbon	0.006	unitless	Default value (USEPA 2002)
Minimum oxygen content for aerobic respiration	1	percentage	Default value (API 2012)
First order biodegradation rate for benzene	0.79	1/hr	Default value (API 2012)
Building Foundation Parameters			
Depth to Bottom of Foundation, Slab-on-grade	15	cm	Default value (Cal/EPA 2011)
Foundation crack ratio	0.005	unitless	Default value (Cal/EPA 2011)
Average vapor flow rate into building	5	$L/min/m^2$	Default value (USEPA 2004)
Foundation thickness	10	cm	Default value (Cal/EPA 2011)
Mixing height of building, Slab-on-grade	244	cm	Residential default value (Cal/EPA 2011)
Commercial Indoor Air Scenarios			
Air exchange rate	1	1/hour	Default value for commercial buildings (Cal/EPA 2011)
Length of building	1000	cm	Default value for commercial buildings (USEPA 2004)
Width of building	1000	cm	Default value for commercial buildings (USEPA 2004)
Mixing height of building, Slab-on-grade	305	cm	Engineering estimate.
Air Dispersion Parameters **- Outdoor Scenario**			
Commercial Outdoor Air Scenarios			
Site specific dispersion factor (Q/C): Parcel H	44	g/m^2-s per kg/m^3	Site-specific estimate based on parcel area of 24.81 acres.
Source/Receptor Parameters -10 foot Construction Trench Scenario			
Depth to groundwater: Parcel H	45	feet	Site-specific estimate
Soil gas sampling depth	1	cm	Site-specific estimate for depth between trench and soil gas sample
Length of construction trench	609.6	cm	Assumed (20 feet)
Width of construction trench	152	cm	Assumed (5 feet)
Depth of construction trench	10	feet	Assumed
Windspeed	0.41	m/s	Conservative Estimate (1/10 of site-specific windspeed)
Site specific dispersion factor (Q/C_{vol})	34.17	g/m^2-s per kg/m^3	Site-specific estimate based on box model.

Notes:
-- =Not applicable
cm = centimeter
g/cm^3 = gram per cubic centimeter
$L/min/m^2$ = liter per minute per 100 square meter

Cal/EPA = California Environmental Protection Agency
USDA = United States Department of Agriculture
USEPA = United States Environmental Protection Agency

Sources:

California Environmental Protection Agency (Cal/EPA). 2005. Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil. January.

California Environmental Protection Agency (CalEPA). 2011. Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance). Final. Department of Toxic Substances Control. October.

United States Environmental Protection Agency (USEPA). 2004. User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings Office of Emergency and Remedial Response. February.

United States Environmental Protection Agency (USEPA). 2002. Supplemental Guidance for Developing. Soil Screening Levels for Superfund Sites. December

American Petroleum Institute (API) 2012. BIOVAPOR – A 1-D Vapor Intrusion Model with Oxygen-Limited Aerobic Biodegradation. Version 2.1. November

TABLE 5-10. Physical/Chemical Properties
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Constituent [a, b]	Molecular Weight	Organic Carbon Partition Coefficient	Diffusivity in Air	Diffusivity in Water	Pure Component Water Solubility	Henry's Law Constant at 25° C	Normal Boiling Point	Critical Temperature	Enthalpy of Vaporization at the Normal Boiling Point	Source
		MW	K_{oc}	D_a	D_w	S	H	T_B	T_C	ΔHv,b	
		(g/mol)	(cm^3/g)	(cm^2/s)	(cm^2/s)	(mg/L)	(atm-m^3/mol)	(^oK)	(^oK)	(cal/mol)	
VOCs	Acetaldehyde	4.40E+01	1.81E+01	1.24E-01	1.41E-05	1.00E+06	7.90E-05				NDEP
VOCs	Acetone	5.80E+01	5.75E-01	1.24E-01	1.14E-05	1.00E+06	3.88E-05	3.29E+02	5.08E+02	6.96E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Acetonitrile	4.10E+01	1.56E+01	1.28E-01	1.70E-05	1.00E+06	2.00E-05	3.55E+02	5.46E+02	7.11E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Acrylonitrile	5.30E+01	8.50E-01	1.08E-01	1.34E-05	7.90E+04	8.84E-05	3.50E+02	5.19E+02	7.79E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	t-Amyl methyl ether	1.02E+02	2.27E+01	6.50E-02	7.80E-06	2.64E+03	1.32E-03				EPISUITE + diisopropyl ether for diffusivities
VOCs	Benzene	7.81E+01	6.20E+01	8.80E-02	9.80E-06	1.75E+03	5.55E-03	3.53E+02	5.62E+02	7.34E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Benzyl chloride	1.27E+02	5.00E+01	6.66E-02	7.80E-06	3.30E+03	5.06E-05				NDEP
VOCs	Bromobenzene	1.57E+02	2.24E+02	7.30E-02	8.70E-06	4.72E+02	3.70E-03				NDEP
VOCs	Bromochloromethane	1.29E+02	2.17E+01	7.87E-02	1.22E-05	1.67E+04	1.46E-03				RSL
VOCs	Bromodichloromethane	1.64E+02	1.00E+02	2.98E-02	1.06E-05	6.74E+03	1.60E-03	3.63E+02	5.86E+02	7.80E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Bromoform	2.53E+02	3.18E+01	3.57E-02	1.04E-05	3.10E+03	5.35E-04	4.22E+02	6.96E+02	9.48E+03	RSL + USEPA 2004 for Tb, Tc, and ΔH
VOCs	Bromomethane	9.50E+01	9.00E+00	7.28E-02	1.21E-05	1.52E+04	6.24E-03	2.77E+02	4.67E+02	5.71E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,3-Butadiene	5.40E+01	1.20E+02	9.80E-02	1.10E-05	7.35E+02	1.78E-01				NDEP
VOCs	2-Butanone	7.20E+01	4.50E+00	8.95E-02	9.80E-06	2.68E+05	2.74E-05	3.53E+02	5.37E+02	7.48E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	n-Butylbenzene	1.34E+02	2.83E+03	7.50E-02	7.80E-06	1.38E+01	1.31E-02	4.56E+02	6.61E+02	9.29E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	sec-Butylbenzene	1.34E+02	2.15E+03	7.50E-02	7.80E-06	1.70E+01	1.87E-02	4.47E+02	6.79E+02	8.87E+04	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	tert-Butylbenzene	1.34E+02	2.15E+03	7.50E-02	7.80E-06	3.00E+01	1.26E-02				NDEP
VOCs	Carbon disulfide	7.60E+01	4.57E+01	1.04E-01	1.00E-05	1.19E+03	3.03E-02	3.19E+02	5.52E+02	6.39E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Carbon tetrachloride	1.54E+02	1.52E+02	7.80E-02	8.80E-06	7.93E+02	3.04E-02	3.50E+02	5.57E+02	7.13E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	3-Chloro-1-propene	7.70E+01	4.38E+01	9.40E-02	1.10E-05	3.37E+03	1.10E-02				NDEP
VOCs	Chlorobenzene	1.13E+02	2.24E+02	7.30E-02	8.70E-06	4.72E+02	3.70E-03	4.05E+02	6.32E+02	8.41E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Chloroethane	6.50E+01	1.47E+01	1.04E-01	1.15E-05	5.70E+03	1.10E-02	2.85E+02	4.60E+02	5.88E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Chloroform	1.19E+02	5.30E+01	1.04E-01	1.00E-05	7.92E+03	3.67E-03	3.34E+02	5.36E+02	6.99E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1-Chlorohexane	1.03E+02	2.40E+02	2.00E-01	7.77E-06	9.10E+01	2.42E-02				EPISUITE + n-Hexane for diffusivities
VOCs	Chloromethane	5.10E+01	3.50E+01	1.09E-01	6.50E-06	8.20E+03	2.40E-02	2.49E+02	4.16E+02	5.11E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	2-Chlorotoluene	1.27E+02	1.60E+02	7.20E-02	8.65E-06	4.70E+02	3.50E-03				NDEP
VOCs	4-Chlorotoluene	1.27E+02	3.75E+02	6.26E-02	8.66E-06	1.06E+02	4.38E-03				RSL
VOCs	Cumene	1.20E+02	2.20E+02	7.50E-02	7.10E-06	6.10E+01	1.20E+00	4.26E+02	6.31E+02	1.03E+04	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Cyclohexane	8.40E+01	1.60E+02	8.00E-02	9.00E-06	5.50E+01	1.98E-01				NDEP
VOCs	p-Cymene	1.34E+02	2.20E+02	7.50E-02	7.10E-06	6.10E+01	1.20E+00				NDEP
VOCs	1,2-Dibromo-3-chloropropane	2.36E+02	1.70E+02	8.00E-02	8.00E-06	1.23E+03	1.50E-04				R
VOCs	Dibromochloromethane	2.08E+02	6.31E+01	1.96E-02	1.05E-05	2.70E+03	8.50E-04	4.16E+02	6.78E+02	5.90E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,2-Dibromoethane	1.88E+02	2.81E+01	7.33E-02	8.06E-06	3.40E+03	3.20E-04	4.05E+02	5.83E+02	8.31E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Dibromomethane	1.74E+02	1.82E+02	8.00E-02	8.00E-06	1.19E+04	9.00E-04	3.70E+02	5.83E+02	7.87E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,2-Dichlorobenzene	1.47E+02	3.79E+02	6.90E-02	7.90E-06	1.56E+02	1.90E-03	4.54E+02	7.05E+02	9.70E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,3-Dichlorobenzene	1.47E+02	3.79E+02	6.90E-02	7.90E-06	1.56E+02	1.90E-03	4.46E+02	6.84E+02	9.23E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,4-Dichlorobenzene	1.47E+02	6.16E+02	6.90E-02	7.90E-06	7.38E+01	2.43E-03	4.47E+02	6.85E+02	9.27E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Dichlorodifluoromethane	1.21E+02	5.80E+01	8.00E-02	1.05E-05	2.80E+02	1.00E-01	2.43E+02	3.85E+02	9.42E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,1-Dichloroethane	9.90E+01	5.30E+01	7.42E-02	1.05E-05	5.06E+03	5.62E-03	3.31E+02	5.23E+02	6.90E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,2-Dichloroethane	9.90E+01	3.80E+01	1.04E-01	9.90E-06	8.52E+03	9.79E-04	3.57E+02	5.61E+02	7.64E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH

TABLE 5-10. Physical/Chemical Properties
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Constituent [a, b]	Molecular Weight MW (g/mol)	Organic Carbon Partition Coefficient K_{oc} (cm^3/g)	Diffusivity in Air D_a (cm^2/s)	Diffusivity in Water D_w (cm^2/s)	Pure Component Water Solubility S (mg/L)	Henry's Law Constant at 25° C H ($atm\text{-}m^3/mol$)	Normal Boiling Point T_B (^oK)	Critical Temperature T_C (^oK)	Enthalpy of Vaporization at the Normal Boiling Point ΔHv,b (cal/mol)	Source
VOCs	1,1-Dichloroethene	9.70E+01	6.50E+01	9.00E-02	1.04E-05	2.25E+03	2.61E-02	3.05E+02	5.76E+02	6.25E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,2-Dichloroethene	9.69E+01	3.96E+01	7.36E-02	1.13E-05	3.61E-02	4.08E-03				EPISUITE + Cis-1,2-dichloroethene for diffusivities
VOCs	cis-1,2-Dichloroethene	9.70E+01	3.55E+01	7.36E-02	1.13E-05	3.50E+03	4.08E-03	3.34E+02	5.44E+02	7.19E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	trans-1,2-Dichloroethene	9.70E+01	3.80E+01	7.07E-02	1.19E-05	6.30E+03	9.38E-03	3.21E+02	5.17E+02	6.72E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,2-Dichloropropane	1.13E+02	4.70E+01	7.82E-02	8.73E-06	2.80E+03	2.80E-03	3.70E+02	5.72E+02	7.59E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,3-Dichloropropane	1.13E+02	4.70E+01	7.82E-02	8.73E-06	2.80E+03	2.80E-03				NDEP
VOCs	2,2-Dichloropropane	1.13E+02	4.39E+01	7.82E-02	8.73E-06	3.44E+02	1.61E-02				EPISUITE + 1,3-Dichloropropane for diffusivities
VOCs	1,1-Dichloropropene	1.11E+02	6.07E+01	6.26E-02	1.00E-05	7.49E+02	5.00E-02				EPISUITE + cis-1,3-Dichloropropene for diffusivities
VOCs	cis-1,3-Dichloropropene	1.11E+02	4.57E+01	6.26E-02	1.00E-05	2.80E+03	1.77E-02	3.81E+02	5.87E+02	7.90E+03	1,3-Dichloropropene (total) used as surrogate for all properties
VOCs	trans-1,3-Dichloropropene	1.11E+02	4.57E+01	6.26E-02	1.00E-05	2.80E+03	1.77E-02	3.81E+02	5.87E+02	7.90E+03	1,3-Dichloropropene (total) used as surrogate for all properties
VOCs	2,2-Dimethylpentane	1.00E+02	1.57E+02	6.50E-02	7.80E-06	4.40E+00	3.15E+00				EPISUITE + diisopropyl ether for diffusivities
VOCs	2,3-Dimethylpentane	1.00E+02	1.81E+02	6.50E-02	7.80E-06	5.25E+00	1.73E+00				EPISUITE + diisopropyl ether for diffusivities
VOCs	2,4-Dimethylpentane	1.00E+02	1.70E+02	6.50E-02	7.80E-06	5.50E+00	1.90E+00				EPISUITE + diisopropyl ether for diffusivities
VOCs	3,3-Dimethylpentane	1.00E+02	1.69E+02	6.50E-02	7.80E-06	5.92E+00	1.84E+00				EPISUITE + diisopropyl ether for diffusivities
VOCs	1,4-Dioxane	8.81E+01	2.63E+00	8.74E-02	1.05E-05	1.00E+06	4.80E-06				RSL
VOCs	Dimethyl disulfide	9.42E+01	3.96E+01	8.00E-02	1.00E-05	3.00E+03	1.21E-03				EPISUITE + Methyl tert-butyl ether for diffusivities
VOCs	Ethanol	4.60E+01	1.00E+00	1.24E-01	1.37E-05	1.00E+06	5.00E-06				NDEP
VOCs	Ethyl tert-butyl ether	1.02E+02	2.11E+01	6.50E-02	7.80E-06	2.64E+03	1.64E-03				EPISUITE + diisopropyl ether for diffusivities
VOCs	Ethyl acetate	8.80E+01	5.94E+01	7.32E-02	9.66E-06	8.00E+04	1.40E-04				NDEP
VOCs	Ethyl benzene	1.06E+02	2.04E+02	7.50E-02	7.80E-06	1.69E+02	7.88E-03	4.09E+02	6.17E+02	8.50E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	3-Ethylpentane	1.00E+02	2.21E+02	6.50E-02	7.80E-06	2.32E+01	2.27E+00				EPISUITE + diisopropyl ether for diffusivities
VOCs	4-Ethyltoluene	1.20E+02	2.20E+02	7.50E-02	7.10E-06	6.10E+01	1.20E+00				NDEP
VOCs	Formaldehyde	3.00E+01	3.63E+00	1.80E-01	2.00E-05	5.50E+05	3.40E-07				NDEP
VOCs	Freon 114	1.71E+02	1.97E+02	7.80E-02	8.20E-06	4.31E+01	1.51E+00				EPISUITE + 1,1,2-Trichloro-1,2,2-trifluoroethane for diffusivities
VOCs	n-Heptane	1.00E+02	8.20E+03	6.16E-02	6.45E-06	3.40E+00	2.00E+00				NDEP
VOCs	n-Hexane	8.60E+01	8.90E+02	2.00E-01	7.77E-06	1.80E+01	1.22E-01	3.42E+02	5.08E+02	6.90E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	2-Hexanone	1.00E+02	1.50E+01	7.00E-02	8.40E-06	1.72E+04	9.32E-05				NDEP
VOCs	Iodomethane	1.42E+02	1.40E+01	7.49E-02	1.15E-04	1.39E+04	5.40E-03				NDEP
VOCs	Methanol	3.20E+01	1.00E+00	1.58E-01	1.65E-05	1.00E+06	4.55E-06				RSL
VOCs	Methyl tert-butyl ether	8.50E+01	6.00E+00	8.00E-02	1.00E-05	1.50E+05	5.90E-04	3.28E+02	4.97E+02	6.68E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	4-Methyl-2-pentanone	1.00E+02	1.34E+02	7.50E-02	7.80E-06	1.90E+04	1.40E-04	3.90E+02	5.71E+02	8.24E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Methylene Chloride	8.50E+01	1.00E+01	1.01E-01	1.17E-05	1.32E+04	2.19E-03	3.13E+02	5.10E+02	6.71E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	2-Methylhexane	1.00E+02	2.02E+02	6.50E-02	7.80E-06	2.54E+00	3.43E+00				EPISUITE + diisopropyl ether for diffusivities
VOCs	3-Methylhexane	1.00E+02	2.11E+02	6.50E-02	7.80E-06	4.95E+00	1.64E+00				EPISUITE + diisopropyl ether for diffusivities
VOCs	Methylmethacrylate	1.00E+02	1.31E+01	7.70E-02	8.60E-06	1.50E+04	3.40E-04	3.74E+02	5.67E+02	8.97E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	2-Nitropropane	8.91E+01	3.08E+01	8.50E-02	1.00E-05	1.70E+04	1.19E-04				NDEP
VOCs	n-Nonyl aldehyde	1.42E+02	3.61E+01	7.50E-02	7.80E-06	9.60E+01	7.34E-04				EPISUITE + n-Butylbenzene for diffusivities
VOCs	n-Octane	1.14E+02	1.60E+04	7.09E-02	7.34E-06	6.60E-01	3.20E+00				NDEP
VOCs	Diisopropyl ether	1.02E+02	2.28E+01	6.54E-02	7.76E-06	8.80E+03	2.56E-03	3.42E+02	5.00E+02		RSL + USEPA 2004 for Tb, Tc, and ΔH
VOCs	n-Propylbenzene	1.20E+02	2.83E+03	7.50E-02	7.80E-06	1.38E+01	1.31E-02	4.32E+02	6.30E+02	9.12E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Styrene	1.04E+02	9.12E+02	7.10E-02	8.00E-06	3.10E+02	2.75E-03	4.18E+02	6.36E+02	8.74E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	alpha-Methylstyrene	1.18E+02	3.60E+02	7.12E-02	8.00E-06	3.00E+02	2.30E-03				NDEP
VOCs	tert Butyl alcohol	7.41E+01	2.92E+00	9.00E-02	1.00E-05	1.81E+05	9.05E-06				NDEP
VOCs	1,1,1,2-Tetrachloroethane	1.68E+02	7.90E+01	7.10E-02	7.90E-06	2.97E+03	3.45E-04	4.04E+02	6.24E+02	9.77E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH

TABLE 5-10. Physical/Chemical Properties
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Constituent [a, b]	Molecular Weight	Organic Carbon Partition Coefficient	Diffusivity in Air	Diffusivity in Water	Pure Component Water Solubility	Henry's Law Constant at 25° C	Normal Boiling Point	Critical Temperature	Enthalpy of Vaporization at the Normal Boiling Point	Source
		MW	K_{oc}	D_a	D_w	S	H	T_B	T_C	ΔHv,b	
		(g/mol)	(cm^3/g)	(cm^2/s)	(cm^2/s)	(mg/L)	(atm-m^3/mol)	(^oK)	(^oK)	(cal/mol)	
VOCs	1,1,2,2-Tetrachloroethane	1.68E+02	7.90E+01	7.10E-02	7.90E-06	2.97E+03	3.45E-04	4.20E+02	6.61E+02	9.00E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Tetrachloroethene	1.66E+02	2.65E+02	7.20E-02	8.20E-06	2.00E+02	1.84E-02	3.94E+02	6.20E+02	8.29E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Tetrahydrofuran	7.20E+01	9.50E-01	9.80E-02	1.10E-05	1.00E+06	7.00E-05				NDEP
VOCs	Toluene	9.20E+01	1.40E+02	8.70E-02	8.60E-06	5.26E+02	6.64E-03	3.84E+02	5.92E+02	7.93E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,2,3-Trichlorobenzene	1.81E+02	1.38E+03	3.95E-02	8.38E-06	1.80E+01	1.25E-03				RSL
VOCs	1,2,4-Trichlorobenzene	1.81E+02	1.66E+03	3.00E-02	8.23E-06	3.00E+02	1.42E-03	4.86E+02	7.25E+02	1.05E+04	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,3,5-Trichlorobenzene	1.81E+02	1.33E+03	7.50E-02	7.10E-06	3.00E+01	1.89E-03				EPISUITE + 1,2,4-Trimethylbenzene for diffusivities
VOCs	1,1,1-Trichloroethane	1.33E+02	1.35E+02	7.80E-02	8.80E-06	1.33E+03	1.72E-02	3.47E+02	5.45E+02	7.14E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,1,2-Trichloroethane	1.33E+02	7.50E+01	7.80E-02	8.80E-06	4.42E+03	9.13E-04	3.86E+02	6.02E+02	8.32E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Trichloroethene	1.31E+02	9.43E+01	7.90E-02	9.10E-06	1.10E+03	1.03E-02	3.60E+02	5.44E+02	7.51E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Trichlorofluoromethane	1.37E+02	1.60E+02	8.70E-02	1.30E-05	1.10E+03	9.70E-02	2.97E+02	4.71E+02	6.00E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,2,3-Trichloropropane	1.47E+02	5.10E+01	7.10E-02	7.90E-06	2.70E+03	2.80E-02	4.30E+02	6.52E+02	9.17E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,1,2-Trichloro-1,2,2-trifluoroethane	1.87E+02	1.60E+02	2.88E-02	8.07E-06	1.10E+03	5.21E-01	3.21E+02	4.87E+02	6.46E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,2,4-Trimethylbenzene	1.20E+02	3.72E+03	7.50E-02	7.10E-06	2.55E-01	5.70E-03	4.42E+02	6.49E+02	9.37E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	1,3,5-Trimethylbenzene	1.20E+02	8.19E+02	7.50E-02	7.10E-06	5.00E+01	7.71E-03	4.38E+02	6.37E+02	9.32E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	2,2,3-Trimethylbutane	1.00E+02	1.36E+02	6.50E-02	7.80E-06	2.89E+01	2.27E+00				EPISUITE + diisopropyl ether for diffusivities
VOCs	Vinyl acetate	8.60E+01	5.25E+00	8.50E-02	9.20E-06	2.00E+04	5.11E-04	3.46E+02	5.19E+02	7.80E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	Vinyl chloride	6.30E+01	1.86E+01	1.06E-01	1.23E-06	2.76E+03	2.70E-02	2.59E+02	4.32E+02	5.25E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	o-Xylene	1.06E+02	2.41E+02	8.70E-02	1.00E-05	1.78E+02	5.19E-03	4.18E+02	6.30E+02	8.66E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
VOCs	m,p-Xylene	1.06E+02	3.89E+02	7.69E-02	8.44E-06	1.85E+02	7.64E-03				USEPA 2004
VOCs	Xylenes (total)	1.06E+02	1.96E+02	7.00E-02	7.80E-06	1.61E+02	7.34E-03	4.12E+02	6.16E+02	8.53E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
SVOCs	Acenaphthene	1.54E+02	4.90E+03	4.21E-02	7.69E-06	4.24E+00	1.55E-04	5.51E+02	8.03E+02	1.22E+04	NDEP + USEPA 2004 for Tb, Tc, ΔH
SVOCs	Acenaphthylene	1.52E+02	1.50E+03	4.21E-02	7.69E-06	1.61E+01	1.14E-04		9.99E+02		NDEP + USEPA 2004 for Tb, Tc, ΔH
SVOCs	Acetophenone	1.20E+02	3.09E+01	6.00E-02	8.70E-06	6.10E+03	1.10E-05	4.75E+02	7.10E+02	1.17E+04	NDEP + USEPA 2004 for Tb, Tc, ΔH
SVOCs	Anthracene	1.78E+02	2.35E+04	3.24E-02	7.74E-06	4.34E-02	6.50E-05		9.99E+02		NDEP + USEPA 2004 for Tb, Tc, ΔH
SVOCs	Azobenzene	1.82E+02	1.95E+03	3.40E-02	7.00E-06	6.40E+00	1.34E-05				NDEP
SVOCs	Benzo(a)anthracene	2.28E+02	1.77E+05	2.61E-02	6.75E-06	9.40E-03	1.20E-05				RSL
SVOCs	bis(2-Chloroethyl) ether	1.43E+02	7.60E+01	6.92E-02	7.53E-06	1.72E+04	1.80E-05	4.51E+02	6.60E+02	1.08E+04	NDEP + USEPA 2004 for Tb, Tc, ΔH
SVOCs	4-Bromophenyl-phenyl ether	2.49E+02	3.08E+03	8.00E-02	8.00E-06	1.45E+00	4.69E-05				EPISUITE + 1,2-Dibromo-3-chloropropane for diffusivities
SVOCs	2-Chloronaphthalene	1.60E+02	1.55E+03	3.47E-02	8.80E-06	1.20E+01	3.10E-04				NDEP
SVOCs	2-Chlorophenol	1.30E+02	3.98E+02	5.01E-01	9.46E-06	2.20E+04	3.91E-04	4.48E+02	6.75E+02	9.57E+03	NDEP + USEPA 2004 for Tb, Tc, ΔH
SVOCs	4-Chlorophenyl-phenyl ether	2.05E+02	3.08E+03	3.00E-02	8.23E-06	3.30E+00	8.73E-05				EPISUITE + 1,2,4-Trichlorobenzene for diffusivities
SVOCs	Dibenzofuran	1.70E+02	7.76E+03	6.01E-02	1.00E-05	3.10E+00	1.30E-05	5.60E+02	8.24E+02	6.64E+04	NDEP + USEPA 2004 for Tb, Tc, ΔH
SVOCs	Fluorene	1.66E+02	7.90E+03	6.08E-02	7.88E-06	1.90E+00	7.70E-05	5.70E+02	8.70E+02	1.27E+04	NDEP + USEPA 2004 for Tb, Tc, ΔH
SVOCs	Hexachlorobenzene	2.85E+02	6.20E+03	2.90E-02	7.85E-06	6.20E-03	1.70E-03	5.83E+02	8.25E+02	1.44E+04	RSL + USEPA 2004 for Tb, Tc, and ΔH
SVOCs	Hexachlorobutadiene	2.61E+02	8.45E+02	2.67E-02	7.03E-06	3.20E+00	1.03E-02	4.86E+02	7.38E+02	1.02E+04	RSL + USEPA 2004 for Tb, Tc, and ΔH
SVOCs	Hexachloroethane	2.37E+02	1.97E+02	3.21E-02	8.89E-06	5.00E+01	3.89E-03	4.58E+02	6.95E+02	9.51E+03	RSL + USEPA 2004 for Tb, Tc, and ΔH
SVOCs	2-Methylnaphthalene	1.42E+02	2.48E+03	5.24E-02	7.78E-06	2.46E+01	5.18E-04	5.14E+02	7.61E+02	1.26E+04	RSL + USEPA 2004 for Tb, Tc, and ΔH
SVOCs	3&4-Methylphenol	1.08E+02	3.00E+02	7.24E-02	9.24E-06	2.15E+04	1.00E-06				RSL - 4-Methylphenol used as surrogate for all properties
SVOCs	Naphthalene	1.28E+02	1.19E+03	5.90E-02	7.50E-06	3.10E+01	4.83E-04	4.91E+02	7.48E+02	1.04E+04	NDEP + USEPA 2004 for Tb, Tc, ΔH
SVOCs	Nitrobenzene	1.20E+02	6.46E+01	7.60E-02	8.60E-06	2.10E+03	2.39E-05	4.84E+02	7.19E+02	1.06E+04	NDEP + USEPA 2004 for Tb, Tc, ΔH
SVOCs	2-Nitrophenol	1.39E+02	2.97E+02	6.66E-02	7.80E-06	2.50E+03	1.28E-05				EPISUITE + Benzyl chloride for diffusivities
SVOCs	n-Nitrosodimethylamine	7.41E+01	2.28E+01	9.88E-02	1.15E-05	1.00E+06	1.82E-06				RSL
SVOCs	Octachlorostyrene	3.80E+02	5.51E+04	2.90E-02	7.85E-06	1.74E-03	2.30E-04				EPISUITE + Hexachlorobenzene for diffusivities
SVOCs	bis(2-Chloro-1-methylethyl) ether	1.71E+02	6.10E+01	6.31E-02	6.40E-06	1.70E+03	1.13E-04				NDEP
SVOCs	Pentachlorobenzene	2.50E+02	3.71E+03	2.94E-02	7.95E-06	8.31E-01	7.03E-04				RSL
SVOCs	Pyrene	2.00E+02	6.80E+04	2.72E-02	7.24E-06	1.35E-01	1.10E-05	6.68E+02	9.36E+02	1.44E+04	NDEP + USEPA 2004 for Tb, Tc, ΔH
SVOCs	Pyridine	7.90E+01	3.30E+01	9.30E-02	1.10E-05	1.00E+06	1.10E-05				NDEP
SVOCs	1,2,4,5-Tetrachlorobenzene	2.16E+02	2.22E+03	3.19E-02	8.75E-06	5.95E-01	1.00E-03				RSL

TABLE 5-10. Physical/Chemical Properties
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Constituent [a, b]	Molecular Weight	Organic Carbon Partition Coefficient	Diffusivity in Air	Diffusivity in Water	Pure Component Water Solubility	Henry's Law Constant at 25° C	Normal Boiling Point	Critical Temperature	Enthalpy of Vaporization at the Normal Boiling Point	Source
		MW	K_{oc}	D_a	D_w	S	H	T_B	T_C	ΔHv,b	
		(g/mol)	(cm^3/g)	(cm^2/s)	(cm^2/s)	(mg/L)	(atm-m^3/mol)	(^oK)	(^oK)	(cal/mol)	

Notes:

NA = Not available
atm-m^3/mol = atmosphere-cubic meter per mole
cal/mol = calorie per mole
cm^3/g = cubic centimeter per gram
cm^2/s = square centimeter per second
g/mol = gram per mole
^oK = degrees Kelvin
mg/L = milligram per liter
PCDD/F = Polychlorinated dibenzo dioxin and furan
PDIST = Petroleum distillates
SVOC = Semivolatile organic compound
TCDD = Tetrachlorodibenzo-p-dioxin
USEPA = United States Environmental Protection Agency
VOC = Volatile organic compound

a. Volatile compounds defined by USEPA (2016) as Constituents with vapor pressure greater than 1 millimeter (mm) Hg or Henry's Law constant greater than 0.00001 atm-m3/mole.

Sources:

United States Environmental Protection Agency (USEPA). 2004. User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings Office of Emergency and Remedial Response. February.
EPISUITE: United States Environmental Protection Agency (USEPA). 2012. Estimation Programs Interface Suite™ for Microsoft® Windows, v 4.11. Washington, DC, USA.
Nevada Division of Environmental Protection (NDEP). 2017. Basic Screening Levels (BCLs) Version 1.0. July.
RSL: United States Environmental Protection Agency (USEPA). 2017. Regional Screening Level (RSL) Table. June.

TABLE 5-11. Soil Properties Data [a]
Nevada Environmental Response Trust Site
Henderson, Nevada

Sample ID	Depth (ft)	Volumetric Water Content[b]	Dry Bulk Density[c] (g/cm^3)	Grain Density[d] (g/cm^3)	Soil Total Porosity[e] (g/cm^3)	Soil Type
SA56-10BSPLP	10	0.134	1.689	2.719	0.379	Loamy Sand
RSAM3-10BSPLP	10	0.145	1.593	2.674	0.404	Loamy Sand
SA166-10BSPLP	10	0.100	1.721	2.681	0.358	Loamy Sand
SA182-10BSPLP	10	0.182	1.740	2.601	0.331	Sandy Loam
RSAJ3-10BSPLP	10	0.154	1.770	2.682	0.340	Loamy Sand
RSAI7-10B	10	0.138	1.661	2.682	0.381	Sand
SA34-10BSPLP	10	0.169	1.738	2.696	0.355	Loamy Sand
SA52-15BSPLP[f]	15	0.239	1.405	2.710	0.481	Sand
RSAQ8-10BSPLP	10	0.148	1.697	2.695	0.370	Sand
RSAN8-10BSPLP	10	0.189	1.679	2.683	0.374	Loamy Sand
RSAQ4-10BSPLP	10	0.141	1.841	2.705	0.319	Sand
SA148-10BSPLP	10	0.119	1.762	2.732	0.355	Sand
SA30-9BSPLP	9	0.160	1.805	2.711	0.334	Sand
SA128-10BSPLP	10	0.156	1.654	2.654	0.377	Loamy Sand
SA102-10BSPLP	10	0.135	1.769	2.696	0.344	Sand
SA64-10BSPLP	10	0.148	1.717	2.651	0.352	Sand
Mean	9.93	0.148	1.722	2.684	0.358	Loamy Sand
Mininum	9	0.100	1.593	2.601	0.319	NA
Maximum	10	0.189	1.841	2.732	0.404	NA
Median	10	0.148	1.721	2.683	0.355	NA

Notes:

NA = not applicable

g/cm^3 = grams per cubic centimeter

[a] The soil properties were reported in Northgate (2010). Soil type is discussed in the main text in both section 2.3 and section 5.2.2.3.

[b] As measured according to ASTM D 2216 and adjusted to convert from mass-based water moisture to volumetric water content.

[c] As measured according to ASTM D 2937.

[d] As measured according to ASTM D 854.

[e] Calculated from dry bulk density and grain density.

[f] Sample not included in evaluation.

Reference:

Northgate Environmental Management, Inc. (Northgate), 2010. Site-Wide Soil Gas Human Health Risk Assessment, Tronox LLC, Henderson, Nevada. November 22.

TABLE 5-12A. Transfer Factors for Vapors from Soil Gas to Indoor Air, Outdoor Air, and Trench Air – Parcel H

Nevada Environmental Response Trust Site

Henderson, Nevada

Chemical Group	Constituent	TF for Soil Gas Migrating to Indoor Air ($\mu g/m^3$ per $\mu g/m^3$)	TF for Soil Gas Migrating to Outdoor Air ($\mu g/m^3$ per $\mu g/m^3$)	TF for Soil Gas Migrating to Construction Trench Air ($\mu g/m^3$ per $\mu g/m^3$)
		5 ft bgs	5 ft bgs	
VOCs	Acetone	3.3E-04	8.2E-06	1.6E-03
VOCs	Acrylonitrile	3.0E-04	7.1E-06	1.4E-03
VOCs	Benzene	5.5E-15	1.2E-16	1.1E-03
VOCs	2-Butanone	2.7E-04	6.0E-06	1.2E-03
VOCs	n-Butylbenzene	2.3E-04	4.8E-06	9.5E-04
VOCs	sec-Butylbenzene	2.3E-04	4.9E-06	9.5E-04
VOCs	Carbon disulfide	2.9E-04	6.7E-06	1.3E-03
VOCs	Carbon tetrachloride	2.3E-04	5.0E-06	9.9E-04
VOCs	Chloroethane	2.9E-04	6.7E-06	1.3E-03
VOCs	Chloroform	2.9E-04	6.7E-06	1.3E-03
VOCs	Cumene	2.3E-04	4.8E-06	9.5E-04
VOCs	p-Cymene	2.3E-04	4.8E-06	9.5E-04
VOCs	1,4-Dichlorobenzene	2.1E-04	4.4E-06	8.7E-04
VOCs	Dichlorodifluoromethane	2.4E-04	5.2E-06	1.0E-03
VOCs	1,4-Dioxane	2.9E-04	6.7E-06	1.3E-03
VOCs	Ethanol	3.6E-04	9.3E-06	1.8E-03
VOCs	Ethyl benzene	2.3E-04	4.8E-06	9.5E-04
VOCs	4-Ethyltoluene	2.3E-04	4.8E-06	9.5E-04
VOCs	Freon 114	2.3E-04	5.0E-06	9.9E-04
VOCs	n-Heptane	1.9E-04	4.0E-06	7.8E-04
VOCs	2-Hexanone	2.2E-04	4.5E-06	8.9E-04
VOCs	4-Methyl-2-pentanone	2.3E-04	4.9E-06	9.6E-04
VOCs	Methylene Chloride	2.8E-04	6.5E-06	1.3E-03
VOCs	Methylmethacrylate	2.3E-04	5.0E-06	9.8E-04
VOCs	n-Octane	2.2E-04	4.6E-06	9.0E-04
VOCs	n-Propylbenzene	2.3E-04	4.8E-06	9.5E-04
VOCs	Styrene	2.2E-04	4.6E-06	9.0E-04
VOCs	alpha-Methylstyrene	2.2E-04	4.6E-06	9.0E-04
VOCs	tert Butyl alcohol	2.8E-04	6.3E-06	1.2E-03
VOCs	1,1,2,2-Tetrachloroethane	2.2E-04	4.6E-06	9.0E-04
VOCs	Tetrachloroethene	2.2E-04	4.6E-06	9.1E-04
VOCs	Toluene	2.5E-04	5.6E-06	1.1E-03
VOCs	1,2,4-Trichlorobenzene	1.1E-04	1.9E-06	3.8E-04
VOCs	Trichloroethene	2.4E-04	5.1E-06	1.0E-03
VOCs	Trichlorofluoromethane	2.5E-04	5.6E-06	1.1E-03
VOCs	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0E-04	1.9E-06	3.6E-04
VOCs	1,2,4-Trimethylbenzene	2.3E-04	4.8E-06	9.5E-04
VOCs	1,3,5-Trimethylbenzene	2.3E-04	4.8E-06	9.5E-04
VOCs	Vinyl acetate	2.5E-04	5.5E-06	1.1E-03
VOCs	o-Xylene	2.5E-04	5.6E-06	1.1E-03
VOCs	m,p-Xylene	2.3E-04	5.0E-06	9.7E-04
SVOCs	Naphthalene	1.9E-04	3.8E-06	7.5E-04

Notes:

ft = feet

bgs = below ground surface

$\mu g/m^3$ = microgram per cubic meter

TF = Transfer Factor

SVOC = Semi-Volatile Organic Compound

VOC = Volatile Organic Compound

TABLE 5-12B. Transfer Factors for Vapors from Shallow Groundwater to Indoor Air, Outdoor Air, and Trench Air – Parcel H

Nevada Environmental Response Trust Site

Henderson, Nevada

Chemical Group	Constituent	TF for Shallow Groundwater Migrating to Indoor Air ($\mu g/m^3$ per $\mu g/L$)	TF for Shallow Groundwater Migrating to Outdoor Air ($\mu g/m^3$ per $\mu g/L$)	TF for Shallow Groundwater Migrating to Construction Trench Air ($\mu g/m^3$ per $\mu g/L$)
VOCs	Acetone	4.4E-05	8.3E-07	1.3E-06
VOCs	Bromodichloromethane	3.4E-04	6.2E-06	9.2E-06
VOCs	Chloroform	2.1E-03	3.8E-05	5.5E-05
SVOCs	Acenaphthene	4.1E-05	7.4E-07	1.2E-06
SVOCs	Anthracene	2.8E-05	5.2E-07	8.1E-07
SVOCs	Benzo(a)anthracene	4.9E-06	9.0E-08	1.4E-07
SVOCs	Fluorene	3.0E-05	5.4E-07	8.5E-07
SVOCs	Hexachlorobenzene	2.1E-04	3.9E-06	5.8E-06
SVOCs	2-Methylnaphthalene	1.5E-04	2.7E-06	4.1E-06
SVOCs	Pyrene	2.3E-06	4.2E-08	6.6E-08

Notes:

µg/L = microgram per liter

$\mu g/m^3$ = microgram per cubic meter

TF = Transfer Factor

SVOC = Semivolatile organic compound

VOC = Volatile Organic Compound

TABLE 5-12C. Transfer Factors for Vapors from Soil to Outdoor Air and Trench Air for Parcel H

Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Chemical	TF for Soil Migrating to Outdoor Air ($\mu g/m^3$ per $\mu g/kg$)	TF for Soil Migrating to Trench Air ($\mu g/m^3$ per $\mu g/kg$)
Pesticide - OCP	Hexachlorobenzene	4.4E-05	2.8E-04

Notes:
µg/kg = microgram per kilogram
$\mu g/m^3$ = microgram per cubic meter
OCP = Organochlorine pesticide
TF = Transfer Factor

TABLE 5-13. Air EPCs Due to Volatile Compounds Migrating from 5 ft bgs Soil Gas to Indoor Air, Outdoor Air, and Trench Air – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Constituent	5 ft bgs Maximum Soil Gas Concentration	Predicted Indoor Air Concentration	Predicted Outdoor Air Concentration	Predicted Trench Air Concentration
		($\mu g/m^3$)			
VOCs	Acetone	3.9E+01	1.3E-02	3.2E-04	6.3E-02
VOCs	Acrylonitrile	1.1E-01	3.3E-05	7.8E-07	1.5E-04
VOCs	Benzene	4.1E+00	2.2E-14	4.9E-16	4.4E-03
VOCs	2-Butanone	5.6E+00	1.5E-03	3.4E-05	6.6E-03
VOCs	n-Butylbenzene	6.1E-01	1.4E-04	2.9E-06	5.8E-04
VOCs	sec-Butylbenzene	1.2E-01	2.7E-05	5.8E-07	1.1E-04
VOCs	Carbon disulfide	3.2E+01	9.2E-03	2.1E-04	4.2E-02
VOCs	Carbon tetrachloride	3.2E-01	7.5E-05	1.6E-06	3.2E-04
VOCs	Chloroethane	1.4E-01	4.0E-05	9.4E-07	1.8E-04
VOCs	Chloroform	1.3E+00	3.8E-04	8.7E-06	1.7E-03
VOCs	Cumene	1.4E-01	3.2E-05	6.8E-07	1.3E-04
VOCs	p-Cymene	1.9E+00	4.3E-04	9.2E-06	1.8E-03
VOCs	1,4-Dichlorobenzene	2.2E+00	4.7E-04	9.8E-06	1.9E-03
VOCs	Dichlorodifluoromethane	2.0E+00	4.8E-04	1.0E-05	2.0E-03
VOCs	1,4-Dioxane	8.3E-01	2.4E-04	5.5E-06	1.1E-03
VOCs	Ethanol	5.5E+00	2.0E-03	5.1E-05	1.0E-02
VOCs	Ethyl benzene	1.1E+00	2.5E-04	5.3E-06	1.0E-03
VOCs	4-Ethyltoluene	8.6E-01	2.0E-04	4.2E-06	8.2E-04
VOCs	Freon 114	9.3E-02	2.2E-05	4.7E-07	9.2E-05
VOCs	n-Heptane	1.6E-01	3.1E-05	6.3E-07	1.2E-04
VOCs	2-Hexanone	4.7E-01	1.0E-04	2.1E-06	4.2E-04
VOCs	4-Methyl-2-pentanone	8.9E-01	2.0E-04	4.3E-06	8.5E-04
VOCs	Methylene Chloride	1.9E-01	5.4E-05	1.2E-06	2.4E-04
VOCs	Methylmethacrylate	1.4E-01	3.3E-05	7.0E-07	1.4E-04
VOCs	n-Octane	3.4E-01	7.4E-05	1.6E-06	3.0E-04
VOCs	n-Propylbenzene	6.8E-01	1.5E-04	3.3E-06	6.4E-04
VOCs	Styrene	2.0E-01	4.4E-05	9.1E-07	1.8E-04
VOCs	alpha-Methylstyrene	2.1E-01	4.6E-05	9.6E-07	1.9E-04
VOCs	tert Butyl alcohol	7.0E-01	1.9E-04	4.4E-06	8.7E-04
VOCs	1,1,2,2-Tetrachloroethane	1.7E-01	3.7E-05	7.8E-07	1.5E-04
VOCs	Tetrachloroethene	5.2E-01	1.1E-04	2.4E-06	4.7E-04
VOCs	Toluene	5.1E+00	1.3E-03	2.9E-05	5.6E-03
VOCs	1,2,4-Trichlorobenzene	1.4E-01	1.5E-05	2.7E-07	5.3E-05
VOCs	Trichloroethene	1.6E-01	3.8E-05	8.1E-07	1.6E-04
VOCs	Trichlorofluoromethane	1.1E+00	2.8E-04	6.2E-06	1.2E-03
VOCs	1,1,2-Trichloro-1,2,2-trifluoroet	4.9E-01	5.0E-05	9.1E-07	1.8E-04
VOCs	1,2,4-Trimethylbenzene	3.1E+00	7.0E-04	1.5E-05	2.9E-03
VOCs	1,3,5-Trimethylbenzene	7.7E-01	1.7E-04	3.7E-06	7.3E-04
VOCs	Vinyl acetate	1.6E+01	4.0E-03	8.8E-05	1.7E-02
VOCs	o-Xylene	2.9E+00	7.4E-04	1.6E-05	3.2E-03
VOCs	m,p-Xylene	6.1E+00	1.4E-03	3.0E-05	5.9E-03
SVOCs	Naphthalene	1.3E+00	2.4E-04	5.0E-06	9.7E-04

Notes:

bgs = below ground surface
EPC = Exposure Point Concentration
ft = feet
$\mu g/m^3$ = microgram per cubic meter
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

TABLE 5-14. Air EPCs Due to Volatile Compounds Migrating from Shallow Groundwater to Indoor Air, Outdoor Air, and Trench Air – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Constituent	Maximum Shallow Groundwater Concentration (µg/L) [1]	Predicted Indoor Air Concentration ($\mu g/m^3$)	Predicted Outdoor Air Concentration ($\mu g/m^3$)	Predicted Trench Air Concentration ($\mu g/m^3$)
VOCs	Acetone	4.8E+00	2.1E-04	4.0E-06	6.2E-06
VOCs	Bromodichloromethane	3.2E-01	1.1E-04	2.0E-06	3.0E-06
VOCs	Chloroform	3.8E+00	7.8E-03	1.4E-04	2.1E-04
SVOCs	Acenaphthene	9.4E-02	3.8E-06	7.0E-08	1.1E-07
SVOCs	Anthracene	1.4E-01	4.0E-06	7.3E-08	1.1E-07
SVOCs	Benzo(a)anthracene	1.8E-01	8.9E-07	1.6E-08	2.5E-08
SVOCs	Fluorene	1.0E-01	3.0E-06	5.4E-08	8.5E-08
SVOCs	Hexachlorobenzene	1.3E-01	2.8E-05	5.0E-07	7.6E-07
SVOCs	2-Methylnaphthalene	5.7E-02	8.4E-06	1.5E-07	2.3E-07
SVOCs	Pyrene	1.9E-01	4.4E-07	7.9E-09	1.3E-08

Notes:
-- = not calculated
EPC = Exposure Point Concentration
µg/L = microgram per liter
$\mu g/m^3$ = microgram per cubic meter
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

[1] maximum chemical concentrations from the most recent two years of shallow groundwater data at each well.

TABLE 5-15. Exposure Assumptions
Nevada Environmental Response Trust Site
Henderson, Nevada

Exposure Factors	Units	Symbol	Indoor Commercial/ Industrial Worker		Outdoor Commercial/ Industrial Worker		Construction Worker	
			Value	Source	Value	Source	Value	Source
Population-Specific Exposure Assumptions								
Exposure Time	hours/day	ET	8	NDEP 2017a	8	NDEP 2017a	8	USEPA 2017
Exposure Time_Trench	hours/day	ET	--	--	--	--	4	VDEQ 2016
Exposure Frequency	days/year	EF	250	NDEP 2017a	225	NDEP 2017a	250	USEPA 2017
Exposure Frequency_Trench	days/year	EF	--	--	--	--	30	[1]
Exposure Duration	years	ED	25	NDEP 2017a	25	NDEP 2017a	1	USEPA 2017
Body Weight	kg_{BW}	BW	80	NDEP 2017a	80	NDEP 2017a	80	USEPA 2017
Averaging Time for Cancinogens	days	AT_c	25,550	NDEP 2017a	25,550	NDEP 2017a	25,550	USEPA 2017
Averaging Time for Noncarcinogens	days	AT_{nc}	9,125	NDEP 2017a	9,125	NDEP 2017a	365	USEPA 2017
Soil Ingestion								
Soil Ingestion Rate	mg_{soil}/day	IR_s	50	NDEP 2017a	100	NDEP 2017a	330	USEPA 2017
Conversion Factor	kg_{soil}/mg_{soil}	CF	1E-06	--	1E-06	--	1E-06	--
Intake Factor for Soil Ingestion, cancer	kg_{soil}/kg_{BW}/day	$IF_{soil.ing\_c}$	1.5E-07	USEPA 1989	2.8E-07	USEPA 1989	4.0E-08	USEPA 1989
Intake Factor for Soil Ingestion, noncancer	kg_{soil}/kg_{BW}/day	$IF_{soil.ing\_nc}$	4.3E-07	USEPA 1989	7.7E-07	USEPA 1989	2.8E-06	USEPA 1989
Soil Dermal Contact								
Skin Surface Area for Soil Contact	cm^2/day	SAs	--	--	3,527	USEPA 2017	3,527	USEPA 2017
Adherence Factor	mg_{soil}/cm^2	AF	--	--	0.12	NDEP 2017a	0.3	USEPA 2017
Conversion Factor	kg_{soil}/mg_{soil}	CF	--	--	1E-06	--	1E-06	--
Intake Factor for Soil Dermal Contact, cancer	kg_{soil}/kg_{BW}/day	$IF_{soil.derm\_c}$	--	--	1.2E-06	USEPA 2004	1.3E-07	USEPA 2004
Intake Factor for Soil Dermal Contact, noncancer	kg_{soil}/kg_{BW}/day	$IF_{soil.derm\_nc}$	--	--	3.3E-06	USEPA 2004	9.1E-06	USEPA 2004
Inhalation of Airborne Particulates								
Conversion Factor	hour/day	CF	24	--	24	--	24	--
Intake Factor for Particulate Inhalation, cancer	unitless	$IF_{part.inh\_c}$	8.2E-02	USEPA 2009	7.3E-02	USEPA 2009	3.3E-03	USEPA 2009
Intake Factor for Particulate Inhalation, noncancer	unitless	$IF_{part.inh\_nc}$	2.3E-01	USEPA 2009	2.1E-01	USEPA 2009	2.3E-01	USEPA 2009
Inhalation of Vapor Migrating from Soil, Soil Gas, or Groundwater to Air								
Conversion Factor	hour/day	CF	24	--	24	--	24	--
Intake Factor for Vapor Inhalation, cancer	unitless	$IF_{vapor.inh\_c}$	8.2E-02	USEPA 2009	7.3E-02	USEPA 2009	2.0E-04	USEPA 2009
Intake Factor for Vapor Inhalation, noncancer	unitless	$IF_{vapor.inh\_nc}$	2.3E-01	USEPA 2009	2.1E-01	USEPA 2009	1.4E-02	USEPA 2009

Notes:

-- = Not applicable

cm^2/day = square centimeter per day

kg_{BW} = kilogram of body weight

kg_{soil}/kg_{BW}/day = kilogram of soil per kilogram of body weight per day

kg_{soil}/mg_{soil} = kilogram of soil per milligram of soil

mg_{soil}/cm^2 = milligram of soil per square centimeter

mg_{soil}/day = milligram of soil per day

NDEP = Nevada Divisoin of Environmental Protection

USEPA = United States Environmental Protection Agency

VDEQ = Virginia Department of Environmental Quality

[1]. Recommended exposure frequency in NDEP's January 12, 2017 comment letter (NDEP 2017b).

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TABLE 5-16. Toxicity Criteria and Dermal Absorption Factors for Soil COPCs
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Chemical	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$		Inhalation Unit Risk $(\mu g/m^3)^{-1}$		USEPA Weight-of-Evidence Carcinogen Classification	Oral Chronic RfD (mg/kg-day)		Inhalation Chronic RfC ($\mu g/m^3$)		Oral Subchronic RfD (mg/kg-day)		Inhalation Subchronic RfC ($\mu g/m^3$)		Soil Dermal Absorption Factor ABS_{soil}	
Metal	Palladium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metal	Zirconium	--	--	--	--	--	0.00008	PPRTV Appendix	--	--	0.00008	PPRTV Appendix [1]	--	--	--	--
Pesticide - OCP	Hexachlorobenzene	1.6	IRIS	0.00046	IRIS	B2	0.0008	IRIS	--	--	0.00001	PPRTV	--	--	--	--

Notes:
-- = Not available
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
ABS_{soil} = Soil dermal absorption factor
B2 = Probable carcinogen, sufficient evidence in animals (USEPA 2014)
COPC = Chemical of potential concern
IRIS = Integrated Risk Information System (USEPA 2017a)
OCP = Organochlorine pesticide
PPRTV = Provisional Peer Reviewed Toxicity Values for Superfund (USEPA 2017b)
RfD = Reference dose
RfC = Reference concentration
USEPA = United States Environmental Protection Agency
[1] Use chronic value as surrogate

Sources:
USEPA. 2014. Prioritized Chronic Dose-Response Values. May.
USEPA. 2017a. Integreated Risk Information System (IRIS). Available online at https://www.epa.gov/iris. Accessed on August 29, 2017.
USEPA. 2017b. Provisional Peer Reviewed Toxicity Values for Superfund (PPRTV). Available online at https://hhpprtv.ornl.gov/. Accessed on August 29, 2017.

TABLE 5-17A. Chronic Inhalation Toxicity Criteria for Soil Gas and Shallow Groundwater COPCs
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Constituent	Inhalation Unit Risk $(\mu g/m^3)^{-1}$		Inhalation RfC $(\mu g/m^3)$	
VOCs	Acetaldehyde	0.0000022	IRIS 2017	9.0	IRIS 2017
VOCs	Acetone	--	--	31000	ATSDR 2016
VOCs	Acetonitrile	--	--	60	IRIS 2017
VOCs	Acrylonitrile	0.000068	IRIS 2017	2	IRIS 2017
VOCs	t-Amyl methyl ether	--	--	3000	IRIS 2017, Sur [1]
VOCs	Benzene	0.0000078	IRIS 2017	30	IRIS 2017
VOCs	Benzyl chloride	0.000049	Cal/EPA 2017	1	PPRTV 2017
VOCs	Bromobenzene	--	--	60	IRIS 2017
VOCs	Bromochloromethane	--	--	40	PPRTV Apendix
VOCs	Bromodichloromethane	0.000037	Cal/EPA 2017	1000	NDEP 2017b, Sur
VOCs	Bromoform	0.0000011	IRIS 2017	--	--
VOCs	Bromomethane	--	--	0.0050	IRIS 2017
VOCs	1,3-Butadiene	0.00003	IRIS 2017	2	IRIS 2017
VOCs	2-Butanone	--	--	5000	IRIS 2017
VOCs	n-Butylbenzene	--	--	400	NEDP 2017b, Sur
VOCs	sec-Butylbenzene	--	--	400	NEDP 2017b, Sur
VOCs	tert-Butylbenzene	--	--	400	NEDP 2017b, Sur
VOCs	Carbon disulfide	--	--	700	IRIS 2017
VOCs	Carbon tetrachloride	0.000006	IRIS 2017	100	IRIS 2017
VOCs	3-Chloro-1-propene	0.000006	Cal/EPA 2017	1	IRIS 2017
VOCs	Chlorobenzene	--	--	50	PPRTV 2017
VOCs	Chloroethane	--	--	10000	IRIS 2017
VOCs	Chloroform	0.000023	IRIS 2017	98	ATSDR 2016
VOCs	1-Chlorohexane	--	--	700	IRIS 2017, Sur [2]
VOCs	Chloromethane	--	--	90	IRIS 2017
VOCs	2-Chlorotoluene	--	--	50	NEDP 2017b, Sur
VOCs	4-Chlorotoluene	--	--	50	NEDP 2017b, Sur
VOCs	Cumene	--	--	400	IRIS 2017
VOCs	Cyclohexane	--	--	6000	IRIS 2017
VOCs	p-Cymene	--	--	400	NEDP 2017b, Sur
VOCs	1,2-Dibromo-3-chloropropane	0.006	PPRTV 2017	0.2	IRIS 2017
VOCs	Dibromochloromethane	--	--	--	--
VOCs	1,2-Dibromoethane	0.0006	IRIS 2017	9	IRIS 2017
VOCs	Dibromomethane	--	--	4	PPRTV Apendix
VOCs	1,2-Dichlorobenzene	--	--	200	HEAST 1997
VOCs	1,3-Dichlorobenzene	--	--	200	NEDP 2017b, Sur
VOCs	1,4-Dichlorobenzene	0.000011	Cal/EPA 2017	800	IRIS 2017
VOCs	Dichlorodifluoromethane	--	--	100	PPRTV Apendix
VOCs	1,1-Dichloroethane	0.0000016	Cal/EPA 2017	--	--
VOCs	1,2-Dichloroethane	0.000026	IRIS 2017	7	PPRTV 2017
VOCs	1,1-Dichloroethene	--	--	200	IRIS 2017
VOCs	1,2-Dichloroethene	--	--	--	--
VOCs	cis-1,2-Dichloroethene	--	--	--	--
VOCs	trans-1,2-Dichloroethene	--	--	--	--
VOCs	1,2-Dichloropropane	0.00001	Cal/EPA 2017	4.0	IRIS 2017
VOCs	1,3-Dichloropropane	--	--	4.0	NEDP 2017b, Sur
VOCs	2,2-Dichloropropane	--	--	4.0	IRIS 2017, Sur [3]
VOCs	1,1-Dichloropropene	0.000004	IRIS 2017, Sur [4]	20	IRIS 2017, Sur [4]
VOCs	cis-1,3-Dichloropropene	0.000004	IRIS 2017, Sur [4]	20	IRIS 2017, Sur [4]
VOCs	trans-1,3-Dichloropropene	0.000004	IRIS 2017, Sur [4]	20	IRIS 2017, Sur [4]
VOCs	2,2-Dimethylpentane	--	--	1000	PPRTV 2017, Sur [5]
VOCs	2,3-Dimethylpentane	--	--	1000	PPRTV 2017, Sur [5]
VOCs	2,4-Dimethylpentane	--	--	1000	PPRTV 2017, Sur [5]
VOCs	3,3-Dimethylpentane	--	--	1000	PPRTV 2017, Sur [5]
VOCs	1,4-Dioxane	0.000005	IRIS 2017	30	IRIS 2017
VOCs	Dimethyl disulfide	--	--	--	--
VOCs	Ethanol	--	--	100000	NDEP 2017a, Sur
VOCs	Ethyl tert-butyl ether	--	--	3000	IRIS 2017, Sur [1]
VOCs	Ethyl acetate	--	--	70	PPRTV 2017
VOCs	Ethyl benzene	0.0000025	Cal/EPA 2017	1000	IRIS 2017
VOCs	3-Ethylpentane	--	--	1000	PPRTV 2017, Sur [5]
VOCs	4-Ethyltoluene	--	--	400	NDEP 2017a, Sur
VOCs	Formaldehyde	0.000013	IRIS 2017	9.8	ATSDR 2016

TABLE 5-17A. Chronic Inhalation Toxicity Criteria for Soil Gas and Shallow Groundwater COPCs
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Constituent	Inhalation Unit Risk $(\mu g/m^3)^{-1}$		Inhalation RfC $(\mu g/m^3)$	
VOCs	Freon 114	--	--	30000	HEAST 1997, Sur [6]
VOCs	n-Heptane	--	--	7000	NDEP 2017a, Sur
VOCs	n-Hexane	--	--	700	IRIS 2017
VOCs	2-Hexanone	--	--	30	IRIS 2017
VOCs	Iodomethane	--	--	170	NDEP 2017a
VOCs	Methanol	--	--	20000	IRIS 2017
VOCs	Methyl tert-butyl ether	0.00000026	Cal/EPA 2017	3000	IRIS 2017
VOCs	4-Methyl-2-pentanone	--	--	3000	IRIS 2017
VOCs	Methylene Chloride	0.00000001	IRIS 2017	600	IRIS 2017
VOCs	2-Methylhexane	--	--	700	IRIS 2017, Sur, [2]
VOCs	3-Methylhexane	--	--	700	IRIS 2017, Sur, [2]
VOCs	Methylmethacrylate	--	--	700	IRIS 2017
VOCs	2-Nitropropane	0.0027	HEAST 1997	20	IRIS 2017
VOCs	n-Nonyl aldehyde	--	--	9.0	IRIS 2017, Sur, [7]
VOCs	n-Octane	--	--	--	--
VOCs	Diisopropyl ether	--	--	700	PPRTV 2017
VOCs	n-Propylbenzene	--	--	1000	PPRTV Apendix
VOCs	Styrene	--	--	1000	IRIS 2017
VOCs	alpha-Methylstyrene	--	--	1000	NDEP 2017b, Sur
VOCs	tert Butyl alcohol	--	--	30000	NDEP 2017a, Sur
VOCs	1,1,1,2-Tetrachloroethane	0.0000074	IRIS 2017	--	--
VOCs	1,1,2,2-Tetrachloroethane	0.000058	Cal/EPA 2017	--	--
VOCs	Tetrachloroethene	0.00000026	IRIS 2017	40	IRIS 2017
VOCs	Tetrahydrofuran	--	IRIS 2017	2000	IRIS 2017
VOCs	Toluene	--	--	5000	IRIS 2017
VOCs	1,2,3-Trichlorobenzene	--	--	2.0	PPRTV 2017, Sur [8]
VOCs	1,2,4-Trichlorobenzene	--	--	2.0	PPRTV 2017
VOCs	1,3,5-Trichlorobenzene	--	--	2.0	PPRTV 2017, Sur [8]
VOCs	1,1,1-Trichloroethane	--	--	5000	IRIS 2017
VOCs	1,1,2-Trichloroethane	0.000016	IRIS 2017	0.20	PPRTV Apendix
VOCs	Trichloroethene	0.0000041	IRIS 2017	2.0	IRIS 2017
VOCs	Trichlorofluoromethane	--	--	700	HEAST 1997
VOCs	1,2,3-Trichloropropane	--	--	0.30	IRIS 2017
VOCs	1,1,2-Trichloro-1,2,2-trifluoroethane	--	--	30000	HEAST 1997
VOCs	1,2,4-Trimethylbenzene	--	--	60	IRIS 2017
VOCs	1,3,5-Trimethylbenzene	--	--	60	IRIS 2017, Sur [9]
VOCs	2,2,3-Trimethylbutane	--	--	1000	PPRTV 2017, Sur [5]
VOCs	Vinyl acetate	--	--	200	IRIS 2017
VOCs	Vinyl chloride	0.0000044	IRIS 2017	100	IRIS 2017
VOCs	o-Xylene	--	--	100	NDEP 2017a, Sur
VOCs	m,p-Xylene	--	--	100	IRIS 2017, Sur [10]
VOCs	Xylenes (total)	--	--	100	IRIS 2017
SVOCs	Acenaphthene	--	--	3.0	NDEP 2017b, Sur
SVOCs	Acenaphthylene	--	--	3.0	NDEP 2017b, Sur
SVOCs	Acetophenone	--	--	400	NDEP 2017b, Sur
SVOCs	Anthracene	--	--	3.0	NDEP 2017b, Sur
SVOCs	Azobenzene	0.000031	IRIS 2017	--	--
SVOCs	Benzo(a)anthracene	0.00006	USEPA 2017	--	--
SVOCs	bis(2-Chloroethyl) ether	0.00033	IRIS 2017	--	--
SVOCs	4-Bromophenyl-phenyl ether	--	--	--	--
SVOCs	2-Chloronaphthalene	--	--	1.0	NDEP 2017b, Sur
SVOCs	2-Chlorophenol	--	--	50	NDEP 2017b, Sur
SVOCs	4-Chlorophenyl-phenyl ether	--	--	--	--
SVOCs	Dibenzofuran	--	--	--	--
SVOCs	Fluorene	--	--	3.0	NDEP 2017b, Sur
SVOCs	Hexachlorobenzene	0.00046	IRIS 2017	--	--
SVOCs	Hexachlorobutadiene	0.000022	IRIS 2017	--	--
SVOCs	Hexachloroethane	0.000011	Cal/EPA 2017	30	IRIS 2017
SVOCs	2-Methylnaphthalene	--	--	--	--
SVOCs	3&4-Methylphenol	--	--	--	--
SVOCs	Naphthalene	0.000034	Cal/EPA 2017	3.0	IRIS 2017
SVOCs	Nitrobenzene	0.00004	IRIS 2017	9.0	IRIS 2017
SVOCs	2-Nitrophenol	--	--	--	--

TABLE 5-17A. Chronic Inhalation Toxicity Criteria for Soil Gas and Shallow Groundwater COPCs
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Constituent	Inhalation Unit Risk ($\mu g/m^3)^{-1}$		Inhalation RfC ($\mu g/m^3$)	
SVOCs	n-Nitrosodimethylamine	0.014	IRIS 2017	0.040	PPRTV Apendix
SVOCs	Octachlorostyrene	--	--	--	--
SVOCs	bis(2-Chloro-1-methylethyl) ether	0.00001	HEAST 1997	--	--
SVOCs	Pentachlorobenzene	--	--	--	--
SVOCs	Pyrene	--	--	3.0	NDEP 2017b, Sur
SVOCs	Pyridine	--	--	120	NDEP 2017b, Sur
SVOCs	1,2,4,5-Tetrachlorobenzene	--	--	--	--

Notes:

-- = Not available
$\mu g/m^3$ = microgram per cubic meter
ATSDR = Agency for Toxic Substances and Disease Registry
Cal/EPA = California Environmental Protection Agency
HEAST = Health Effects Summary Tables
IRIS = Integrated Risk Information System
NDEP = Nevada Division of Environmental Protection
PPRTV = Provisional Peer Reviewed Toxicity Values for Superfund
SVOC = Semivolatile Organic Compound
RfC = Reference Concentration
Sur = Surrogate
USEPA = United States Environmental Protection Agency
VOC = Volatile Organic Compound

[1] Used toxicity value for methyl tertbutyl ether as surrogate.
[2] Used the toxicity value for hexane as surrogate.
[3] Used toxicity value for 1,2-dichloropropane as surrogate.
[4] Used toxicity value for 1,3-dichloropropene as surrogate.
[5] Used the toxicity value for pentane as surrogate.
[6] Used toxicity value for Freon 113 as surrogate.
[7] Used toxicity value for acetaldehyde as surrogate.
[8] Used the toxicity value for 1,2,4-trichlorobenzene as surrogate.
[9] Used the toxicity value for 1,2,4-trimethylbenzene as surrogate.
[10] Used the toxicity value for xylenes (total) as surrogate.

Sources:

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Nevada Division of Environmental Protection (NDEP) 2017b. User's Guide and Technical Document for Basic Comparison Levels. Appendix B. July.
Provisional Peer Reviewed Toxicity Values for Superfund (PPRTV). 2017. Available online at https://hhpprtv.ornl.gov/. Accessed in May 2017.
USEPA. 2017. User's Guide for Regional Screening Levels (RSLs)for Chemical Contaminants at Superfund Sites. June.

TABLE 5-17B. Subchronic Inhalation Toxicity Criteria for Soil Gas and Shallow Groundwater COPCs
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Constituent	Subchronic Inhalation RfC ($\mu g/m^3$)	
VOCs	Acetaldehyde	9	IRIS [1]
VOCs	Acetone	30882	ATSDR 2017
VOCs	Acetonitrile	60	IRIS [1]
VOCs	Acrylonitrile	2	IRIS [1]
VOCs	t-Amyl methyl ether	3000	IRIS, Sur [1]
VOCs	Benzene	80	PPRTV
VOCs	Benzyl chloride	4	PPRTV
VOCs	Bromobenzene	60	IRIS [1]
VOCs	Bromochloromethane	100	PPRTV
VOCs	Bromodichloromethane	20	PPRTV
VOCs	Bromoform	--	--
VOCs	Bromomethane	100	PPRTV
VOCs	1,3-Butadiene	2	IRIS [1]
VOCs	2-Butanone	5000	IRIS [1]
VOCs	n-Butylbenzene	400	NEDP 2015, Sur [1]
VOCs	sec-Butylbenzene	400	NEDP 2015, Sur [1]
VOCs	tert-Butylbenzene	400	NEDP 2015, Sur [1]
VOCs	Carbon disulfide	700	HEAST 1997
VOCs	Carbon tetrachloride	189	ATSDR 2017
VOCs	3-Chloro-1-propene	1	IRIS [1]
VOCs	Chlorobenzene	2302	PPRTV
VOCs	Chloroethane	4000	PPRTV
VOCs	Chloroform	244	ATSDR 2017
VOCs	1-Chlorohexane	700	IRIS 2017, Sur [1],[2]
VOCs	Chloromethane	3000	PPRTV
VOCs	2-Chlorotoluene	800	PPRTV 2017
VOCs	4-Chlorotoluene	800	PPRTV 2017, Sur [3]
VOCs	Cumene	400	IRIS [1]
VOCs	Cyclohexane	18000	PPRTV
VOCs	p-Cymene	400	NEDP 2017b, Sur [1]
VOCs	1,2-Dibromo-3-chloropropane	2	PPRTV
VOCs	Dibromochloromethane	--	--
VOCs	1,2-Dibromoethane	9	IRIS [1]
VOCs	Dibromomethane	40	PPRTV
VOCs	1,2-Dichlorobenzene	2000	HEAST 1997
VOCs	1,3-Dichlorobenzene	200	NEDP 2017b, Sur [1]
VOCs	1,4-Dichlorobenzene	1202	ATSDR 2017
VOCs	Dichlorodifluoromethane	1000	PPRTV
VOCs	1,1-Dichloroethane	5000	HEAST 1997
VOCs	1,2-Dichloroethane	70	PPRTV
VOCs	1,1-Dichloroethene	79	IRIS [1]
VOCs	1,2-Dichloroethene	--	--
VOCs	cis-1,2-Dichloroethene	793	ATSDR 2017, Sur [4]
VOCs	trans-1,2-Dichloroethene	793	ATSDR 2017
VOCs	1,2-Dichloropropane	4	PPRTV
VOCs	1,3-Dichloropropane	4	NEDP 2017b, Sur [1]
VOCs	2,2-Dichloropropane	4	IRIS 2017, Sur [1], [5]
VOCs	1,1-Dichloropropene	20	IRIS 2017, Sur [1], [6]
VOCs	cis-1,3-Dichloropropene	20	IRIS 2017, Sur [1], [6]
VOCs	trans-1,3-Dichloropropene	20	IRIS 2017, Sur [1], [6]
VOCs	2,2-Dimethylpentane	1000	PPRTV 2017, Sur [1]
VOCs	2,3-Dimethylpentane	1000	PPRTV 2017, Sur [1]
VOCs	2,4-Dimethylpentane	1000	PPRTV 2017, Sur [1]
VOCs	3,3-Dimethylpentane	1000	PPRTV 2017, Sur [1]
VOCs	1,4-Dioxane	721	ATSDR 2017
VOCs	Dimethyl disulfide	--	--

TABLE 5-17B. Subchronic Inhalation Toxicity Criteria for Soil Gas and Shallow Groundwater COPCs
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Constituent	Subchronic Inhalation RfC ($\mu g/m^3$)	
VOCs	Ethanol	100000	NDEP 2015, Sur [1]
VOCs	Ethyl tert-butyl ether	3000	IRIS, Sur [1]
VOCs	Ethyl acetate	700	PPRTV
VOCs	Ethyl benzene	9000	PPRTV
VOCs	3-Ethylpentane	1000	PPRTV 2017, Sur [1]
VOCs	4-Ethyltoluene	400	NDEP 2017a, Sur [1]
VOCs	Formaldehyde	37	ATSDR 2017
VOCs	Freon 114	30000	HEAST 1997, Sur [1]
VOCs	n-Heptane	4000	PPRTV
VOCs	n-Hexane	2000	PPRTV
VOCs	2-Hexanone	30	IRIS [1]
VOCs	Iodomethane	170	NDEP 2017a [1]
VOCs	Methanol	20000	IRIS [1]
VOCs	Methyl tert-butyl ether	2524	ATSDR 2017
VOCs	4-Methyl-2-pentanone	3000	IRIS [1]
VOCs	Methylene Chloride	1042	ATSDR 2017
VOCs	2-Methylhexane	700	IRIS 2017, Sur, [1],[4]
VOCs	3-Methylhexane	700	IRIS 2017, Sur, [1],[4]
VOCs	Methylmethacrylate	700	IRIS [1]
VOCs	2-Nitropropane	20	IRIS [1]
VOCs	n-Nonyl aldehyde	9	IRIS 2017, Sur [1]
VOCs	n-Octane	--	--
VOCs	Diisopropyl ether	700	PPRTV
VOCs	n-Propylbenzene	1000	PPRTV
VOCs	Styrene	3000	HEAST 1997
VOCs	alpha-Methylstyrene	1000	NDEP 2017b, Sur [1]
VOCs	tert Butyl alcohol	30000	NDEP 2017a, Sur [1]
VOCs	1,1,1,2-Tetrachloroethane	--	--
VOCs	1,1,2,2-Tetrachloroethane	--	--
VOCs	Tetrachloroethene	41	ATSDR 2017
VOCs	Tetrahydrofuran	2000	IRIS [1]
VOCs	Toluene	5000	PPRTV
VOCs	1,2,3-Trichlorobenzene	2	PPRTV 2017, Sur [1]
VOCs	1,2,4-Trichlorobenzene	2	PPRTV 2017 [1]
VOCs	1,3,5-Trichlorobenzene	2	PPRTV 2017, Sur [1]
VOCs	1,1,1-Trichloroethane	3820	ATSDR 2017
VOCs	1,1,2-Trichloroethane	2.0	PPRTV
VOCs	Trichloroethene	2.1	ATSDR 2017
VOCs	Trichlorofluoromethane	1000	PPRTV
VOCs	1,2,3-Trichloropropane	0.30	IRIS [1]
VOCs	1,1,2-Trichloro-1,2,2-trifluoroethane	50000	PPRTV
VOCs	1,2,4-Trimethylbenzene	60	PPRTV
VOCs	1,3,5-Trimethylbenzene	60	PPRTV
VOCs	2,2,3-Trimethylbutane	1000	PPRTV 2017, Sur [1],[5]
VOCs	Vinyl acetate	35	ATSDR 2017
VOCs	Vinyl chloride	77	ATSDR 2017
VOCs	o-Xylene	400	PPRTV 2017, sur
VOCs	m,p-Xylene	400	PPRTV 2017, sur
VOCs	Xylenes (total)	400	PPRTV
SVOCs	Acenaphthene	3	NDEP 2017b, Sur [1]
SVOCs	Acenaphthylene	3	NDEP 2017b, Sur [1]
SVOCs	Acetophenone	400	NDEP 2017b, Sur [1]
SVOCs	Anthracene	3	NDEP 2017b, Sur [1]
SVOCs	Azobenzene	--	--
SVOCs	Benzo(a)anthracene	--	--
SVOCs	bis(2-Chloroethyl) ether	120	ATSDR 2017

TABLE 5-17B. Subchronic Inhalation Toxicity Criteria for Soil Gas and Shallow Groundwater COPCs
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Constituent	Subchronic Inhalation RfC ($\mu g/m^3$)	
SVOCs	4-Bromophenyl-phenyl ether	--	--
SVOCs	2-Chloronaphthalene	1	NDEP 2017b, Sur [1]
SVOCs	2-Chlorophenol	50	NDEP 2017b, Sur [1]
SVOCs	4-Chlorophenyl-phenyl ether	--	--
SVOCs	Dibenzofuran	--	--
SVOCs	Fluorene	3	NDEP 2017b, Sur [1]
SVOCs	Hexachlorobenzene	3	--
SVOCs	Hexachlorobutadiene	4	Cal/EPA 2017 [1]
SVOCs	Hexachloroethane	58100	ATSDR 2017
SVOCs	2-Methylnaphthalene	--	--
SVOCs	3&4-Methylphenol	--	--
SVOCs	Naphthalene	3	IRIS [1]
SVOCs	Nitrobenzene	20	HEAST 1997
SVOCs	2-Nitrophenol	0.50	PPRTV
SVOCs	n-Nitrosodimethylamine	0.040	PPRTV Apendix 2017 [1]
SVOCs	Octachlorostyrene	--	--
SVOCs	bis(2-Chloro-1-methylethyl) ether	--	--
SVOCs	Pentachlorobenzene	--	--
SVOCs	Pyrene	3	NDEP 2017b, Sur [1]
SVOCs	Pyridine	120	NDEP 2017b, Sur [1]
SVOCs	1,2,4,5-Tetrachlorobenzene	--	--

Notes:

-- = Not available
$\mu g/m^3$ = microgram per cubic meter
ATSDR = Agency for Toxic Substances and Disease Registry
HEAST = Health Effects Summary Tables
IRIS = Integrated Risk Information System
NDEP = Nevada Division of Environmental Protection
PPRTV = Provisional Peer Reviewed Toxicity Values for Superfunc
RfC = Reference Concentration
Sur = Surrogate
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

[1] Chornic toxicity values were used when subchronic toxicity values were not available.
[2] Used the toxicity value for pentane as surrogates.
[3] Used toxicity value for Freon 113 as surrogates.
[4] Used the toxicity value for hexane as surrogates.
[5] Used toxicity value for acetaldehyde as surrogates.
[6] Used the toxicity value for 1,2,4-trichlorobenzene as surrogates.

Sources:

ATSDR. 2017. Minimal Risk Levels. June.
Cal/EPA. 2017. Human and Ecological Risk Office (HERO) Human Health Risk assessment (HHRA) Note 3 - DTSC-Modified Screening Levels (DTSC-SLs). August.
Health Effects Assessment Summary Tables (HEAST). 1997.
Integrated Risk Information System (IRIS). 2017. Online database Maintained by the USEPA. Accessed May 10, 2017.
Nevada Division of Environmental Protection (NDEP) 2015. Basic Comparison Levels. February.
Provisional Peer Reviewed Toxicity Values for Superfund (PPRTV). 2017. Available online at https://hhpprtv.ornl.gov/. Accessed on August 2017.

TABLE 5-18. Soil Cancer Risks and Non-Cancer Hazard Indices – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Indoor Commercial/Industrial Worker (0-2 feet bgs)		Indoor Commercial/Industrial Worker (0-10 feet bgs)		Outdoor Commercial/Industrial Worker (0-2 feet bgs)		Outdoor Commercial/Industrial Worker (0-10 feet bgs)		Construction Worker (0-10 feet bgs)	
	Cancer Risk	Non-Cancer HI	Cancer Risk	Non-Cancer HI	Cancer Risk	Non-Cancer HI	Cancer Risk	Non-Cancer HI	Cancer Risk	Non-Cancer HI
H	4E-07	0.1	4E-07	0.1	4E-07	0.2	4E-07	0.3	2E-08	1

Notes:
bgs = below ground surface
HI = Hazard index

TABLE 5-19. Asbestos Cancer Risks– Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Risk Type	Indoor Commercial/Industrial Worker			Outdoor Commercial/Industrial Worker			Construction Worker		
		Amphibole Risk	Chrysotile Risk	Total Asbestos Risk	Amphibole Risk	Chrysotile Risk	Total Asbestos Risk	Amphibole Risk	Chrysotile Risk	Total Asbestos Risk
H	Best Estimate	0E+00	1E-09	1E-09	0E+00	3E-09	3E-09	0E+00	3E-08	3E-08
	Upper-Bound Estimate	8E-08	2E-09	8E-08	2E-07	5E-09	2E-07	2E-06	5E-08	2E-06

Notes:
Best Estimate = Calculated based on the number of long fibers observed in soil samples.
Upper-Bound Estimate = Calculated based on the 95% upper confidence limit (UCL) of the number of long fibers observed in soil samples from a Poisson distribution.

TABLE 5-20. Soil Gas Cancer Risks and Non-Cancer Hazard Indices – Parcel H

Nevada Environmental Response Trust Site
Henderson, Nevada

Population	Soil Gas (< 5 ft bgs)	
	Cancer Risk	HI
Indoor Worker	2E-09	0.00005
Outdoor Worker	5E-11	0.000001
Construction Worker (Trench Scenario)	3E-11	0.00002

Notes:
bgs = below ground surface
ft = feet
HI = Hazard Index

TABLE 5-21. Shallow Groundwater Cancer Risks and Non-Cancer Hazard Indices – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Population	Groundwater	
	Cancer Risk	HI
Indoor Worker	2E-08	0.00002
Outdoor Worker	3E-10	0.0000003
Construction Worker (Trench Scenario)	1E-12	0.00000002

Note:
HI = Hazard Index

TABLE 6-1. Uncertainty Analysis of J Qualified Soil Data
Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Analyte	Maximum Concentration of Qualified Data	Qualifier	Maximum Detected Concentration in Soil HRA Data Set	Screening Level	Unit
H	1,2,4-Trimethylbenzene	0.00055	J	0.00055	218	mg/kg
H	2,3,7,8-TCDD TEQ	0.000021	J	0.000021	0.0027	mg/kg
H	2-Butanone	0.0018	J	0.0018	28,400	mg/kg
H	Acetone	0.0093	J	0.024	1,040,000	mg/kg
H	Antimony	0.33	J	0.50	519	mg/kg
H	Arsenic	4.0	J	5.2	7.2	mg/kg
H	Barium	219	J	275	238,000	mg/kg
H	Benzo(g,h,i)perylene	0.0028	J	0.0028	25,300	mg/kg
H	Beryllium	0.74	J	0.74	2,540	mg/kg
H	beta-BHC	0.010	J	0.040	1.7	mg/kg
H	bis(2-Ethylhexyl)phthalate	0.069	J	0.069	183	mg/kg
H	Boron	4.8	J	14	259,000	mg/kg
H	Bromide	4.5	J	4.5	441,000	mg/kg
H	Butylbenzylphthalate	0.11	J	0.11	1,350	mg/kg
H	Cadmium	0.48	J	0.69	1,260	mg/kg
H	Calcium	57,400	J	158,000	NA	mg/kg
H	Chlorate	3.1	J	10	38,900	mg/kg
H	Chloride	36	J	1,640	113,000	mg/kg
H	Chromium (total)	8.7	J	15	1,950,000	mg/kg
H	Copper	31	J	367	36,700	mg/kg
H	Fluoranthene	0.0066	J	0.0066	33,700	mg/kg
H	Fluoride	1.0	J	2.0	51,900	mg/kg
H	Lead	10	J	51	800	mg/kg
H	Lithium	9.2	J	48	2,600	mg/kg
H	Manganese	442	J	684	28,100	mg/kg
H	Mercury	0.033	J	0.033	389	mg/kg
H	Methylene Chloride	0.021	J	0.021	1,550	mg/kg
H	Molybdenum	1.0	J	1.0	6,490	mg/kg
H	Nitrate	10	J	39	2,080,000	mg/kg
H	Nitrite	0.13	J	0.13	130,000	mg/kg
H	Perchlorate	0.28	J	22	908	mg/kg
H	Phenanthrene	0.0038	J	0.0038	25	mg/kg
H	Phosphorus (total)	667	J	2,020	9,630,000	mg/kg
H	Platinum	0.012	J	0.012	649	mg/kg
H	Pyrene	0.0063	J	0.0063	44	mg/kg
H	Radium-226	0.84	J	2.5	0.023	pCi/g
H	Radium-228	2.2	J	3.0	0.041	pCi/g
H	Selenium	0.80	J	0.80	6,490	mg/kg
H	Silicon	578	J	578	NA	mg/kg
H	Silver	0.15	J	0.15	6,490	mg/kg
H	Sodium	514	J	1,230	NA	mg/kg
H	Strontium	394	J	500	779,000	mg/kg
H	Sulfate	125	J	640	NA	mg/kg
H	Sulfur	1,310	J	2,400	NA	mg/kg
H	Thallium	0.34	J	0.34	13	mg/kg
H	Thorium-230	3.0	J	3.0	8.4	pCi/g
H	Tin	4.9	J	4.9	779,000	mg/kg
H	Titanium	950	J	950	5,190,000	mg/kg
H	Toluene	0.0028	J	0.0028	817	mg/kg
H	Trichlorofluoromethane	0.0027	J	0.0027	1,210	mg/kg
H	Tungsten	0.61	J	0.67	1,040	mg/kg
H	Uranium (total)	1.7	J	26	3,830	mg/kg
H	Uranium-234	2.7	J	3.5	11	pCi/g
H	Uranium-235	0.16	J	0.20	0.35	pCi/g
H	Uranium-238	0.98	J	2.6	1.4	pCi/g
H	Zinc	36	J	67	389,000	mg/kg

TABLE 6-1. Uncertainty Analysis of J Qualified Soil Data
Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Analyte	Maximum Concentration of Qualified Data	Qualifier	Maximum Detected Concentration in Soil HRA Data Set	Screening Level	Unit
H	Zirconium	26	J	26	104	mg/kg
H	4,4'-DDD	0.0035	J-	0.0035	15	mg/kg
H	Acetonitrile	0.021	J-	0.021	3,750	mg/kg
H	Antimony	0.50	J-	0.50	519	mg/kg
H	Barium	275	J-	275	238,000	mg/kg
H	Chloride	174	J-	1,640	113,000	mg/kg
H	Phosphorus (total)	1,940	J-	2,020	9,630,000	mg/kg
H	Silicon	530	J-	578	NA	mg/kg
H	Sulfate	526	J-	640	NA	mg/kg
H	Tungsten	0.67	J-	0.67	1,040	mg/kg
H	2,4'-DDE	0.014	J+	0.014	9.5	mg/kg
H	4,4'-DDE	0.0036	J+	0.060	9.5	mg/kg
H	4,4'-DDT	0.0019	J+	0.089	7.5	mg/kg
H	Aluminum	9,030	J+	9,970	1,240,000	mg/kg
H	Barium	235	J+	275	238,000	mg/kg
H	beta-BHC	0.040	J+	0.040	1.7	mg/kg
H	Cadmium	0.69	J+	0.69	1,260	mg/kg
H	Calcium	62,200	J+	158,000	NA	mg/kg
H	Chloride	28	J+	1,640	113,000	mg/kg
H	Chromium (total)	15	J+	15	1,950,000	mg/kg
H	Copper	77	J+	367	36,700	mg/kg
H	Iron	9,530	J+	18,200	908,000	mg/kg
H	Lead	11	J+	51	800	mg/kg
H	Magnesium	17,000	J+	17,000	5,200,000	mg/kg
H	Manganese	544	J+	684	28,100	mg/kg
H	Niobium	12	J+	12	130	mg/kg
H	Nitrate	4.7	J+	39	2,080,000	mg/kg
H	Palladium	1.0	J+	1.0	NA	mg/kg
H	Silicon	251	J+	578	NA	mg/kg
H	Silver	0.13	J+	0.15	6,490	mg/kg
H	Strontium	500	J+	500	779,000	mg/kg
H	Vanadium	40	J+	56	6,420	mg/kg
H	Zinc	32	J+	67	389,000	mg/kg

Notes:
mg/kg = milligram per kilogram
pCi/g = picocurie per gram
BHC = Hexachlorocyclohexane
DDD = Dichlorodiphenyldichloroethane
DDE = Dichlorodiphenyldichloroethylene
DDT = Dichlorodiphenyltrichloroethane
HRA = Health risk assessment
J = Estimated value
J- = Estimate value, biased low
J+ = Estimate value, biased high
NA = Not available
TCDD = Tetrachlorodibenzo-p-dioxin
TEQ = Toxicity equivalent

TABLE 6-2. Uncertainty Analysis of Soil Data with Blank Contamination

Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Analyte	Maximum Reported Concentration in 2012 Blank Contamination Amended Table (Northgate 2014)	Maximum Detected Concentration in Soil HRA Data Set	Screening Level
H	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	0.0000016	0.000021 (2,3,7,8-TCDD TEQ)	0.0027 (2,3,7,8-TCDD TEQ)
H	1,2,3,6,7,8-Hexachlorodibenzofuran	0.00000026		
H	1,2,3,7,8,9-Hexachlorodibenzofuran	0.00000051		
H	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	0.00000012		
H	Octachlorodibenzodioxin	0.0000092		
H	Octachlorodibenzofuran	0.0000028		
H	Acetone	0.019	0.024	1,040,000
H	Boron	15	14	259,000
H	Cadmium	0.14	0.69	1,260
H	Lithium	21	48	2,600
H	Methylene Chloride	0.021	ND	1,550
H	Molybdenum	0.91	1.0	6,490
H	Niobium	9.4	12	130
H	Silver	0.11	0.15	6,490
H	Sodium	138	1,230	NA
H	Sulfate	5.1	640	NA
H	Thallium	0.32	0.34	13
H	Tin	0.52	4.9	779,000
H	Tungsten	0.85	0.67	1,040
H	Uranium-238	0.97	2.6	1.4

Notes:
mg/kg = milligram per kilogram
pCi/g = picocurie per gram
HRA = Health risk assessment
NA = Not available
ND = Not detected
TCDD = Tetrachlorodibenzo-p-dioxin
TEQ = Toxicity equivalent

Source:
Northgate. 2014. Post-remediation Screening Health Risk Assessment Report for Parcels C, D, F, G, and H, Revision 3, Henderson, Nevada.

TABLE 7-1. Soil Data Quality Assessment – Parcel H

Nevada Environmental Response Trust Site

Henderson, Nevada

Depth Interval	0-2 ft bgs		0-10 ft bgs	
Sample Size [1]	26		47	
P_1 [2]	0	0	0	0
Sample count for effect size	1	2	1	2
Effect size [3]	0.0385	0.0769	0.0213	0.0426
P_2 [4]	0.0385	0.0769	0.0213	0.0426
	Number of samples required [5]			
β=15%	49	24	89	44
β=20%	41	21	75	37
β=25%	36	18	65	32

Notes:

bgs = below ground surface

ft = feet

COPC = Chemical of potential concern

[1] The maximum number of samples for COPCs collected at the defined depth interval.

[2] P_1 is the theoretical proportion of samples exceeding a threshold as specified in the null hypothesis. Input 0.000001 in G*Power, because the minimum input is 0.000001 in Gpower.

[3] Effect size is population proportion, set to be the defined number of samples over the total number of samples.

[4] P_2 is P_1 plus effect size.

[5] Calculations were conducted using the Exact – Generic Binomial Test in the software program G*Power.

TABLE 7-2. Soil Gas Data Quality Assessment – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Medium	Soil Gas (0-5 ft bgs)
Parcel	**H**
Number of Samples	2
P_1 [1]	0
Sample count for effect size	1
Effect size [2]	0.500
P_2 [3]	0.500
	Number of samples required [4]
β=15%	3
β=20%	3
β=25%	2

Notes:

bgs = below ground surface

ft = feet

[1] P_1 is the theoretical proportion of concentrations exceeding a threshold as specified in the null hypothesis. Input 0.000001 in G*Power, because the minimum input is 0.000001 in Gpower.

[2] Effect size is population proportion, set to defined number of samples over total number of samples.

[3] P_2 is P_1 plus effect size.

[4] Calculations were done using the Exact – Generic binomial test in the software program G*Power.

TABLE 7-3. Shallow Groundwater Data Quality Assessment – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Medium	Shallow Groundwater	
Parcel	H	
Number of Samples	5	
P_1 [1]	0	0
Sample count for effect size	1	2
Effect size [2]	0.200	0.400
P_2 [3]	0.200	0.400
	Number of samples required [4]	
β=15%	9	4
β=20%	8	4
β=25%	7	3

Notes:

[1] P_1 is the theoretical proportion of concentrations exceeding a threshold as specified in the null hypothesis. Input 0.000001 in G*Power, because the minimum input is 0.000001 in Gpower.

[2] Effect size is population proportion, set to defined number of samples over total number of samples.

[3] P_2 is P_1 plus effect size.

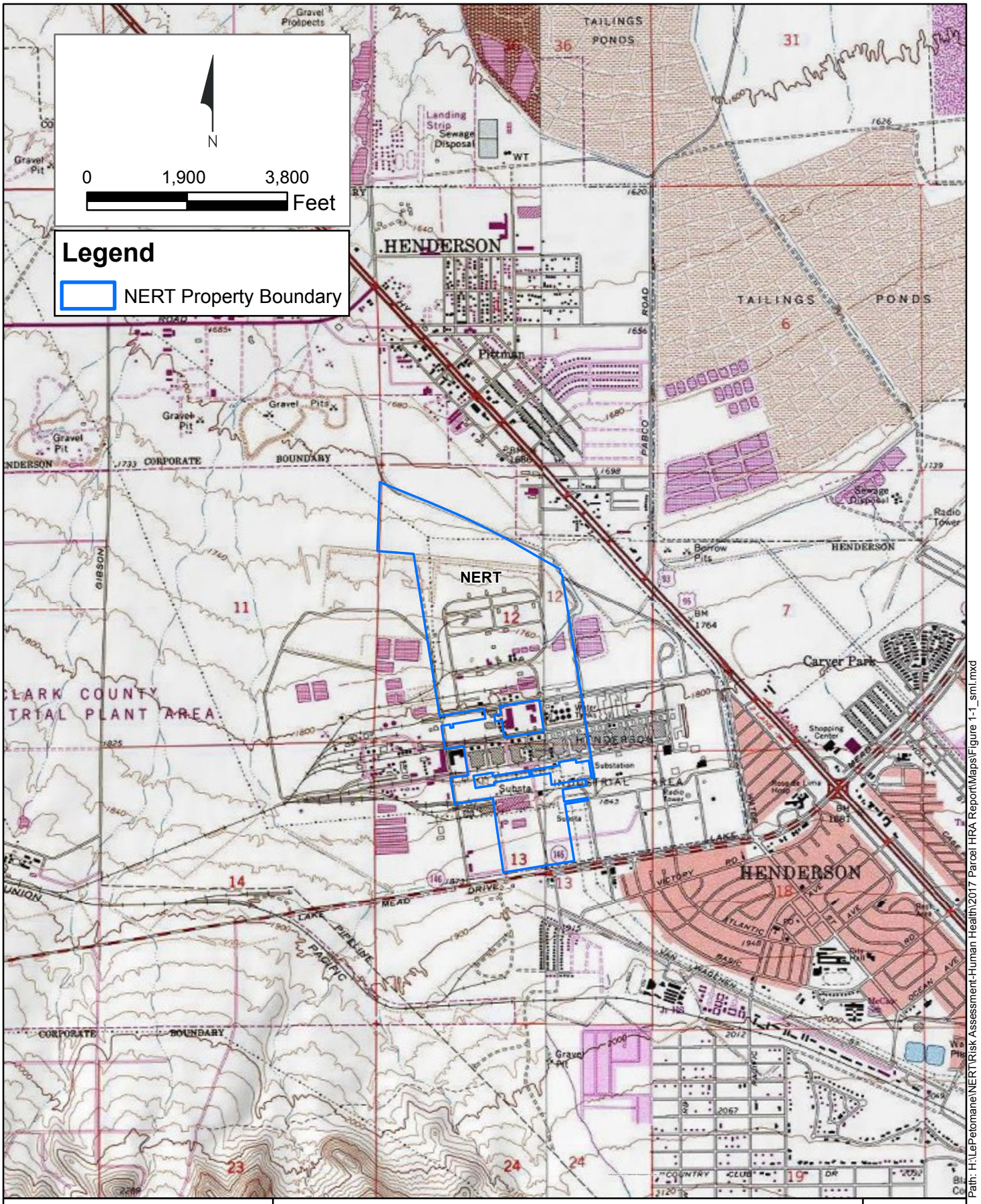
[4] Calculations were done using the Exact – Generic binomial test in the software program G*Power.

TABLE 8-1. Summary of Cumulative Risks – Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Exposure [1]	Indoor Commercial/Industrial Worker		Outdoor Commercial/Industrial Worker		Construction Worker	
		Cancer Risk	Non-Cancer HI	Cancer Risk	Non-Cancer HI	Cancer Risk	Non-Cancer HI
H	Cumulative Risk for Soil (0-2 ft) and Soil Gas (5 ft)	4E-07	0.1	4E-07	0.2	--	--
	Cumulative Risk for Soil (0-10 ft) and Soil Gas (5 ft)	4E-07	0.1	4E-07	0.3	2E-08	1
	Asbestos - Best Estimate	1E-09	--	3E-09	--	3E-08	--
	Asbestos - Upper-Bound Estimate	8E-08	--	2E-07	--	2E-06	--

Notes:
-- = Not applicable
ft = feet
HI = Hazard index

FIGURES



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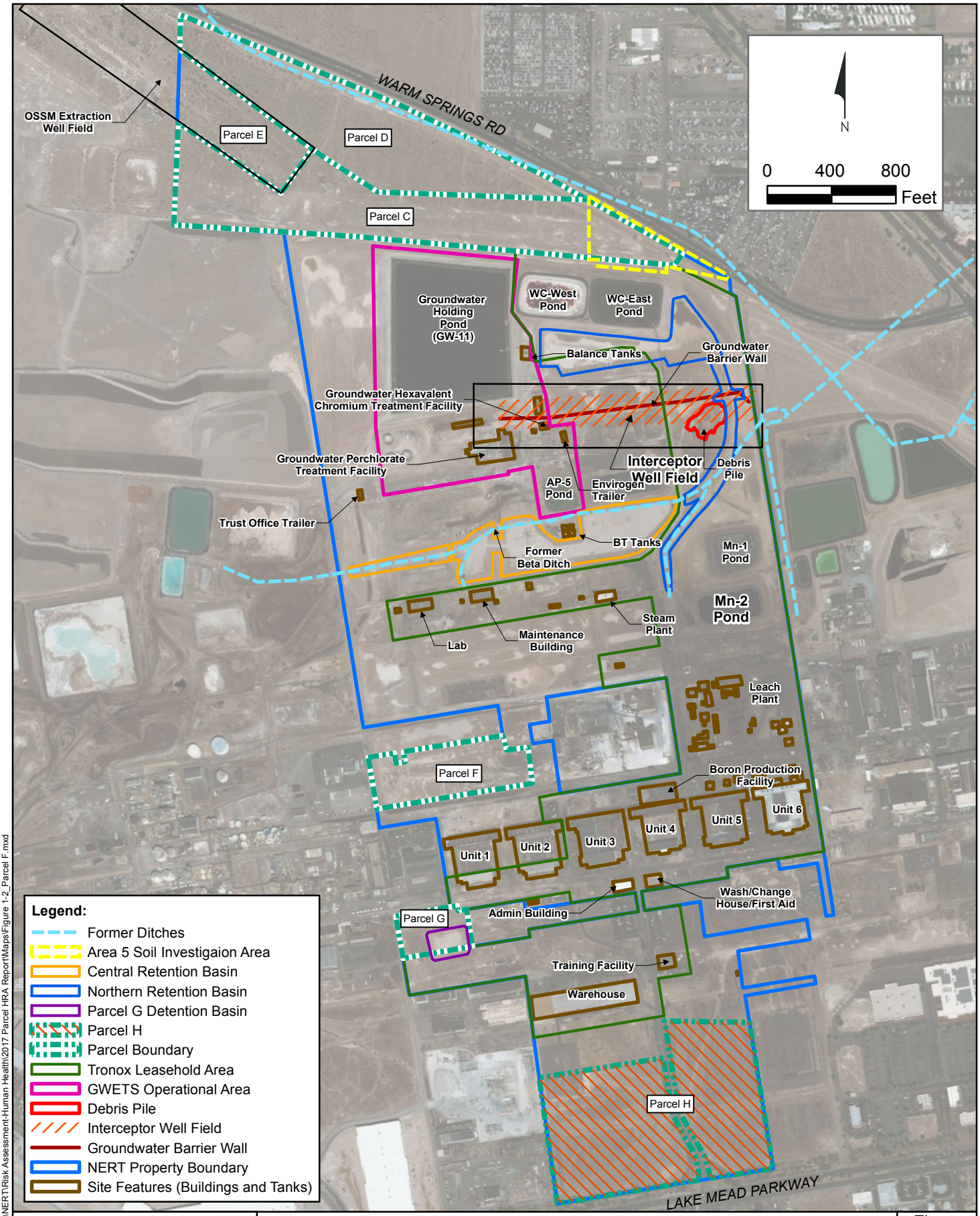
RAMBOLL

Site Location Map

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **1-1**

Drafter: EF	Date: 1/25/2018	Contract Number: 21-41400A	Approved by:	Revised:



RAMBOLL

Study Area and Site Features
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **1-2**

Drafter: RS/EF | Date: 1/29/2018 | Contract Number: 21-41400A | Approved by: | Revised:

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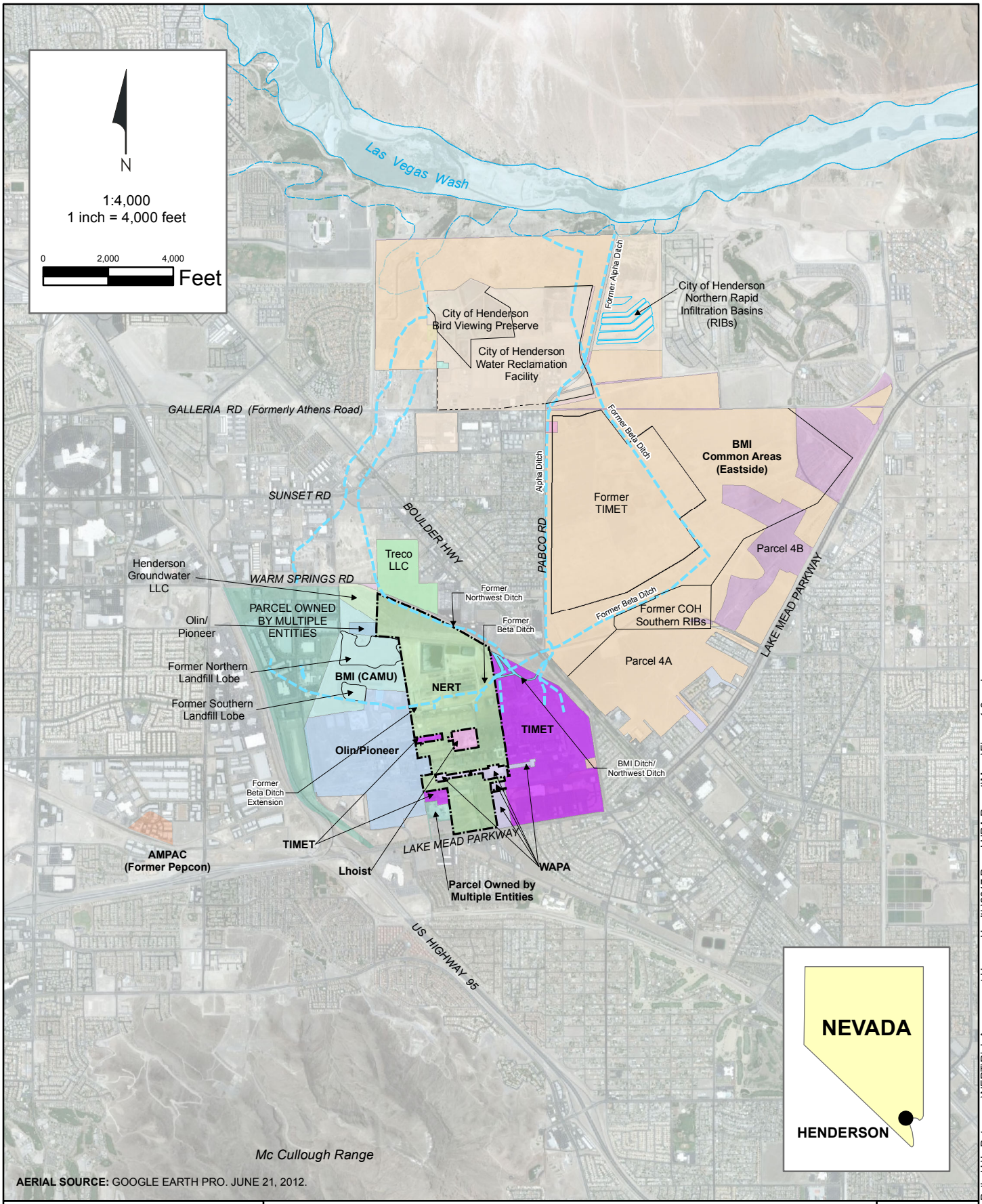

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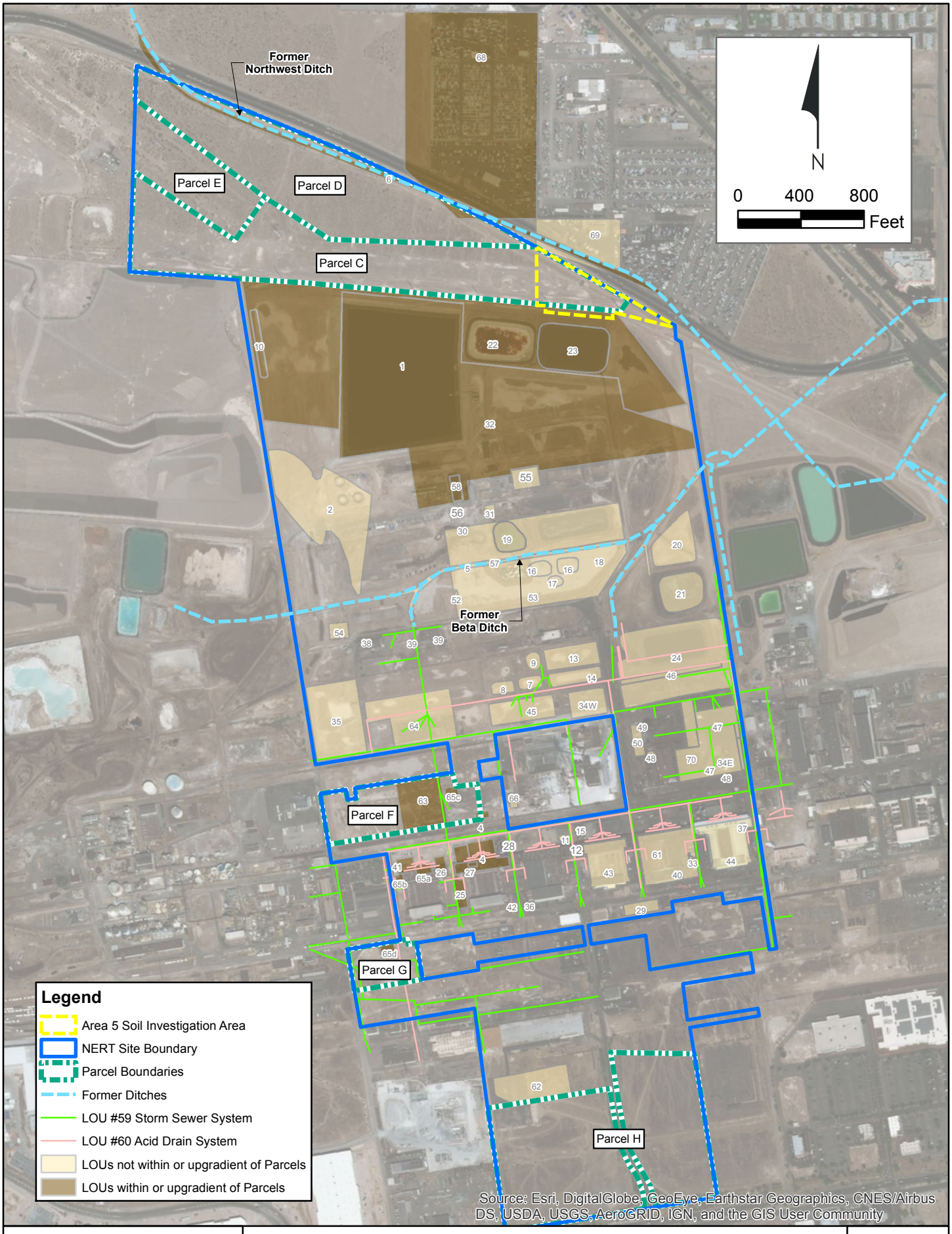
RAMBOLL

Surrounding Facilities

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
1-3

Drafter: EF Date: 1/25/2018 Contract Number: 21-41400A Approved by: Revised:

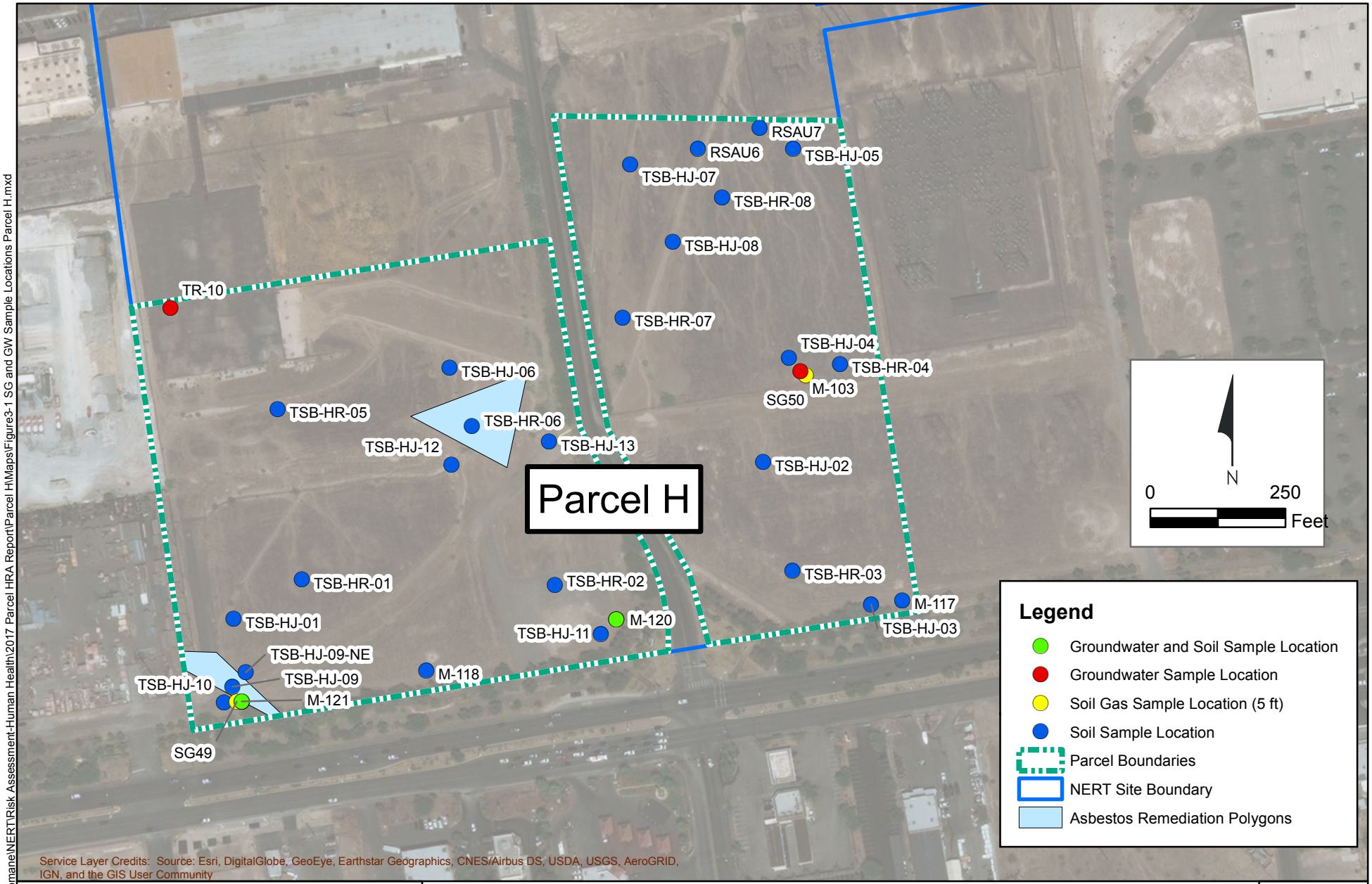


RAMBOLL

Parcels, Operations Area, and LOU Map
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **2-1**

Drafter: EF | Date: 1/25/2018 | Contract Number: 21-41400A | Approved by: | Revised:



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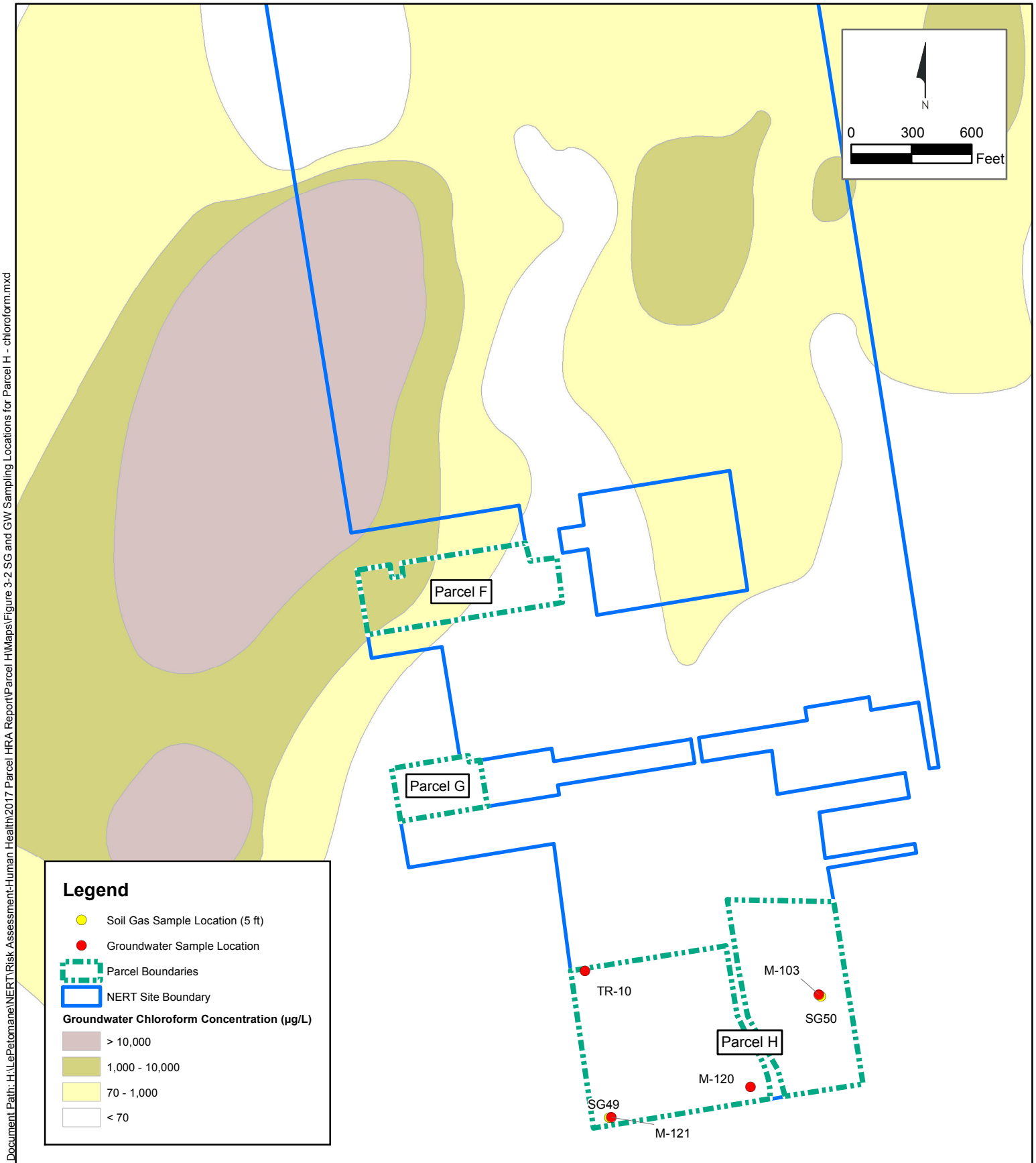
RAMBOLL

Remediation Polygons and Soil, Groundwater, and Soil Gas Sample Locations for Parcel H

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **3-1**

Drafter: RS | Date: 1/29/2018 | Contract Number: 21-41400A | Approved by: | Revised:



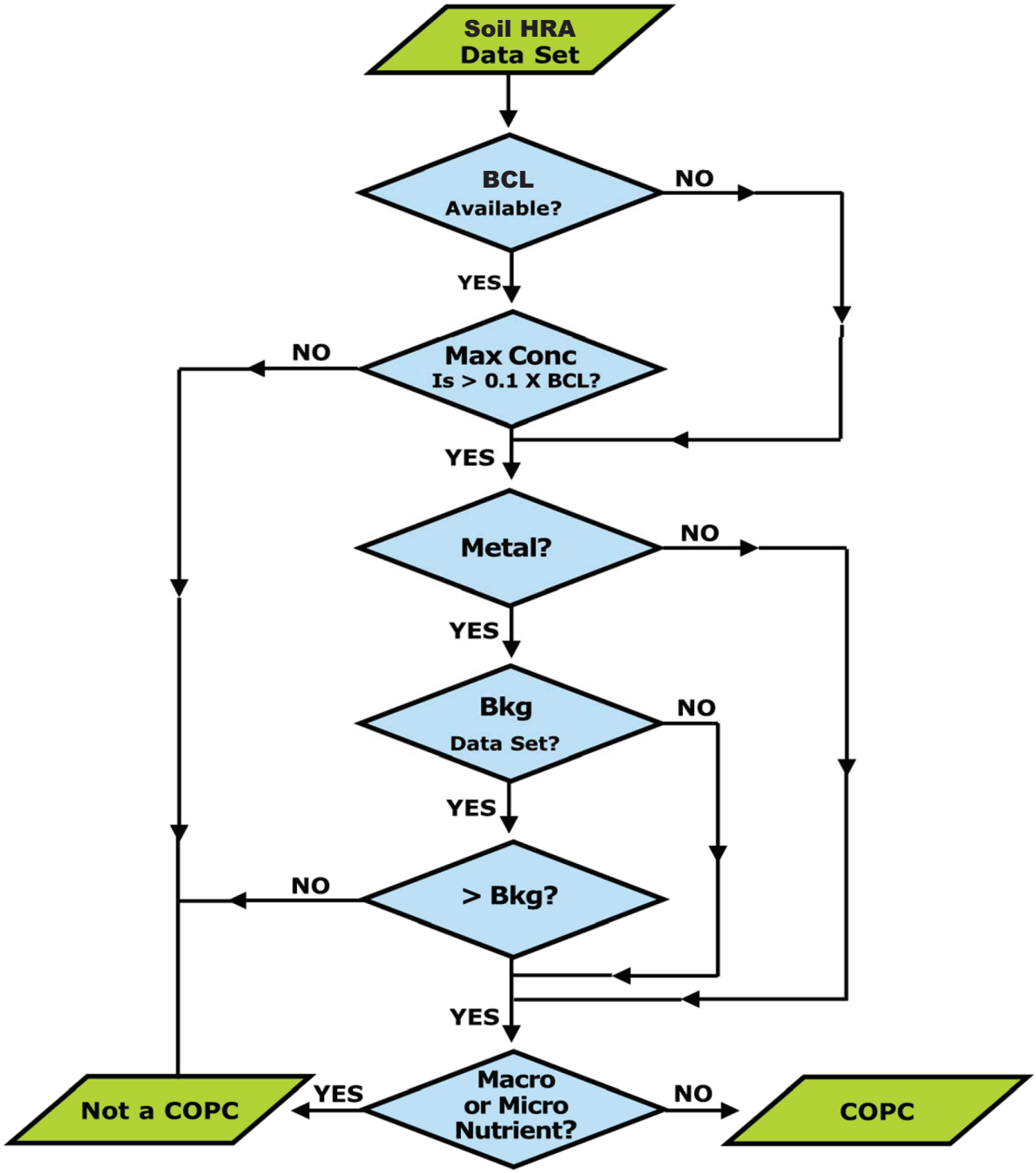
Document Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2017 Parcel HRA Report\Parcel H\Maps\Figure 3-2 SG and GW Sampling Locations for Parcel H - chloroform.mxd

RAMBOLL

Soil Gas and Groundwater Sampling Locations for Parcel H (Chloroform Plume as Depicted in 2015)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
3-2

Drafter: EF | Date: 1/25/2018 | Contract Number: 21-41400A | Approved by: | Revised:



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RAMBOLL

DRAFTED BY: RS

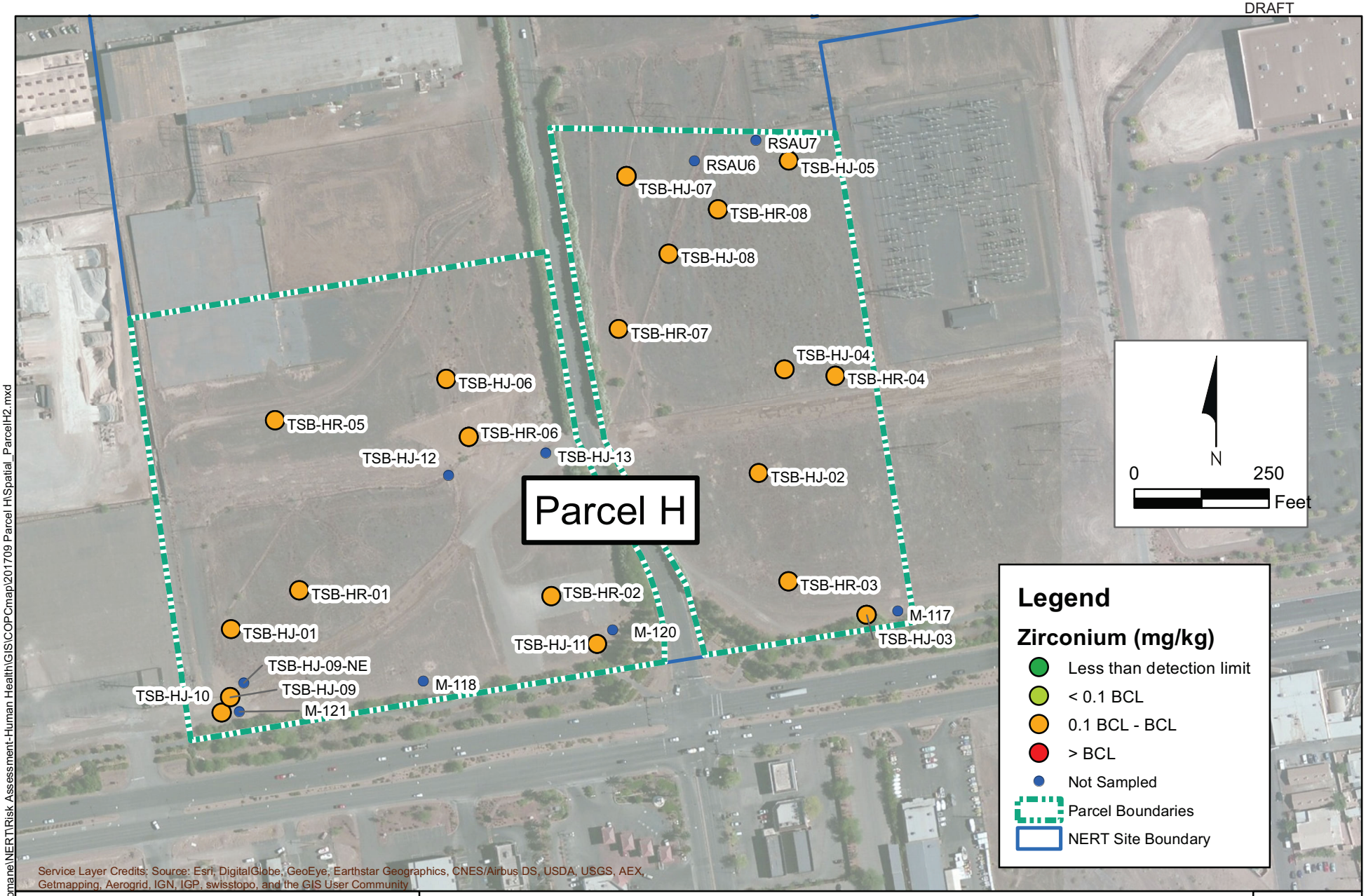
DATE: 8/19/16

Soil COPC Identification Flowchart

FIGURE

5-1

DRAFT



Document Path: H:\LePetomane\NERT\Risk Assessment-Human Health\GIS\COPCmap\201709 Parcel H\Spatial_ParcelH2.mxd

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Spatial Intensity Plot for Parcel H - Zirconium

[BCL = 104 mg/kg]

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **5-2**

Drafter: RS | Date: 8/25/2017 | Contract Number: 21-41400A | Approved by: | Revised:

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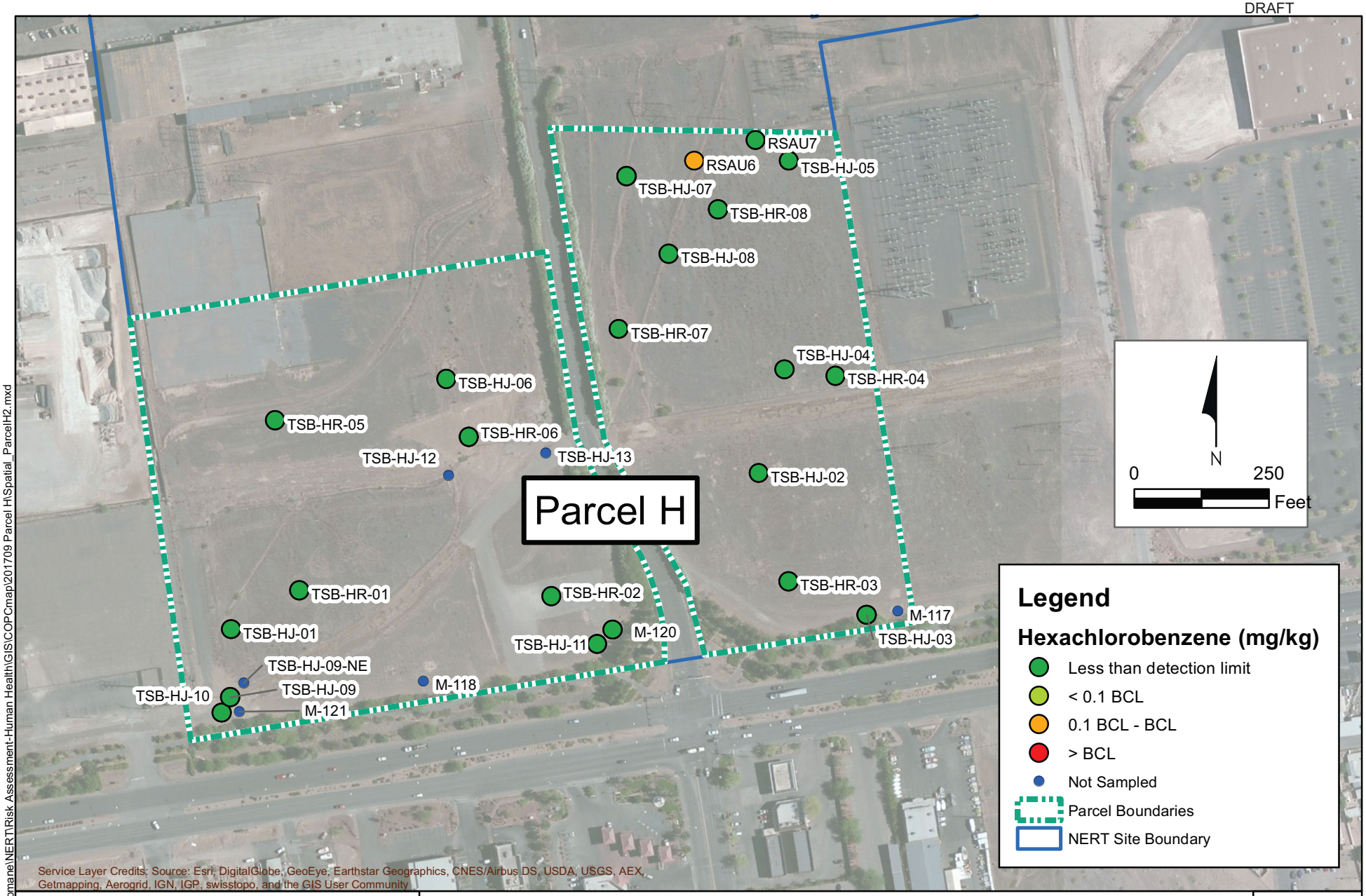

Document Path: H:\LePetomane\NERT\Risk Assessment-Human Health\GIS\COPCmap\201709 Parcel H\Spatial_ParcelH2.mxd

RAMBOLL

Spatial Intensity Plot for Parcel H - Hexachlorobenzene

[BCL = 0.23 mg/kg]

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **5-3**

Drafter: RS | Date: 8/25/2017 | Contract Number: 21-41400A | Approved by: | Revised:

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Document Path: H:\LePetomane\NERT\Risk Assessment-Human Health\GIS\COPCmap\201709 Parcel H\Spatial_ParcelH-LongC.mxd

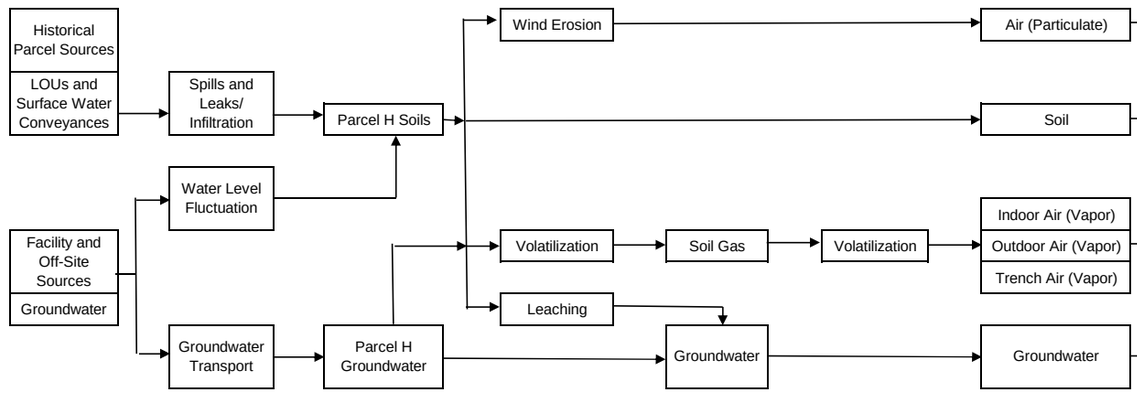
RAMBOLL

Spatial Intensity Plot for Parcel H - Long Chrysotile Fiber

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **5-4**

Drafter: RS | Date: 8/29/2017 | Contract Number: 21-41400A | Approved by: | Revised:



Primary Source	Primary Release Mechanism	Primary Impacted Medium	Secondary Release Mechanism	Secondary Impacted Medium	Tertiary Release Mechanism	Exposure Medium	Exposure Route	Current/Future Receptor						
								On-Parcel				Off-Site		
								Construction Worker	Indoor Commercial/ Industrial Worker	Outdoor Commercial/ Industrial Worker	Visitor and Trespasser	Indoor Commercial/ Industrial Worker	Outdoor Commercial/ Industrial Worker	Resident
Historical Parcel Sources; LOUs and Surface Water Conveyances	Spills and Leaks/ Infiltration	Parcel H Soils	Wind Erosion			Air (Particulate)	Inhalation [1], [2]	X	X	X	O [9]	O [10]	O [10]	O [10]
						Soil	Ingestion [1]	X	X	X	O [9]	--	--	--
							Dermal Contact	X	--	X	O [9]	--	--	--
							External [3]	X	X	X	O [9]	--	--	--
Facility and Off-Site Sources; Groundwater	Water Level Fluctuation		Volatilization	Soil Gas	Volatilization	Indoor Air (Vapor)	Inhalation	--	X	--	--	O [11]	--	O [11]
						Outdoor Air (Vapor)	Inhalation	O [4]	O [7]	X	O [9]	O [11]	O [11]	O [11]
						Trench Air (Vapor)	Inhalation	X [5]	--	--	--	--	--	--
	Groundwater Transport	Parcel H Groundwater	Leaching	Groundwater		Groundwater	Ingestion	-- [6]	-- [8]	-- [8]	-- [8]	-- [8]	-- [8]	-- [8]
							Dermal Contact	-- [6]	-- [8]	-- [8]	-- [8]	-- [8]	-- [8]	-- [8]

Notes:

X = Complete or potentially complete exposure pathway
O = Complete, but negligible exposure pathway; discussed qualitatively
-- = Incomplete exposure pathway
EPC = Exposure point concentration
LOU = Letter of Understanding
PEF = Particulate emission factor
VOC = Volatile organic compound

[1] Includes radionuclide exposures, if applicable.
[2] Includes asbestos exposures.
[3] Only radionuclide exposures, if applicable.
[4] The exposure to VOCs in outdoor air is not quantitatively evaluated for construction workers because it is expected to be much lower than the exposure to VOCs in trench air.
[5] To be conservative, construction workers are assumed to be exposed to vapors migrating from soil gas/groundwater while standing in a 10-foot trench in the unsaturated zone, placing them closer to the potential sources.
[6] Incidental ingestion and dermal contact with groundwater by construction workers are not considered complete exposure pathways because depth to groundwater is greater than 10 feet below ground surface.
[7] The exposure to VOCs in outdoor air is not quantitatively evaluated for indoor commercial/industrial workers because it is expected to be much lower than the exposure to VOCs in indoor air.
[8] Exposure via domestic use of groundwater is not evaluated because Site groundwater is not used as a domestic water supply.
[9] Visitors and trespassers are not quantitatively evaluated because 1) public access is generally restricted at industrial sites, and 2) while the public may have access to commercial sites, on-site workers have a much higher exposure potential because they spend substantially more time at the site.
[10] For inhalation of soil particulates, the PEF for on-site construction workers is much higher than the PEF during construction for off-site receptors (see discussion in text Section 6.2.2.1). Therefore, as compared with other exposure factors that may be higher for the off-site receptors, the exposures through inhalation of soil particulates by off-site receptors are expected to be lower than the exposures by on-site construction workers, and are not quantitatively evaluated.
[11] For inhalation of vapors migrating from soil gas or groundwater, the EPCs in air for off-site receptors are expected to be much lower than those for on-site receptors due to air dispersion given the above distances to parcel boundaries (see discussion in text Section 6.2.2.1). Therefore, the off-site receptors are not quantitatively evaluated.

RAMBOLL

Conceptual Site Model for Potential Human Exposures
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **5-5**

Drafter: | Date: 6/29/2017 | Contract Number: 21-41400A | Approved by: | Revised:

APPENDIX A
RESPONSE TO COMMENT LETTERS

APPENDIX A-1
RESPONSE TO COMMENT LETTER – RESPONSES TO NDEP COMMENTS ON SOIL HRA REVISION 3

Appendix A-1

Explanatory Note:
The following are the list of comments received from NDEP on May 6, 2015 on the Post-remediation Screening Health Risk Assessment Report for Parcels C, D, F, G and H, Revision 3 (dated June 19, 2014).

General Comments

General Comment 1: Background for radionuclides.

Background comparisons for metals were performed using the RZ-A data for background, per NDEP recommendations and previous comparisons of site data with background. This is because of the difference between the BRC/TIMET background concentrations and the RZ-A concentrations; the latter exhibit lower mean concentrations, and the differences are often statistically significant. Hence, RZ-A was used as a more local background dataset than the BRC/TIMET BMI Complex-side background data.

However, the BRC/TIMET background data have been used for radionuclides. An initial and cursory review of the BRC/TIMET background and RZ-A concentration data for radionuclides also indicates that the RZ-A mean concentrations are less than the BRC/TIMET mean concentrations. For at least five of the radionuclides under consideration the differences are statistically significant. This suggests that the RZ-A data should be used as background for radionuclides as well as for metals.

An obvious conclusion is that RZ-A represents a (slightly) different geology than the locations for the BRC/TIMET data. However, both datasets of interest are ostensibly taken from McCullough range derived soils. It is possible that there are other issues at play, but this is difficult to determine based on the presentation. For example, perhaps there are analytical issues. It is not unusual for different labs to report slightly different concentrations. A possible course of action would be to investigate lab reports more closely. Also note that the Ra-228 concentrations appear to be quite low in RZ-A, compared to the BC/TIMET data and compared to data from other RZs (or Parcels). This is perhaps an indication of analytical issues.

It is also possible that acid-solvent leaching of the soil matrix with subsequent transport to groundwater has occurred in this area, and this is cause for somewhat decreased concentrations of some metals and radionuclides in relatively near surface soils. Possible courses of action to further investigate this possibility might include evaluation of redox potential of these soils, and spatial comparison to groundwater concentrations for some metals (e.g., arsenic, uranium).

Response:

Northgate and Ramboll had understood that the RZ-A background data set should be used for chemical analytes, but that the BRC/TIMET BMI Complex background data set should be used for radionuclides. We note that the BRC/TIMET background data set was used for the radionuclide background analysis presented in the June 27, 2012 HRArev2 report (Section 5.2.1) and that NDEP did not comment on that analysis; Northgate therefore used the same data set (i.e., the BRC/TIMET data set) in the HRArev3 report.

As agreed during the October 13, 2015 and January 28, 2016 meeting with

NDEP and NDEP consultants to discuss the radionuclide background analysis (Ramboll Environ 2015), the radionuclide background analysis and discussion were revised as follows:

- The background evaluation for radionuclides was based on the comparison with the RZ-A data set for COPC selection.
- An expanded discussion of analytical and other issues associated with the data sets for the radionuclides are included in Section 5.1.1.2.
- Through the comparison of preliminary cancer risks calculated for the parcel data set and background data set (both RZ-A background and BRC/TIMET background), radionuclides are considered as consistent with background and not identified as COPCs.

General Comment 2: Spatial plots.

A request was made for spatial plots, and some have been provided. Chemicals included in spatial plots are those that are identified as COPCs. However, spatial plots of some other chemicals would be useful to understand and contribute to the CSM. This is perhaps more important here at this site because of the concentrations that are lower than BRC/TIMET background in RZ-A.

Of further note is that the spatial plots are not as useful as plots that use a continuous scale across concentrations (while perhaps using different symbols for non-detects). Splitting data by the mean concentration does not provide a general picture of concentration patterns, and does not allow easy comparison of chemicals for similar spatial patterns. Also, use of large and small circles for shallow and deeper samples does not make it easy to discern differences or patterns. Continuous concentration plots and separate plots for surface and deeper samples would be more helpful.

Also, there does not appear to be much discussion of the results of the spatial plots, perhaps because it is not easy to see effects or patterns given the types of plots provided. There is a discussion in Section 4.5 of why some chemicals were chosen for plotting, but there is no discussion of the results.

Response:

Spatial quartile plots for selected detected analytes and spatial intensity plots for all COPCs are provided in the revised report. In the spatial quartile plots, the concentrations bins are tied to those used for the box plots (i.e., <Q1, Q1-Q3, Q3 + [1.5 x IQR] and > Q3 + [1.5 x IQR]). In the spatial intensity plots, the concentrations bins are tied to BCLs or other screening criteria. Discussion of the spatial plots are provided in the report text. Although Neptune did not like the spatial quartile plots or the spatial intensity plots, Ramboll found the spatial plots to be helpful from a risk perspective. Through agreement between Ramboll and Neptune, Neptune would develop their own plots using the data provided in this report by Ramboll.

General Comment 3: Radionuclide risk.

Certain radionuclides were identified as COPCs in Revision 3 of the Parcels C – H HRA Report pursuant to comments on Revision 2 of the HRA Report indicating that radionuclide concentrations appeared elevated relative to background. Because a radionuclide risk assessment has not previously been presented the assessment in Revision 3 was reviewed:

a. Particulate inhalation exposure pathway; indoor worker. The exposure assessment for radionuclides (Section 5.3.2.3) includes a reference to the BCL User's Guide (NDEP 2008-rev 2013) for methodology and equations. Although NDEP (2008-rev 2013) does not differentiate indoor and outdoor workers for radionuclide BCLs, separate calculations for radionuclide risk were performed in Revision 3 of the Parcels C – H HRA Report consistent with the exposure assessment for chemicals. Inhalation of particulates in indoor air, using an attenuation factor applied to ambient air concentrations, is identified as a potentially complete exposure pathway for chemicals in NDEP (2008-rev 2013). In Section 5.1.3, the rationale provided for excluding this pathway for the indoor worker in Revision 3 of the Parcels C – H HRA Report is a reference to a supplemental soil screening levels guidance (EPA 2002a). The fact that particulate inhalation was not identified as a recommended chemical exposure pathway for indoor workers in EPA (2002a) is not justification for excluding this pathway from the radionuclide risk assessment. EPA (2002a) was among the references evaluated during development of the BCLs for the BMI Complex and Common Areas, yet inhalation of particulates in indoor air was retained as a potentially complete exposure pathway for BCL calculations. An attenuation factor for indoor air particulate concentrations may be applied in the inhalation pathway risk calculation for indoor workers to refine this calculation. In fact, a dilution factor for outdoor to indoor air is listed among the parameters shown in Table 7 of the Parcels C – H HRA Report. Please provide rationale for not quantifying indoor worker inhalation risk for radionuclides.

   We note that practically, the particulate inhalation pathway will make a negligible contribution to total radionuclide risks. But this should be demonstrated / explained to justify not evaluating it. An option might be to consider pathway contributions for the BCL calculations.

   Response:

   Radionuclides are not identified as COPCs, and therefore are not carried forward into the risk calculation.

b. Particulate emission factor value. Revision 3 of the Parcels C – H HRA Report presents a screening-level calculation of risk using the maximum concentration for each COPC from all Parcels. The values for industrial/commercial and construction PEF are not stated in the report. Instead, tables are referenced that show Parcel-specific PEF values. The radionuclide risk calculation workbook was reviewed to determine that the Parcel G PEF values were applied in the calculations. The Parcel G PEF values are the largest among all Parcels, and particulate loading in air (and hence cancer risk) is inversely proportional to the magnitude of the PEF value. The selection of the Parcel G PEF values for a screening calculation should be explained since the most-protective value would more commonly be applied during screening.

   Response:

   The soil HRA has been revised to include a separate evaluation of risks for each individual parcel. Parcel-specific PEFs were used for each individual parcel.

c. Tables 7 and 8. The inhalation rate values used for the radionuclide risk calculations should be added to these tables.

Response:

Radionuclides are not identified as COPCs, and therefore are not carried forward into the risk calculation.

d. Section 5.5.4. The use of maximum detected background concentrations as a point of comparison to the screening-level risk assessment results for each scenario is inappropriate and should be removed from this discussion. An estimate of average background radionuclide concentrations may be employed in the risk assessment calculations for the purpose of providing a point of comparison to Site risks and estimating incremental cancer risks. If the protectively biased screening-level risk assessment results using the maxima from all Parcels is inadequate to support risk management decisions a baseline risk assessment for each Parcel using Parcel-specific concentrations should be prepared. Comparison of maxima is completely inappropriate. Maxima are, by their very nature, highly uncertain with values that are greatly affected by sample size. In this case the sample size used for background is 95, which is much greater than the site sample size for any single parcel. Not only is this approach statistical indefensible, but it is made worse by the background sample size used. This is notwithstanding the issue in General Comment #1 above, which requires use of the RZA data to represent background for radionuclides.

Response:

The soil HRA has been revised to include a separate evaluation of risks for each individual parcel. All discussion comparing risks to maxima background radionuclide concentrations were deleted. As noted, discussion comparing parcel risks with risks associated with both the RZ-A and the BRC/TIMET background data set based on 95% UCL over the mean soil activities are included in the revised HRA.

e. Section 5.6, Uncertainty Analysis. A subsection should be added to the Uncertainty Analysis focusing on the radionuclide risk assessment. The current Uncertainty Analysis focuses primarily on the results of the chemical risk assessment. Various aspects of this discussion are not applicable to the radionuclide risk assessment and key uncertainties related to the radiation risk assessment (such as the radon-222 pathway) are not presently addressed.

Response:

A discussion of uncertainties in the radionuclide risk assessment is presented in Section 6.2.4, including uncertainties with excluding radionuclides from the risk calculation and inhalation risk of radon gas (radon-222) within a commercial building.

f. Radon-222 risk. As discussed in Appendix E-4 of the BCL User's Guide (NDEP 2008-rev 2013) inhalation of radon gas within a building is potentially of greater concern than other exposure pathways related to radium-226. At a minimum, a discussion of potential radon-222 inhalation risks should be added to Section 5.5.4.1 and to the new radionuclide risk assessment subsection of the Uncertainty Analysis.

Response:

A discussion of the inhalation risks from radon in indoor air is presented in Section 6.2.4.

General Comment 4: Asbestos data.

ENVIRON noted in their comment responses to Neptune DVSR comments as follows: DVSR Comment d on Table D-10 of the HRA. The comment response indicates that sample Q3-PF-1-1-0.0 was adjusted in Table D-10 to show an analytical sensitivity of 2.99E+06 structures/g PM10. In asbestos workbook Parcel F_asbestos_riskcalcrev.xlsx the analytical sensitivity for this sample is instead 2.96E+06 structures/g PM10. Please clarify.

Response:

The analytical sensitivity listed in asbestos workbook Parcel F_asbestos_riskcalcrev.xlsx for sample Q3-PF-1-1-0.0 was replaced with the value of 2.99E+06.

General Comment 5: Asbestos risk calculation workbooks.

a. The asbestos risk assessment calculations employ both original and field duplicate samples. This increases the sample size by treating these quality control samples as independent samples, resulting in lower values of pooled analytical sensitivity. If field duplicate samples are to be treated as independent samples the magnitude and variability of results for the field duplicate pairs must be compared with that of primary samples to demonstrate that field duplicate results are independent of primary sample results, otherwise the asbestos risk can be under-estimated.

Response:

We note that both original and field duplicate samples were used in the analysis presented in the HRA rev2 report and that NDEP did not comment on the analysis; Northgate therefore used the same approach in the HRArev3 analysis.

The asbestos cancer risks based on the primary and field duplicate samples are presented in the risk characterization section, and the asbestos cancer risks based on the primary samples only are presented in Section 6.1.7. Results indicate that excluding the field duplicate samples would not change the conclusion.

b. References for site-specific values used in the PEF calculations should be provided in the workbooks. These include site surface area, in situ wet bulk soil density, gravimetric soil moisture content, soil silt content, and road surface soil silt content. The references were discovered in Table 6 of the HRA Report. Please provide the appropriate reference in appropriate asbestos sections of the report.

Response:

References for site-specific values used in the PEF calculations are provided in Table 5-8.

Attachment A-1

RTC Comment 1. Section 4.2. The section notes that MS/MSD recoveries were outside of control limits in 570 instances and that holding-time exceedances in 75 instances. This potential effect on the risk assessment should be discussed in the uncertainty analysis.

Response:

The discussion of the potential effect on the risk assessment of the qualified data is provided in Section 6.1.6.

New Comment 1a. The revised text of Section 5.6 discusses the potential impacts of J-qualified data on the risk assessment results and concludes that J and J- data would not impact COPC selection or identification of maximum concentrations. In particular, the text states, "COPC selection was based on the maximum detected concentration; for analytes not selected as COPCs, the J-qualified results were significantly below BCLs such that even if corrected for the low bias, the analyte would not have been identified as a COPC." This statement should be supported by analysis showing estimated bias-corrected values compared to BCLs.

Response:

A summary of the comparison of J-qualified data to BCLs is provided in Table 6-1.

New Comment 1b. In Section 4.2 it is stated that 444 field duplicate results, and one MS/MSD pair, were qualified for excessively large relative percent difference values. Table C-1 however shows only 304 results qualified due to reason code 17 (Field duplicates did not meet the 50% RPD control criterion). The previous report version stated that there were 570 instances where MS/MSD recovery was outside of control limits, but Table C-1 shows 1,281 results qualified due to reason code 4 (The MS/MSD recovery was outside of control limits). The previous report also noted 75 instances of holding time exceedances. Section 4.2 does not specifically discuss holding time exceedance in the current version, but Table C-1 indicates that 1,164 results were qualified due to reason code 1 (The sample preparation and/or analytical holding time was exceeded). Please explain these discrepancies and revise Section 4.2 to provide a complete summarization of data validation results.

Response:

All qualified results (i.e., U, J, J-, and J+ qualified data) for the non-asbestos analytes are presented in Appendix F, Table F-1, and the reasons for these qualified results are summarized in the DVSRs (see Appendix E). The data qualified due to precision exceedance are summarized in Table E-4, and discussed in Section 4.1.1.7.

RTC Comment 2. Section 4.2. Identify rejected data and discuss implications for the risk assessment.

Response:

The discussion of the potential effect of the rejected data on the risk

assessment is presented in Section 6.1.3.

RTC Comment 3. Table 5. Please update using the latest BCL table and guidance (August, 2013).

Response:

The report was updated using the BCL tables and guidance issued in July 2017.

RTC Comment 4. Table 9. The Deliverable should rely upon the latest toxicity criteria for each of the COPCs (listed in Table 9). The NDEP (2013) reference necessarily documents toxicity criteria current when this reference was prepared, but these criteria are subject to revision over time. The authors should review the federal and state agency references where relevant toxicity criteria are published to identify current toxicity criteria. (The values in Table 9 were checked and are current with present-day values published by federal and state agencies – this clarification pertains to methodology and future assessments).

Response:

Comment acknowledged; the referenced federal and state agency sources for the toxicity values were reviewed to confirm that the most current values are being used at the time the report is submitted.

RTC Comment 5. Editorial change. Please change “contaminate” to “contaminant” in footnote #5.

Response:

This comment was addressed.

Attachment A-2

RTC Comment 1. Section 5.2.1. The reasoning by which all radionuclides were dismissed as COPCs appears flawed. In the case of Parcel H, not just one but all four radionuclides in the uranium series were clearly elevated with respect to background.

Response:

Per discussion in the October 13, 2015 and January 28, 2016 meeting with NDEP and NDEP consultants, the radionuclide background analysis for Parcel H is pending for Neptune's review. In this report, the background evaluation for radionuclides was based on the comparison with the RZ-A data set for COPC selection. An expanded discussion of analytical and other issues associated with the data sets for the radionuclides are included in Section 5.1.1.2. Through the comparison of preliminary cancer risks calculated for the parcel data set and background data set (both RZ-A background and BRC/TIMET background), radionuclides are considered as consistent with background and not identified as COPCs.

New Comment 1a. Section 5.2.1, 3rd paragraph, 1st sentence. The text indicates that the "potential comparability issues identified for metals data were not observed" for radionuclides. Our review of radionuclide summary statistics for the RZ-A site background and BRC/TIMET (2007) background data sets suggests that, as for metals, RZ-A site background for radionuclides may also be lower than regional background for radionuclides. Data analysis must be provided to support the statement that radionuclides are not affected by the comparability issues and justify the use of the BRC/TIMET (2007) background data set for radionuclides.

Response:

Please see response to General Comment #1.

New Comment 1b. Section 5.2.1, last paragraph. A review of Table F-4 does not support the identification as COPCs of only the uranium-238 decay series radionuclides (U-238, U-234, Th-230, Ra-226) in Parcel H. Thorium-232 and radium-228 are also indicated as being present in Parcel H soils at concentrations elevated above background, indicating that the thorium-232 decay series (Th-232, Ra-228, Th-228) should be retained as COPCs.

Response:

Per discussion in the October 13, 2015 and January 28, 2016 meeting with NDEP and NDEP consultants, the radionuclide background analysis for Parcel H is pending for Neptune's review. In this report, the background evaluation for radionuclides was based on the comparison with the RZ-A data set for COPC selection. An expanded discussion of analytical and other issues associated with the data sets for the radionuclides are included in Section 5.1.1.2. Through the comparison of preliminary cancer risks calculated for the parcel data set and background data set (both RZ-A background and BRC/TIMET background), radionuclides are considered as consistent with background and not identified as COPCs.

RTC Comment 2. Spatial intensity plots showing the spatial distribution of analytes are needed to evaluate the implicit assumption that there is no spatial structure to the soil samples and therefore it is appropriate to pool samples.

Response:

Please see response to General Comment #2.

New Comment 2a. Spatial intensity plots should be provided for all chemicals rather than a subset. The purpose of such plots is to investigate possible spatial patterns that can inform the conceptual site model, provide a basis for evaluating data adequacy, and finally support data aggregation for exposure assessment. Also, identifying chemical collocation is facilitated by review of these plots. Producing plots for all analytes should not require substantially more effort than for a subset, and in fact may ultimately be more efficient since there is then no need to provide rationale for omitting a subset of chemicals based on documentation of the reviews described in the response.

Response:

Please see response to General Comment #2.

New Comment 2b. The spatial plots provided in Figures 7 through 17 are inadequate to allow review of spatial patterns of contamination. The plots should provide a continuous scale, using color or bubble size. Distinguishing concentrations at different locations as either greater or less than the mean as the current plots are configured is of limited value for identifying the location of anomalously high values. In addition, it would be more helpful to have separate plots for the two different depth layers – these could be presented side-by-side.

Response:

Please see response to General Comment #2.

RTC Comment 3. Executive Summary. Please revise the paragraph related to asbestos risks to correct the reference to constant lifetime exposure for construction worker amphibole upper-bound cancer risk results in the risk assessment.

Response:

The paragraph has been revised.

New Comment 3a. Footnote 2 clarifies that the fiber counts referenced to the Removal Action Workplan are not remediation goals. Explain the relevance of the cited Removal Action Workplan fiber counts or remove these sentences from the paragraph.

Response:

The language in the report has been revised to delete any suggestion that the number of fiber counts is a remediation goal.

New Comment 3b. In both Executive Summary and Section 5.5.3 there are

statements that the upper-bound risk estimates are based on an observed count of zero long amphibole structures in the 75 remaining (post-abatement) samples from the Parcels. These statements are incorrect and misleading, and conflict with the request for clarification of this issue in Comment 19. Asbestos UCLs and related risk estimates were not calculated with 75 samples but rather with the number of post-abatement samples collected in each individual parcel, which range from 6 samples (Parcel G; 6E-06 cancer risk) to 23 samples (Parcel H; 2E-06 cancer risk). Please revise the text in this paragraph and Section 5.5.3.

Response:

The text in the Executive Summary and Section 6.2.2.2 has been revised to reflect the number of samples in Parcel H, as appropriate to the discussion.

RTC Comment 4. Section 2.2; last paragraph. Asbestos remediation goals are stated in this paragraph without reference. The basis for the chrysotile and amphibole asbestos counts referenced to the Removal Action Workplan is not described in the post-remediation risk assessment and it is inappropriate to infer that these fiber counts somehow define acceptable post-remediation levels of asbestos in soil. Fiber counts in a sample are not meaningful without an associated analytical sensitivity, so while these counts may have significance for delineating target areas for soil remediation in the workplan context they have no particular significance in a risk assessment context. More specifically, it is the pooled analytical sensitivity based on multiple samples that is relevant for estimating asbestos soil concentrations and this is a function of the number of samples as well as sample-specific analytical sensitivity. Explain the relevance of the cited Removal Action Workplan fiber counts or remove this language.

Response:

The language in the report has been revised to delete any suggestion that the number of fiber counts is a remediation goal.

RTC Comment 5. Section 3.1. Appendix C contains data files for samples with qualified results only. The text of Section 3.1 states, "A complete listing of the Parcel Soil Confirmation samples and SDGs is presented in Table 1-2 of the Northgate (2010a) Data Validation Summary Report for the Parcels, which is discussed later in this report and provided in Appendix C." Please briefly describe the three Excel workbooks also provided in Appendix C.

Response:

All the data summary tables and documents related to the soil DUE are presented in Appendices E and F. Appendix E includes four Excel workbooks for data not considered due to soil removal and asbestos abatement activities, data excluded during data processing, rejected data, and qualified field duplicate, in addition to a folder with data validation summary reports. Appendix F includes post remediation soil HRA data set for chemicals and radionuclides (including all U- and J-qualified data) and the post remediation soil HRA data set for asbestos.

RTC Comment 6. Section 3.7. Please define a "trigger sample" as referenced in the sentence describing how "…the trigger sample point was surveyed and marked by LVP."

Response:

This was clarified in the text of Section 3.3.1.2.

RTC Comment 7. Section 4.2. Data validation methods and results for asbestos should be discussed.

Response:

Neptune validated the asbestos results in accordance with NDEP guidance (Neptune 2014), and a memorandum responding to the specific issues identified in the DVSRs along with the agreed data set for risk assessment purposes in the EDD was submitted to NDEP (ENVIRON 2014). The final asbestos data set used in this post-remediation soil HRA is presented in Table F-2.

RTC Comment 8. Section 4.2. Add a discussion of laboratory accreditation / certification under Criterion III.

Response:

The text in Section 4.1.1.4 was amended indicating that analyses were conducted by NDEP-certified laboratories.

RTC Comment 9. Section 4.2. Provide more details about detection limits above BCLs for benzo(a)pyrene and dibenz(a,h)anthracene. Table 5 indicates that detection frequencies for detected PAHs are relatively low, being in all cases less than 5%. This provides evidence that PAHs are not a widespread soil contaminant and support a conclusion that detection limit issues for benzo(a)pyrene and dibenz(a,h)anthracene are not a significant concern. Please add a discussion of this line of evidence to the text of the report.

Response:

A discussion of the impacts of elevated SQLs on the soil COPC selection and risk estimates is presented in Section 6.1.2.

RTC Comment 10. Section 4.2. More information needs to be provided about the RPD exceedances. This information should be summarized in a table.

Response:

The data qualified due to precision exceedance are summarized in Table E-4, and discussed in Section 4.1.1.7.

New Comment 10a. The summary of the assessment of precision in the revised text (444 field duplicate results, and one MS/MSD pair, were qualified for excessively large relative percent difference values) appears inconsistent with the earlier text (570 instances where MS/MSD recovery was outside of control limits). Please explain this discrepancy.

Response:

The summary of data qualified due to precision exceedance was reorganized, and was checked against the DVSRs for consistency.

New Comment 10b. Vinyl acetate is identified as the only analyte for which an MS/MSD sample exceeded the RPD criterion. This result was qualified with the statement that vinyl acetate "is not a compound that is included in the HRA data set (Appendix D)." Section 4.4 states that all confirmation data are included in Appendix D. Please identify any other analytes that have been excluded, explain the basis for which an analyte such as vinyl acetate would have been excluded from the assessment data set, and provide this information in the risk assessment report.

Response:

Vinyl acetate was not excluded from the soil HRA data set (see Table F-1), and no data point for vinyl acetate was qualified for MS/MSD RPD exceedance. No analyte was excluded from the soil HRA data set due to precision exceedance.

RTC Comment 11. Section 4.2. Provide the total number of results evaluated and results rejected to calculate percent completeness.

Response:

The rejected data are summarized in Table E-3, and the calculated completeness for Parcel H is presented in Section 4.1.1.7.

RTC Comment 12. Section 4.2 and Appendix C. Section 4.2 and Table C-1 do not provide enough information about the data qualifications made. All data qualifications, not just J-, should be discussed. Additionally, Table C-1 needs to provide: limits and recoveries, definition of reason codes, holding time vs exceeded time, LCS/LCSD issues, and an explanation of the yellow highlight. The text on page 21 (570 MS/MSD exceedances and 75 holding time exceedances) does not accord with the numbers of exceedances for these endpoints in Table C-1.

Response:

All qualified results (i.e., U, J, J-, and J+ qualified data) for the non-asbestos analytes are presented in Table F-1, and the reasons for these qualified results, including details of the exceedances and deficiencies, are summarized in the DVSRs (see Appendix E).

New Comment. The summary bullets related to J-qualified data in the Data Quality Indicators discussion were deleted in this revision of the risk assessment. A summary table with information for each analytical suite was introduced for the data completeness endpoint, but summary information related to data qualifiers for precision and accuracy is now missing. Summary tables for precision and accuracy parameters should be added to Section 4.2. These summaries, and reference to Table C-1 as appropriate, should be used as the basis for the discussion of the effect of uncertainty in data usability/data evaluation (Section 5.6) on risk assessment results and conclusions. Table C-1 should be referenced for data qualification details, but this table has >8400 rows and requires summarization in the main report. See also clarification for Attachment A-1,

Comment 1, for specific examples of discrepancies between Table C-1 and Section 4.2.

Response:

The Data Quality Indicators discussion was reorganized in Section 4.1.1.7 of this report. All the data summary tables and documents related to the soil DUE are presented in Appendices E and F. Appendix E includes four Excel workbooks for data not considered due to soil removal and asbestos abatement activities, data excluded during data processing, rejected data, and qualified field duplicate, in addition to a folder with data validation summary reports. Appendix F includes post remediation soil HRA data set for chemicals and radionuclides (including all U- and J-qualified data) and post remediation soil HRA data set for asbestos. This information was used as the basis for the discussion of the effect of uncertainty in data usability/data evaluation on risk assessment results and conclusions (see Section 6.1).

RTC Comment 13. Section 4.2. There needs to be more information about how blank contamination was handled for DVSRs. Blank contamination is one of the parameters that should be summarized in Section 4.2 and discussed in relation to the effect of uncertainty in data usability/data evaluation (Section 5.6) on risk assessment results and conclusions. Although the impact of blank contamination is discussed in Section 5.6 a summary of the sample results affected by blank contamination should be provided in Section 4.2. Information summarizing the levels of contamination found in blank samples should be added to the discussion in Section 4.2. See also the clarification for Comment 12.

Response:

As requested by NDEP and in accordance with the most recent guidance (NDEP 2012) for evaluating data associated with blank contamination, Ramboll queried the censored data for blank contamination from the project database, and changed them from nondetected values at PQLs (U qualified) to detected values at reported concentrations (J qualified) if the PQLs were higher than the reported concentrations. Such revisions only affected the two samples collected during the 2009 Phase B investigation (RSAU6 and RSAU7). However, during our review, Ramboll noticed that several discrepancies in the data associated with blank contamination exist between the project database and the amended tables of the DVSRs Northgate prepared in the Soil HRA Report Revision 3 (Northgate 2014), especially for the reported concentrations. Data consistent with the project database are included in this soil HRA, and the impacts of such discrepancies on the soil HRA results are further discussed in Section 6.1.6. Also, please see our response to NDEP comment on Attachment A-2, Comment #12.

RTC Comment 14. Section 5.2.1. Please clarify why data from two different locations are used as background. Analysis must be provided to support this statement and justify the use of the BRA and TIMET (2007) background data set for radionuclides. As noted in the New Comment for RTC Comment 1, our cursory review of radionuclide summary statistics for the RZ-A site background and BRA and TIMET (2007) background data sets suggests that, as for metals, RZ-A site background for radionuclides may also be lower than regional background for radionuclides. Geologic differences are cited in Section 5.2.1 and in this comment response as one possible explanation of the discrepancy

between Site and background concentrations for analytes in the metals analytical suite, and such differences could also affect radionuclide concentrations.

Response:

See response to General Comment #1.

RTC Comment 15. Section 5.2.1. The reason for using different substitution values for non-detects for parametric and non-parametric tests should be discussed. Section 5 .2.1 was revised to cite NDEP guidance for the substitution values, but the rationale for the use of different values for parametric and non-parametric tests was not provided as the response indicated it would be. Please provide a brief summary of the rationale, which pertains to the difference between representing results by ranked value (non-parametric tests) versus representing results by the most-likely actual value (parametric tests).

Response:

The text in Section 4.1.2.2 was expanded accordingly.

RTC Comment 16. Section 5.2.1. Discuss issues related to the use of PQLs in the data analyses in lieu of SQLs. The analytes affected by this issue are not specified nor is the direction or degree of potential bias clearly explained for data analyses affected by this issue. Tables including affected analytes would be helpful, including a comparison of the non-detect limits with the detected data, and some discussion of how this affects conclusions. Table 3 contains some of this information. For example, the non-detect (presumably PQLs) for antimony appear to range from 1 – 5.4 ppm, but the detected data range from 0.088 to 0.32 ppm. The same basic issues arise for all metals that have non-detects reported (e.g., boron, cadmium, chromium VI, mercury, thallium, tin, tungsten). Some of these metals failed background comparisons, however, the impact of the PQLs on these background comparisons is not clear. For example, boron and thallium failed background comparisons – was this because of the high PQLs?

Response:

As discussed in Section 4.1.1.5, the issue of reporting nondetect results to PQL instead of SQL no longer exists in the current soil HRA data set. After taking the responsibility for maintaining the project database on behalf of the Trust in early 2011, Ramboll repossessed the nondetect data according to the current NDEP guidance on the use of censoring limits (NDEP 2008). In the soil HRA data set, nondetect results are reported to the SQL whenever it is available; otherwise, nondetect results are reported to the method detection limit (MDL). Only when either SQL or MDL is not available, the nondetect results are reported to the PQL.

RTC Comment 17. Section 5.2.2. Reconcile presentation of amphibole risks with amphibole not being identified as a COPC. Consistent with the April 1, 2014 NDEP response to the NERT response to Comment 17, amphibole was retained as a COPC. Table 5 indicates amphibole was identified as a COPC based on NDEP (2011), but no NDEP (2011) reference is included in the risk assessment references (Section 7). Please provide the reference.

Response:

Long amphibole fiber was included as a COPC per NDEP guidance (Neptune 2015).

RTC Comment 18. Section 5.5.3. Revise paragraph to accurately describe bias related to the asbestos URF used in the risk assessment. The Comment 3 is also applied to this comment.

Response:

The uncertainty of asbestos toxicity value is discussed in Section 6.2.3. Also, see response to Attachment A-2, Comment 3.

RTC Comment 19. Section 5.6. Add a discussion explaining the relationship between sample size and pooled analytical sensitivity to provide context for upper-bound asbestos risk estimates. This discussion provides a good summary of the relationship between sample size, fiber count, and the 95UCL for asbestos. This should be referenced in addressing New Comment for RTC Comment 3 and RTC Comment 18.

Response:

The discussion of uncertainty in asbestos exposure point concentrations is presented in Section 6.2.2.2, in response to NDEP Attachment A-2 RTC Comment 3 and RTC Comment 18.

RTC Comment 20. Section 5.2.1. The rationale and distinction between parcel level comparisons and site wide comparisons should be more fully discussed in the main report. The following new text was added to Section 5.2.1: "The background evaluation was performed for each Parcel individually and is presented for both the combined Parcels and individual Parcels. The Parcels were evaluated individually because potential sources of chemicals could exist only in certain Parcels." Please revise the second sentence as follows: "The Parcels were evaluated individually because they had different operational histories and previous soil investigations identified different potential contaminants among the different Parcels (see Section 2.0)"

Response:

The soil HRA has been revised to include a separate evaluation of risks for each individual parcel, so the background evaluation will only be performed for each parcel individually. The referenced sentence was revised as suggested in Section 4.1.2.2.

RTC Comment 21. Tables F5A and F5B. Explain what is meant by the "Number Missing" column.

Response:

The missing number is the count of sampling locations for which one or more results are unavailable. A footnote has been added to Tables I-5A and I-5B.

RTC Comment 22. Section 5.5.3. The variation in the asbestos upper-bound risk estimates is a function of differences in sample size and should be explained in that context.

Response:

See response to Attachment A-2 RTC Comment 19.

RTC Comment 23. Table 5. Add a footnote explaining blue shading.

Response:

A footnote was added to Table 5-1 explaining that blue shading indicates analyte is carried forward to COPC identification Step 2.

RTC Comment 24. Appendix F boxplots. The points outside of the 1.5x interquartile range are not necessarily outliers.

Response:

The term “outlier” was deleted from all boxplots in Appendix I.

APPENDIX A-2
RESPONSE TO COMMENT LETTER – RESPONSES TO NDEP COMMENTS ON SOIL GAS HRA REVISION 1

Appendix A-2

Explanatory Note:
The following are the list of comments received from NDEP on January 12, 2017 on the Soil Gas Investigation and Health Risk Assessment for Parcels C, D, F, G, and H, Revision 1 (dated September 23, 2016).

General Comment:

1. Run the J&E model for the soils at the depth of 5 ft. and 10 ft., and the groundwater with the data available, respectively;
2. The input data for the J&E model must use the site specific data. If the site specific data is not available, NERT should choose using the default values of the dominant soil classifications for corresponding soil horizons at the site or collecting new data for the depth of 5 ft. and 10 ft.;
3. Do a 30-day exposure frequency for trench model analysis.

Specific Comment #1 - March 18, 2013 NERT HRA Work Plan, on page 2, Section 1.1 Overview, footnote #4 and Section 5.4.3
This section states: "Potential risks associated with soils within the Study Area are currently being evaluated. The current draft of the soil HRA was submitted to NDEP on May 18, 2012 (Northgate 2012) and NDEP provided comments on the draft HRA on August 7, 2012. Responses to NDEP comments and revisions to the draft HRA are in preparation. Results from the final (NDEP-approved) HRA will be combined with the risk results for the vapor intrusion pathway to evaluate cumulative risk."

The current version of the report only addresses the vapor intrusion pathway and makes no statement with regard to next steps/path forward. It is understood that the path forward is dependent upon risk management decisions among stakeholders, however, the current report does not address the cumulative risk.

Response: Reporting of cumulative risk (soil + soil gas) was discussed on pages 2, 3-4, and 49 of the Rev1 report. As noted on those pages, the original plan was for the cumulative cancer risks and HIs for inhalation of VOCs (as evaluated in the Soil Gas HRA) and for soil-related pathways (for all soil chemicals of potential concern) to be presented in the final version of the Soil Gas HRA or in the final version of the soil HRA. The current version of this report now addresses soil, soil gas and groundwater for Parcels C, D and G.

Specific Comment #2 - March 18, 2013 NERT HRA Work Plan, Figure 5
Figure 5, the CSM, indicates that the downgradient receptor pathways for Indoor Worker and Resident are complete. Further, page 35, Section 5.2.I Conceptual Site Model, last paragraph states:

> "In accordance with the 2010 and 2013 risk assessment work plans (Northgate and Exponent 2010a; ENVIRON 2013a), off-site receptors, visitors, and trespassers were not quantitatively evaluated in the HRA. The rationale for excluding these receptors and a qualitative in the HRA. The rationale for excluding these receptors and a qualitative discussion of their potential risks is presented in Section 6.4.

And on Page 47, Section 6.4, Exposure Assessment, fourth paragraph states:

> "In accordance with the NDEP-approved Health Risk Assessment Work Plan (Northgate and Exponent 2010a), off-site receptors were not quantitatively

evaluated in the HRA. Inhalation of VOCs by on-site outdoor commercial/industrial workers serves as an upper-bound estimate of the potential exposures to VOCs by off-site receptors, ..."

For reference and clarity of the administrative record, the Health Risk Assessment Work Plan (Northgate and Exponent 2010a) specifically states on page 8:

> "...off-Site receptors will not be quantitatively evaluated in post-remediation risk assessments and a discussion will be included to provide rationale for this decision, and the associated uncertainties will be included in the uncertainty assessment."

The report lacks transparency as regards rationale and justification for not evaluating off- Site receptors as this justification is not brought forward into the HRA report. It should also be noted this plan states, "Based on the relative differences in the on-Site receptor particulate emission factor .... and the off-Site receptor particulate emission factor during construction, ... versus other exposure factors that may be higher for the off-site receptor, the on-Site construction exposure will be greater than that of the off-Site receptors." Underline added for emphasis to draw attention to lack of technical justification for not evaluating the off-Site receptor. Recommend revision to this section to provide clear justification and technical rationale for why off-Site receptors are protected.

Response: Discussion was added to clarify this point in Section 6.2.2.

Specific Comment #3 - Executive Summary

The construction worker receptor should be evaluated using a model accounting for vapor intrusion into a utility trench such as that from the Virginia Department of Environmental Quality (2016).[1]

Response: A utility trench was not included in the approved work plan. At the request of NDEP a utility trench scenario has been added to the Parcel C, D, and G HRA Report.

Specific Comment #4 - Section 1. Introduction, page 3.

The text states that "In addition, based on a review of figures showing a chloroform plume in shallow groundwater, NDEP noted that the 2008 Phase B investigation soil gas samples were collected from locations where VOC results would likely be biased low. Finally, NDEP commented that it may be reasonable to use the site-wide soil gas data reported in the 2010 Site-Wide Soil Gas HRA in conjunction with groundwater data to evaluate potential risks for the vapor intrusion pathway."

Section 1. Introduction, page 5. The text states that "Since completion of the soil gas sampling and Revision 0 of this HRA, USEPA issued the final version of its guidance Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air (USEPA 2015a). Ramboll has reviewed the guidance and found that the completed field work and HRA are generally consistent with the current guidance."

USEPA (2015) referenced herein states that "Modeling results for idealized scenarios

[1] http://www.deg.virginia.gov/Programs/LandProtectionRevitalization/RemediationPrograrn/Voluntai:yRemediationPr ogram/VRPRiskAssessmentGuidance /Guidance.aspx

show that, in homogeneous soil, soil gas concentrations tend to be greater beneath the building than at the same depth in adjacent open areas when the vapor source is underneath the building, even if the source is laterally extensive relative to the building footprint (e.g., broad plume of contaminated groundwater) (USEPA 2012b). Given these predictions and supporting field evidence (USEPA 2012a, see Figure 6; Luo et al. 2009; Patterson and Davis 2009, see Figure 1), individual exterior soil gas samples cannot generally be expected to accurately estimate sub-slab or indoor air concentrations. This potential limitation may be particularly valid for shallow soil gas samples collected exterior or adjacent to a building footprint...Deeper soil gas samples collected in the vadose zone immediately above the source of vapor contamination (i.e., 'near-source' soil gas samples; see Section 6.3.1) can reasonably be expected to be less susceptible to the diluting effects of ambient air, compared to shallow soil gas samples. On this basis, deeper soil gas samples collected in the vadose zone immediately above the source of vapor contamination will tend to be more suitable than will be shallow soil gas samples for assessing vapor concentrations that may be in contact with the building's sub-slab." The USEPA (2015) as referenced in the Deliverable does not appear to support the use of shallow soil gas sample on open areas.

Response: Groundwater modelling results were included in the previous report in Appendix I. As discussed with NDEP, the groundwater results have been updated and moved into the main text as an additional line of evidence. In addition, soil gas samples collected in 2007 within Parcels C and D at a depth of 10 ft bgs have been identified and included in the Parcel C, D and G HRA Report.

Specific Comment #5 - Section 2.1.5 Parcel H, First Line, page 14

The text indicates the size of Parcel H is 24.5 acres. However, the J&E modeling done used a parcel size of 26.3. Please reconcile and correct J&E modeling accordingly (Table 12).

Response: This will be corrected in the Parcel H HRA Report.

Specific Comment #6 - Section 4.1.1Soil Gas Data Set, Second Paragraph, page 22

The text indicates that there are 12 sampling locations from the 2008 investigation ...shown on Figures 5 and 6. Consistent with the RTCs, for Parcel H, why not include the soil gas data from sample locations SG47, SG66 and SG67?

Response: Samples SG47, SG66, and SG67 are to the north of Parcel H. For the few cases in which samples exterior to a parcel boundary were included in the HRA data set, the samples were located downgradient (not updgradient) of a parcel.

Specific Comment #7 - Section 4.2.2.2 Parcels F, G, and H), page 32.

1. The text states that "However, as previously described (Section 2.3), chloroform was not detected in the 0 and 10 ft soil samples collected within Parcel F (7 of which were located within LOU 63, although downgradient of SG34), but was detected at concentrations of 200 and 410 µg/kg in two of the 20 and 30 ft soil samples collected within Parcel F, suggesting a groundwater source." Please show this data in graphic and/or tabular form.
2. The text states that "For the outlier pair, for which the soil gas concentration was higher than predicted, available shallow soil samples (at 0 and 10 ft bgs) did not provide evidence of a surface source, with chloroform detected only in deep soil samples at 20 and 30 ft bgs." The correlation shown in Figure 8 does not support the predicted concentration assumed herein. Given that USEPA (2015) referenced in the states that "Modeling results for idealized scenarios show that, in homogeneous soil, soil gas concentrations tend to be greater beneath the building than at the same depth in adjacent open areas...individual exterior soil gas samples cannot generally be

expected to accurately estimate sub-slab or indoor air concentrations ... This potential limitation may be particularly valid for shallow soil gas samples collected exterior or adjacent to a building footprint..."Please explain the apparent low bias in shallow soil gas as shown in these two paragraphs in Section 4.2.2.2.

Response: As agreed with NDEP, the groundwater/soil gas comparison has been removed from the report. Groundwater modelling results were included in the previous report in Appendix I. As discussed with NDEP, the groundwater results have been updated and moved into the main text as an additional line of evidence.

Specific Comment #8 - Section 4.2.3 Spatial Analysis of VOCs in Soil Gas, page 32
In general, it appears that this exercise also supports the tenet of groundwater as the source yet several exceptions are noted. For example, no discussion is offered concerning significant contribution of carbon tetrachloride in Parcel G soil gas samples E-SG-8 and SG47. However, shallow groundwater data (Table 8) in Parcel G monitoring well TR-8 reports nondetect or very low estimated concentrations. Please update this section to provide a more robust interpretation of the data.

Response: During our meeting, NDEP agreed to remove this comment.

Specific Comment #9 - Section 5.2.3.2 Fate and Transport Modeling, page 36.
The text states that "For the receptors evaluated in this HRA (future on-site workers), transfer factors for soil gas to indoor air and outdoor air were derived based on migration of soil gas from 5 ft bgs into a commercial slab-on-grade building and into ambient air." The J&E model documentation states that the advective zone of influence for soil gas flow is limited to soil immediately adjacent to the building foundation. The foundation acts as a barrier to atmospheric cycles resulting in higher sub-foundation soil gas concentrations than measured in the absence of a building. Computer simulations by Massmann and Farrier (1992) supports the concept that "fresh air may migrate several meters into the subsurface during a barometric pressure cycle." Three-dimensional modeling by Abreu, et.al. (2008) indicated that for shallow sources on undeveloped land the best sampling depth was between 4 to 5 meters of depth and for deep sources samples should be collected from a maximum depth of 5.5 meters.

Reference to Table 12 and Table 14. The J&E soil gas model was for shallow 5-foot deep soil gas samples; however, the soil physical properties were for soil samples from 9 to 15 feet deep with an average of 10 feet deep. The mean volumetric water content was 0.154 (unitless) and the total porosity was 0.366 (unitless). Ifcomparable shallow soil samples are not available on the NERT site then J&E default values for loamy sand (volumetric water content 0.076 and total porosity was 0.39) should be used in the model.

Response: Groundwater modelling results were included in the previous report in Appendix I. As discussed with NDEP, the groundwater results will be updated and moved into the main text as an additional line of evidence.

In addition, soil gas samples collected from Parcels C and D at a depth of 10 feet bgs have been identified and included in the HRA. The 10 foot soil properties were used for all soil gas modelling but the use of more conservative default soil properties is discussed in the uncertainties section (Section 6.2.2.3).

The site-specific soil properties were used in the modelling of both the 5 and 10 foot soil gas samples. After reviewing site boring logs and lithology, the site-specific soil

properties were used with the removal of the one sample collected at 15 feet. Reviewing both the boring logs in the parcels and the boring logs where the samples were collected did not reveal any systematic increase in “wetness” between 5 and 10 feet throughout the site. While a few locations did note wetter conditions at 10 feet, a few locations also noted wetter conditions at 5 feet as well. Additionally, there is very little variability among the soil properties measured from the 9 and 10 feet samples. The exception to that is the one sample collected at a depth of 15 feet that did note wetter conditions than typical and also had the highest water filled porosity measured at the site. It was decided to remove the 15 foot sample from the evaluation and modify the site-specific soil properties to include only the samples from 9 and 10 feet. We also reviewed the stratigraphy from the site and in all of the parcel areas, both 5 and 10 feet should be located in the same stratigraphic unit (the alluvium) and are expected to have very similar conditions. The upper muddy creek formation, which should have wetter soil properties, does not appear stratigraphically until significantly deeper than 10 feet in all three parcels.

Use of conservative default values in the place of site-specific soil properties has been addressed in the uncertainty section (Section 6.2.2.3).

Specific Comment #10 - Section 6.3, page 46
The report states "California's default air exchange rate of 1 air change per hour (Cal/EPA 2011) was used in the absence of a default rate from USEPA. A conservative height of 10 ft was assumed, although many commercial buildings have higher first floor ceilings." The CalEPA default commercial building height (8 feet) should be used.

Response: The height was proposed and agreed upon in the Work Plan.

Specific Comment #11 - Section 6.3 Exposure Concentrations, page 50.
The text states that "Lastly, it is expected that the soil gas samples will provide a more accurate risk characterization because soil gas samples are collected closer to the point of exposure." It is accurate to say that the shallow soil gas sample is closer to the point of exposure; however, it is inaccurate to say that a shallow soil gas sample is equivalent to a sub-slab or deep soil gas sample. Shallow soil gas samples over undeveloped land are not equivalent to either sub-slab soil gas (USEPA, 2015; USEPA, 2004) or soil gas samples from undeveloped land (Massmann and Farrier, 1992; Abreu, et.al., 2008). Given the probable low bias from shallow soil gas in undeveloped (open) as cited here and in previous comments, it is recommended that shallow soil gas samples be used as only one line of evidence. Furthermore, it is recommended that the groundwater COPCs be modeled using the J&E Groundwater Model.

Response: Groundwater modelling results were included in the previous report in Appendix I. As discussed with NDEP, the groundwater results were updated and moved into the main text as an additional line of evidence. In addition, soil gas samples collected in 2007 within Parcels C and D at a depth of 10 ft bgs have been identified and included in the Parcel C, D and G HRA.

Specific Comment #12 – Table 1 LOUs Within and Directly Upgradient of the Study Area Parcels
Parcel C does not list LOU #58 yet Figure 4 indicates it is within or directly upgradient. Please correct accordingly.

Response: For this report, the table has been removed but the figure retained (now Figure 2-1). As shown in the figure, LOU #58 is not within or directly upgradient of

Parcel C.

Specific Comment #13 - Table 3
Please provide the equation(s) used to derive the risk-based concentrations (RBCs).

Response: Page 32 of the report states that "The RBCs were derived using the inputs to the Johnson and Ettinger (1991) model and values for exposure assumptions and toxicity criteria presented in Section 5 of this HRA." Equations for deriving RBCs were added in the Section 5 of the report.

Specific Comment #14 - Table 4 Field Duplicate Qualifications
Please verify the calculation for sample pairs E-SG-6-030813 1,2 Dibromoethane, E-SG-6- 030813 cis-1,3 Dichloropropene, E-SG-6-0308131 1,1,1,2-Tetrachloroethane as they do not appear to be correct.

Response: Soil gas sample E-SG-6-030813 collected in 2013 is located in Parcel F. The calculations for field duplicates for this sample are updated and included in the Parcel F HRA Report which is anticipated to be submitted to NDEP by the end of 2017.

Specific Comment #15 - Table 7 Soil Gas Summary Statistics -Combined 2008 and 2013 Data

Several chemicals were which were detected in 2008 were not analyzed in 2013 yet the report does not provide rationale for elimination of these chemicals from the suite. The chemicals are noted as follows:

- N-Butylbenzene @ 100% detection frequency
- Ethanol @ 92% detection frequency
- N-Octane @ 50% detection frequency
- N-Propylbenzene @ 75% detection frequency

Please provide some discussion on the subject.

Response: Although both investigations used analytical method TO-15, the laboratories reported a different set of chemicals. As shown in Appendix Q, Table Q-2-4, all chemicals listed above were evaluated for noncarcinogenic effects in the soil gas HRA and none contributed significantly to the estimated HIs for any parcels or exposure populations.

Specific Comment #16 - Table 8
Please expand this table to include all groundwater COPCs listed in Table 9.

Response: Groundwater tables were revised and now include all groundwater COPCs.

Specific Comment #17 - Table 11
Was vapor intrusion modeling and associated risk calculations conducted for chloroform for Parcel E? If not, because Figure 4 and Figure 5 show elevated chloroform concentrations in groundwater immediately south/southwest (upgradient) of Parcel E, it is recommended that a groundwater-based vapor intrusion model be used to quantify the potential future risk associated with chloroform in groundwater given the expectation that this chloroform will soon migrate beneath this parcel.

Response: Parcel E is not included in this report.

Specific Comment #18 - Table 12 and Table 14
Are there any data soil properties data available for samples collected at depths less than or equal to 5 feet? If so, they should be used. The default saturation (ratio of water-filled porosity to porosity) for a loamy sand is approximately 19% whereas the value used in the model (0.154 / 0.366) equates to approximately 42%. The values listed in the table are associated with samples collected from depths ranging between 9 and 15 feet. Please provide justification for using these samples for vapor intrusion model simulations based on a source depth of only 5 feet, especially given the moist/wet conditions noted on some of the boring logs included in Appendix F in the 9- to 15-foot depth interval in which the soil properties samples were collected. The potential for lower moisture conditions in the depth interval ranging between 0 and 5 feet, and associated higher risk values, should be discussed.

Response: See response to Specific Comment #9.

Specific Comment #19 - Table 13 and 'VLOOKUP' Table
Many of the chemical property values in these tables are outdated in comparison to those more recently published by the USEPA. It is recommended that the updated USEPA values be used. For example, the reference concentration for TCE – which is a COPC as listed in Table 9 - has been revised downward from 0.04 mg/m^3 to 0.002 mg/m^3.

Response: The tables were updated.

Specific Comment #20 - Table 14
Footnote b of this table states that the volumetric moisture content is "As measured per ASTM D 2216". This is incorrect as ASTM D 2216 measures moisture content on a mass basis (e.g., grams of water per gram of soil). Mass basis moisture values should be adjusted using dry bulk density and water density values as described in NDEP (2010) *Soil Physical and Chemical Property Measurement and Calculation Guidance.*

Response: The values presented in the table are already corrected using that methodology. The footnote in the table has been revised for clarity.

Specific Comment #21 - Figure 4, Figure 5, and Figure 6
Please add a groundwater flow direction arrow (or arrows) to these figures. Further, Figure 5 indicates the Primary Source of Groundwater VOC is from Off-Site sources. As new field data is collected the validity of this assumption is called into question, specifically as regards Units 4 and 5 investigations. Revision to this figure is recommended.

Response: A revised figure (Figure 3-3) was made to incorporate the changes. Previous Figures 5 and 6 are now included in Appendix B and groundwater flow direction arrows have been added. Figure 5 shows the chloroform groundwater plume as it was depicted in 2010. Figure 6 shows the chloroform groundwater plume as it was depicted in 2016.

Specific Comment #22 - Figures
The figure suggests that there are chloroform data are from 2008 and 2013. Are there more recent chloroform soil gas data?

Response: No.

Specific Comment #23 - Figure 6
Comparison to Figure 5 shows the chloroform in groundwater plume is migrating to the northeast. A discussion regarding the potential for soil gas concentrations to increase or decrease at the various parcels in the future as the chloroform in groundwater plume continues to migrate should be included. API Publication Number 4741 (2005) notes that for deeper sources (i.e., greater than 10 meters [30 feet] – which is in reasonable agreement with the 35-foot depth modeled in this report), vertical vapor-phase travel times can be on the order of years to decades.

Response: Discussion has been added in Section 5.4.3.1.

Specific Comment #24 - Figure 7 and Figure 8
Are there contemporaneous groundwater and soil gas data? From what year? Are there co-located (in plan-view) groundwater and soil gas data?

Response: Per NDEP's comment, the scatter plots of co-located groundwater and soil gas data were removed.

Specific Comment #25 - Appendix H, J&E, Groundwater Advanced and Soil Gas Advanced Models.
Please provide the rationale and reference for adding the Reference Concentration on the Chemical Properties sheet for both models.

Response: It was added for convenience but has been removed from the printouts in this report.

Specific Comment #26 - Appendix I, Shallow Groundwater Evaluation, Section 1.5, page 1-4.
The text states that "It is expected that the soil gas sampling will provide a more accurate risk characterization because the samples are collected closer to the receptor. In general, the closer the sampled medium is to the receptor, the more relevant the data are for estimating exposure and greater its weight of evidence (California Environmental Protection Agency [Cal/EPA] 2011)." Please refer to Comment # 10 above.

Response: Groundwater modelling results were included in the previous report in Appendix I. As discussed with NDEP, the groundwater results have been updated and moved into the main text as an additional line of evidence. In addition, soil gas samples collected in 2007 within Parcels C and D at a depth of 10 ft bgs have been identified and included in the Parcel C, D and G HRA.

Editorial Comments
Specific Comment No. #27 - Page 7, Section 1.4 Geologic and Hydrogeologic Setting
This section states:

> "Soil types identified in the on-site soil borings include poorly sorted gravel, silty gravel, poorly sorted sand, well sorted sand, and silty sand (ENSR 2005)"

This discussion should tie back to the loamy sand parameter on Table 12. Suggest footnote.

Response: Footnote has been added to refer to the text for further discussion of the soil type selection.

Specific Comment #28 - Page 8, Section 1.4 Geologic and Hydrogeologic Setting, last paragraph, last sentence.
This statement is not support without reference to technical report. Suggest adding reference.

Response: Reference was added.

Specific Comment #29 – Page 16, Section 2.3 Study Area CSM, third bullet
This bullet states: "Additional investigation is necessary at the Unit 4 and 5 Buildings to better understand the distribution of chloroform in this area. This work was begun in early 2016 and will continue into 2017."

Yet, on the following page and paragraph the Deliverable states,

> "...nor is there evidence of significant on-Site sources of groundwater contamination." ...."There is no evidence to suggest that soils at the Study Area are acting as a source of groundwater VOC contamination; further, concentrations in soil are not indicative of historic releases of chloroform to soils"

Suggest deleting these statements as there is insufficient data until the site investigation is complete.

Response: The Study Area refers to the Parcels, not the Operations area which includes the Unit 4 and 5 Buildings. The text has been changed to clarify this.

Specific Comment #30 - Page 30, Section 4.2.2 Scatterplots for Co-located Soil Gas and Groundwater Samples
Although classified as "shallow" groundwater monitoring wells, TR-6 is screened from 60 - 80 ft bgs in the UMCf and TR-8 is screened from 63-93 ft bgs UMCf as compared to M-92 Parcel F) which is screened from 39 - 49 ft bgs. Perhaps this should be noted/considered in discussions correlating groundwater data to soil gas data.

Response: As mentioned in response to comment #7, as agreed with NDEP, the groundwater/soil gas comparison has been removed from the report. However, this will be noted in the general discussion.

Specific Comment #31 - Page 35, Section 5.2.1 Conceptual Site Model
It should be noted that the nearest resident north - northwest is only 1550 ft away from Parcel D and the nearest resident south is only 500 ft from parcel H.

Response: Noted and added to the text.

Specific Comment #32 - Figure 10 Explanation b
Please correct the sentence for Explanation b.

Response: Corrected the sentence.

Specific Comment #34 - Table 10 References
USEPA, 2002. Should be revised to USEPA, 2002b.

Response: References have been updated.

References

Abreu, L., Johnson, P., and McAlary, T. 2006. 3D Model Simulations and Implications to Near Building Sampling. USEPA VI Workshop, AEHS Conference, San Diego, CA. March.

Massmann, J., and D. F. Farrier. 1992. Effects of Atmospheric Pressures on Gas Transport in the Vadose Zone. Water Resources Research, v. 28, n. 3, p. 777 -791.

NDEP, 2010. Soil Physical and Chemical Property Measurement and Calculation Guidance, BMI Plant Sites and Common Areas Projects, Henderson, Nevada. March 11.

USEPA, 1992. Supplemental Guidance to RAGS: Calculating the Concentration Term. Office of Solid Waste and Emergency Response. Publication 9285.7-081. May.

USEPA, 2004. User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. February.

USEPA, 2015. OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air. EPA9200.2-154. June.

APPENDIX B
REMOVAL ACTION WORKPLAN FOR SOIL, TRONOX PARCELS "C", "D", "F", "G", AND "H" SITES

Basic Environmental
COMPANY

July 1, 2008

Ms. Shannon Harbour, P.E.
Nevada Division of Environmental Protection
Bureau of Corrective Actions
2030 E. Flamingo Road, Suite 230
Las Vegas, Nevada 89119-0818

Subject: Removal Action Workplan for Soil, Tronox Parcels "C", "D", "F", "G" and "H" Sites, Henderson, Nevada

Dear Shannon:

On behalf of Tronox, Basic Environmental Company (BEC) appreciates the opportunity to submit this Removal Action Workplan (RAW) to address the remediation of impacted soil at the Tronox Parcels "C", "D", "F", "G" and "H". These Sites are located within the Tronox facility, north of Lake Mead Parkway, one mile west of the intersection with Boulder Highway, in Henderson, Nevada. Figure 1 illustrates the location of the subject Sites within the Tronox property.

The conclusion that remediation of soil at each of the Sites is needed is based on the findings of the field investigations carried out in accordance to each of the NDEP-approved Phase 2 Sampling and Analysis Plans. The overall goal of this RAW is to present a cleanup strategy for each of the Sites that effectively reduces, to the extent feasible, the human health risks associated with the identified soil in the impacted areas of each Site. . As with prior work on Parcels A and B, NDEP has indicated that a target risk of one in a million excess cancers will be utilized to guide remediation. Preliminary risk summary tables for each of the Parcels were presented and discussed with NDEP, Tronox and AIG in a meeting at the NDEP offices May 15, 2008. All proposed remediation work will be completed under the direction of a State of Nevada Certified Environmental Manager. Discussion on the proposed remediation at each of the Sites is presented below.

Parcels C and D

Results of the Phase 2 field investigation indicate the presence of amphibole (one or more long fibers) and/or chrysotile (four or more long fibers) at four locations within Parcels C and D, as well as elevated levels of dioxins/furans (above the Agency for Toxic Substances and Disease Registry [ATSDR] action level of 1.0 parts per billion) at one location. Based on the sample locations across the Site, a Thiessen or Voronoi map was overlaid across the Site.

Voronoi maps are constructed from a series of polygons formed around each sample location. Voronoi polygons are created so that every location within a polygon is closer to the sample location in that polygon than any other sample location. These polygons do not take into account the respective concentrations at each sample location.

875 West Warm Springs Road, Henderson, Nevada 89011 • Phone 702.567.0400 • Fax 702.567.0473

These polygons were used as the basis for the areal extent of remediation for each of the locations with elevated asbestos levels. Those polygons associated with elevated asbestos levels proposed for remediation are shown on Figure 2. At two sample locations, the size of the remediation polygon area is large. This area could be reduced by the placement of two additional sample locations (shown on Figure 2) and it is our intent to collect these additional samples. If these sample locations are clean, then the reduced polygon shown on Figure 2 would be the remediation area. However, if one or both have elevated levels of asbestos, then the areal extent for remediation would be the original polygon(s) size.

One exception to the use of these polygons for the extent of asbestos remediation is the sample location in Parcel D, TSB-DR-04, which is situated within a drainage ditch. Two supplemental samples were collected approximately 100 feet to either side of this sample, along the ditch. Results of these sample locations were considered clean, therefore, the extent of the proposed remediation for sample location TSB-DR-04 is half the distance to each of these two supplemental samples, and bounded by the extent of the ditch in the other two directions.

Because the extent of impact associated with the sample location with elevated dioxins/furans is likely to be small, the remediation area is based on a 50-foot square area around this sample location (TSB-CR-07). The total areal extent of remediation at Parcels C and D ranges from 2.6 to 3.7 acres, depending on whether the additional samples are collected, and their results.

Parcel F

Results of the Phase 2 field investigation indicate the presence of amphibole (one or more long fibers) and/or chrysotile (four or more long fibers) at eight locations within Parcel F, as well as several other chemicals at three of these locations. Based on the sample locations across the Site, a Thiessen or Voronoi map was overlaid across the Site. These polygons were used as the basis for the areal extent of remediation for each of the locations with elevated asbestos levels. Those polygons associated with elevated contaminant levels in surface soil (results for deep soil samples are pending) proposed for remediation are shown on Figure 3. The total areal extent of remediation at Parcel F is 3.8 acres.

Parcel G

Results of the Phase 2 field investigation indicate the presence of amphibole (one or more long fibers) at two locations within Parcel G, as well as elevated levels of benzo(a)pyrene (above the USEPA Region 6 MSSL) at one location.. Based on the sample locations across the Site, a Thiessen or Voronoi map was overlaid across the Site. These polygons were used as the basis for the areal extent of remediation for each of the locations with elevated asbestos and benzo(a)pyrene levels. Those polygons associated with elevated levels in surface soil (results for deep soil samples are pending) proposed for remediation are shown on Figure 4. The total areal extent of remediation at Parcel G is 1.3 acres.

Parcel H

Results of the Phase 2 field investigation indicate the presence of amphibole (one or more long fibers) and/or chrysotile (four or more long fibers) at two locations within Parcel H. Based on the sample locations across the Site, a Thiessen or Voronoi map was overlaid across the Site. These polygons were used as the basis for the areal extent of remediation for each of the locations with elevated asbestos levels. Those polygons associated with elevated asbestos levels proposed for

remediation are shown on Figure 5. At one sample location, the size of the remediation polygon area is large. This area could be reduced by the placement of two additional sample locations (shown on Figure 5) and it is our intent to collect these additional samples. If these sample locations are clean, then the reduced polygon shown on Figure 5 would be the remediation area. However, if one or both have elevated levels of asbestos, then the areal extent for remediation would be increased appropriately. The total areal extent of remediation at Parcel H ranges from 0.55 to 2.1 acres, depending on whether the additional samples are collected, and their results.

Confirmation Sampling

Following remediation confirmation sampling will be conducted at each of the original sample locations. Field activities will be conducted in accordance with applicable standard operating procedures (SOPs; BRC, ERM and MWH 2007). The BRC Quality Assurance Project Plan (QAPP; BRC and ERM 2008) and Health and Safety Plan (HASP; BRC and MWH 2005) prepared for the BMI Common Areas will be used for confirmation soil sampling.

For each location, the proposed analyte list is composed of those chemicals that triggered the remediation at that location. Collectively, the analytes set includes; polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxins/furans, metals and asbestos.

Following collection and analysis of confirmation soil samples, the data will be discussed with the NDEP. If results are considered acceptable, a risk assessment will be conducted to evaluate the potential risks to future on-site human receptors at each Site. The receptors identified to be evaluated in the risk assessment will be consistent with the proposed development of each Site.

Schedule

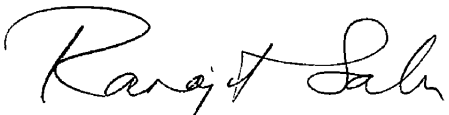
Once final approval of the RAW is received from NDEP, field implementation activities can commence within one week. BEC will provide NDEP with at least two days notice prior to the initiation of field activities at the Site. It is anticipated that this work can be completed within one week, depending on field conditions. The confirmation soil samples will be submitted to the laboratories and placed on a standard turn around time. A report will be completed within three weeks after the final data are received from the laboratory and validated.

Closing Remarks

See attached for appropriate certification language and signature. Please direct any remaining questions or comments you may have to me at 626-382-0001.

Sincerely,

Basic Environmental Company



Ranajit Sahu, CEM
Project Manager

cc: Brian Rakvica, NDEP, BCA, Las Vegas, NV 89119
Jim Najima, NDEP, BCA, Carson City, NV 89701

Attachments: Figure 1 – Tronox/BEC Parcel Map with Tronox Source Areas
Figure 2 – Remediation Areas – Parcels "C" and "D"
Figure 3 – Remediation Areas – Parcel "F"
Figure 4 – Remediation Areas – Parcel "G"
Figure 5 – Remediation Areas – Parcel "H"

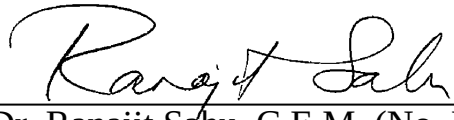
References

Basic Remediation Company (BRC) and MWH. 2005. BRC Health and Safety Plan, BMI Common Areas, Clark County, Nevada. October.

Basic Remediation Company (BRC), ERM, and MWH. 2007. BRC Field Sampling and Standard Operating Procedures, BMI Common Areas, Clark County, Nevada. August.

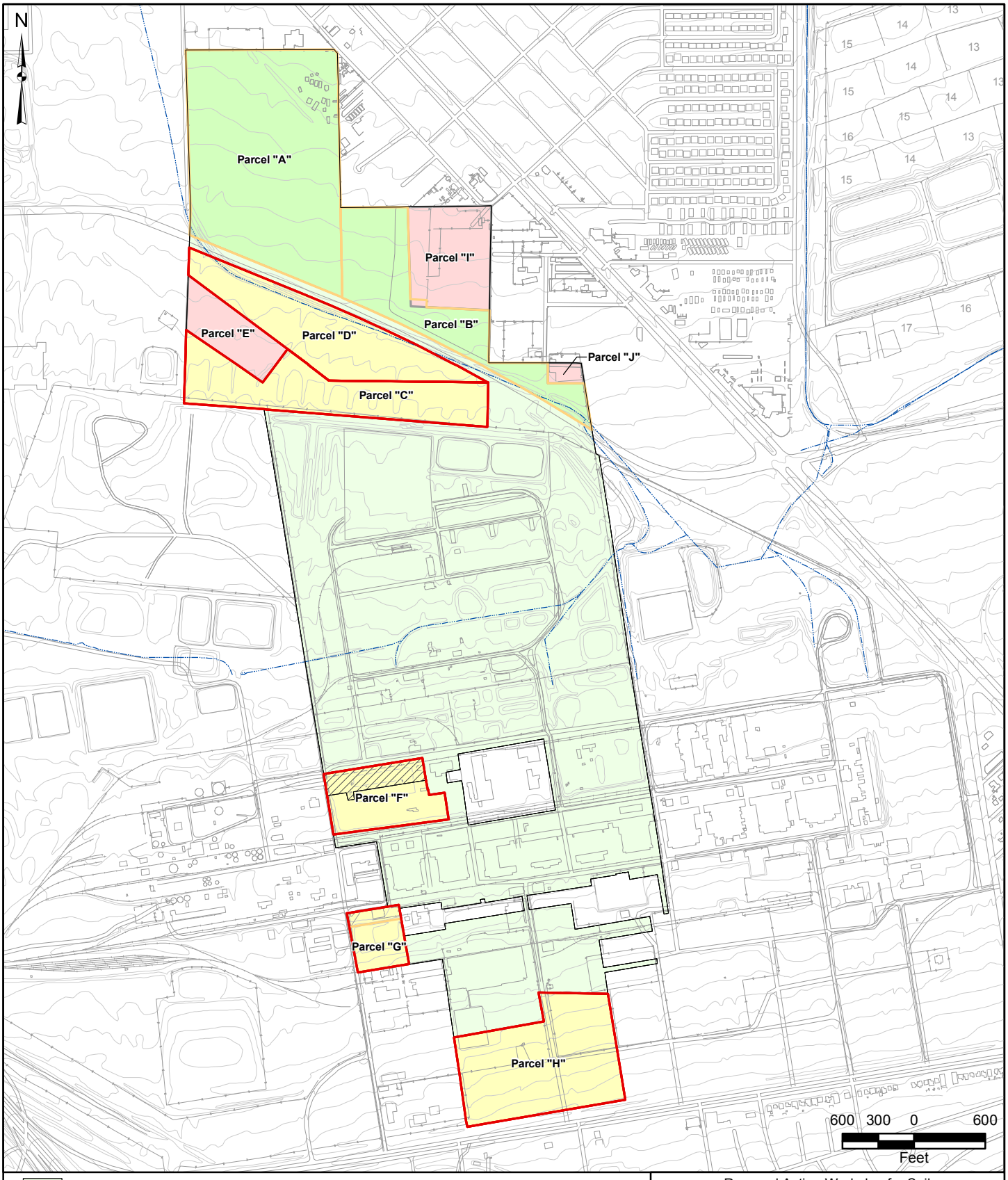
Basic Remediation Company (BRC) and ERM. 2008. BRC Quality Assurance Project Plan. BMI Common Areas, Clark County, Nevada. April.

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.



July 1, 2008

Dr. Ranajit Sahu, C.E.M. (No. EM-1699, Exp. 10/07/2009) Date
BRC Project Manager



Tronox Property

Historical Ditches

Tronox/BEC Parcels

- Parcels included in this RAW
- NFA previously obtained
- NFA to be obtained later
- TIMET NFA Area

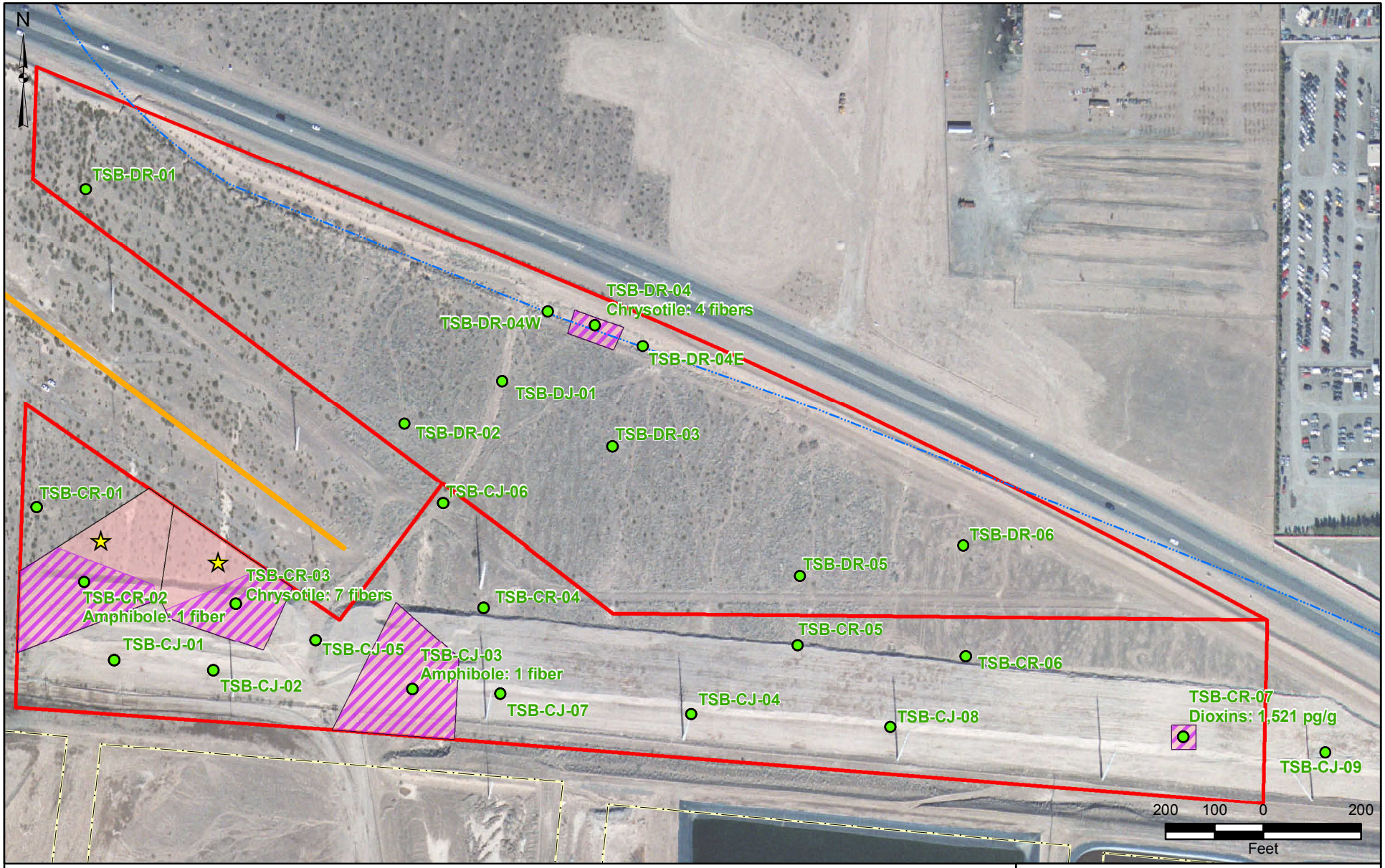
Removal Action Workplan for Soil
Tronox Parcels "C", "D", "F", "G" and "H"

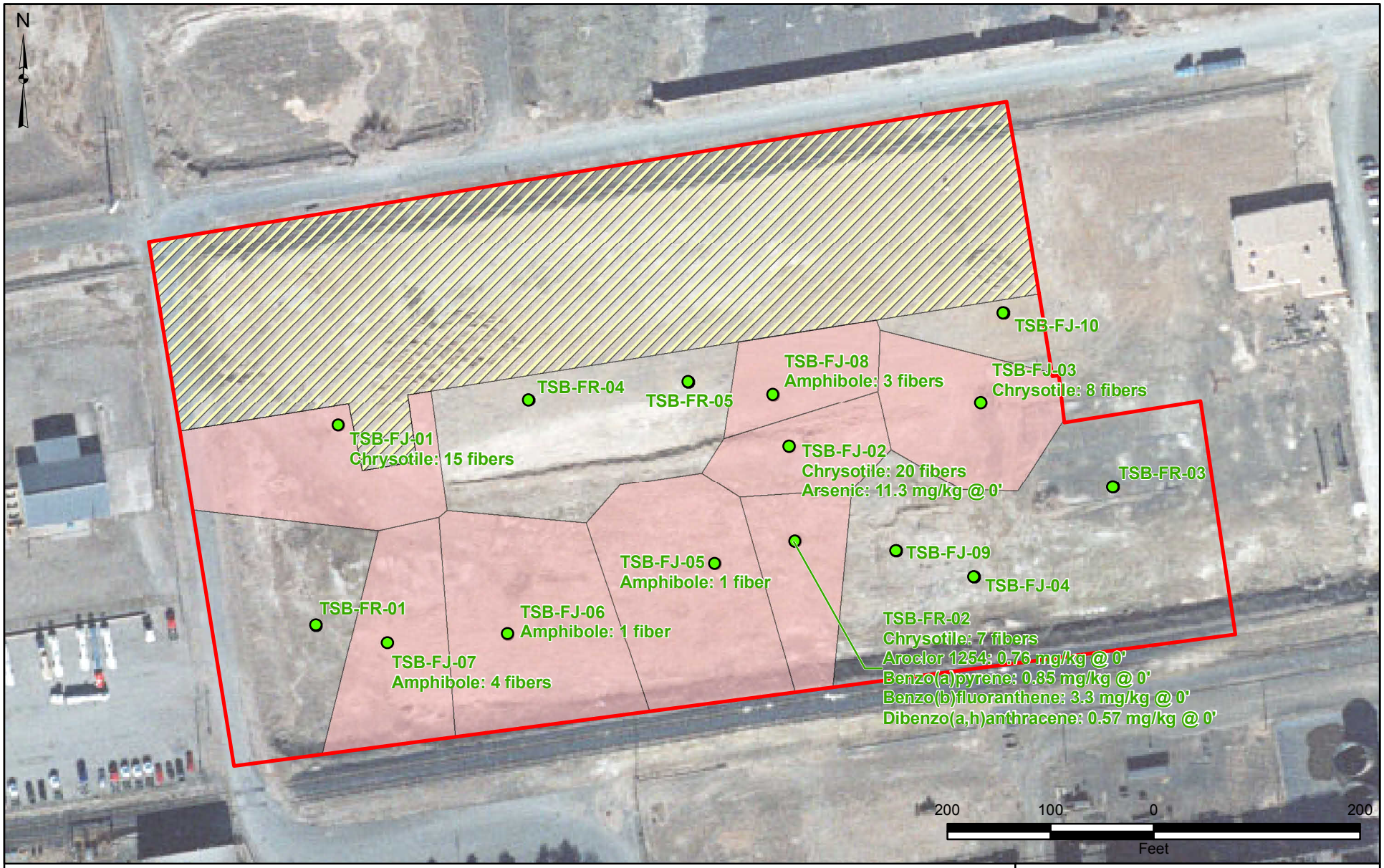
FIGURE 1

TRONOX/BEC
PARCEL MAP

Basic Environmental COMPANY

Prepared by:	Date	JOB No. 0069073
MKJ	07/01/08	FILE: GIS/BEC/TRONOX/FIGURE_1.MXD


N
TSB-DR-01
TSB-DR-04
Chrysotile: 4 fibers
TSB-DR-04W
TSB-DR-04E
TSB-DJ-01
TSB-DR-02
TSB-DR-03
TSB-CR-01
TSB-CJ-06
TSB-DR-06
TSB-DR-05
TSB-CR-03
Chrysotile: 7 fibers
TSB-CR-02
Amphibole: 1 fiber
TSB-CR-04
TSB-CR-05
TSB-CJ-01
TSB-CJ-05
TSB-CJ-03
Amphibole: 1 fiber
TSB-CR-06
TSB-CJ-02
TSB-CJ-07
TSB-CJ-04
TSB-CJ-08
TSB-CR-07
Dioxins: 1,521 pg/g
TSB-CJ-09
200 100 0 200
Feet
Parcel Boundaries
Historical Effluent Ponds
Pioneer/Montrose GW Treatment System
Historical Northwestern Ditch
Additional Asbestos Sample Location
Sampling Location
Proposed Scrape Areas (3.7 Acres)
Scrape Area with 2 Extra Pts (2.6 Acres)
Random Sample
Judgmental Sample
Parcel ID
TSB-CR(J)-01
Sample Number
January 2008 Aerial from AeroTech Mapping.
Removal Action Workplan for Soil
Tronox Parcels "C", "D", "F", "G" and "H"
FIGURE 2
REMEDIATION AREAS
PARCELS "C" AND "D"
Basic Environmental COMPANY
Prepared by: MKJ
Date 07/01/08
JOB No. 0069073
FILE: GIS/BEC/TRONOX/FIGURE_2.MXD



Parcel F Boundary

TIMET NFA Area

Sampling Location

Proposed Scrape Areas (3.8 Acres)

Random Sample

Judgmental Sample

Parcel ID

TSB-FR(J)-01

Sample Number

January 2008 Aerial from AeroTech Mapping.

Removal Action Workplan for Soil
Tronox Parcels "C", "D", "F", "G" and "H"

FIGURE 3

REMEDIATION AREAS
PARCEL "F"

Basic Environmental COMPANY

Prepared by: MKJ

Date 07/01/08

JOB No. 0069073
FILE: GIS/BEC/TRONOX/FIGURE_3.MXD

Sampling Location

Parcel G Boundary

Proposed Scrape Areas (1.3 Acres)

Random Sample

Judgmental Sample

Parcel ID

TSB-GR(J)-01

Sample Number

January 2008 Aerial from AeroTech Mapping.

Removal Action Workplan for Soil
Tronox Parcels "C", "D", "F", "G" and "H"

FIGURE 4

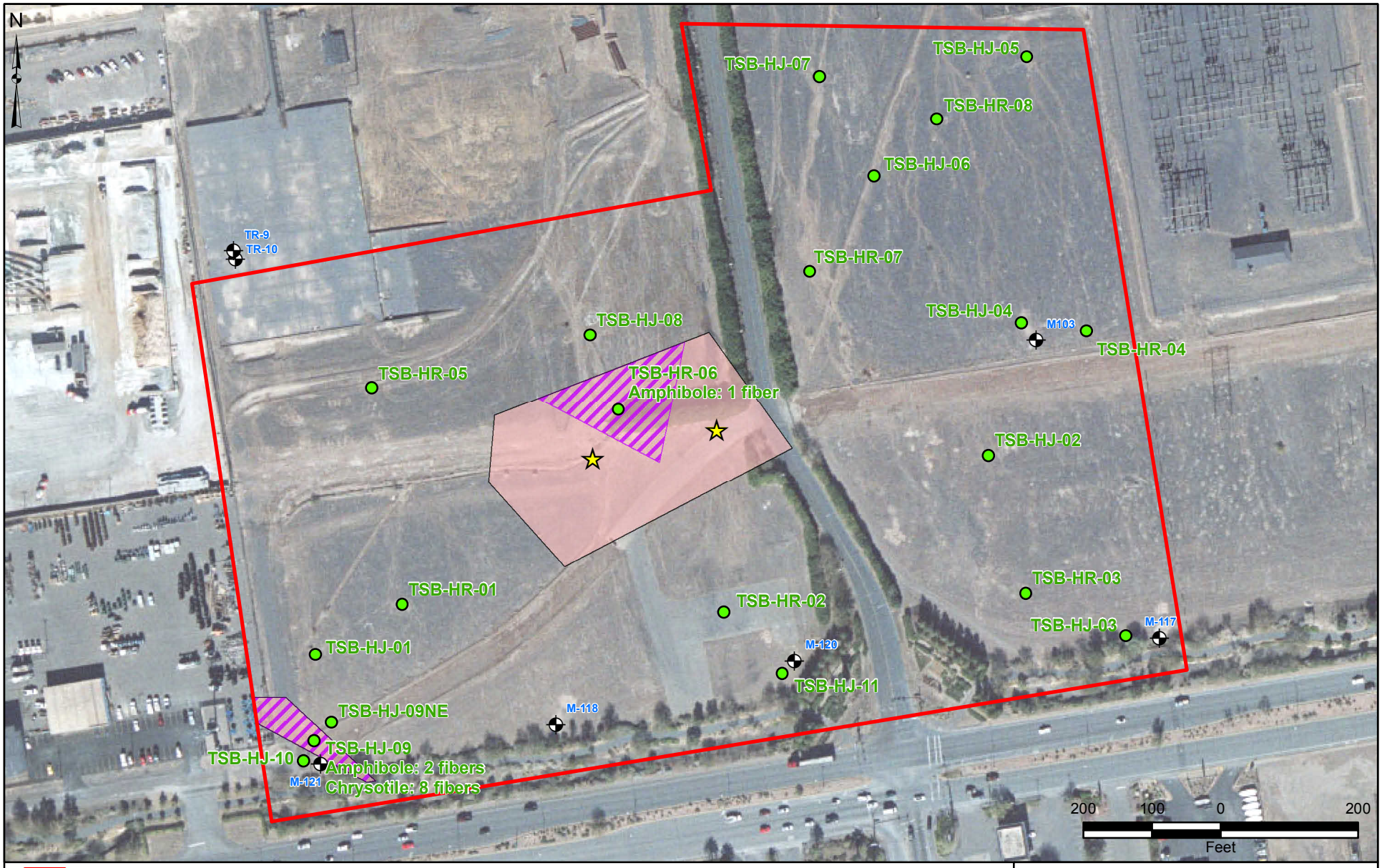
REMEDIATION AREAS
PARCEL "G"

Basic Environmental COMPANY

Prepared by: MKJ

Date 07/01/08

JOB No. 0069073
FILE: GIS/BEC/TRONOX/FIGURE_4.MXD



Parcel H Boundary

Additional Asbestos Sample Location

Sampling Location

Proposed Scrape Areas (2.1 Acres)

Scrape Area with 2 Extra Pts (0.55 Acres)

Sample ID Nomenclature:

TSB-HR(J)-01

- TSB-HR: Parcel ID
- (J): Judgmental Sample
- (R): Random Sample
- 01: Sample Number

January 2008 Aerial from AeroTech Mapping.

Removal Action Workplan for Soil
Tronox Parcels "C", "D", "F", "G" and "H"

FIGURE 5

REMEDIATION AREAS
PARCEL "H"

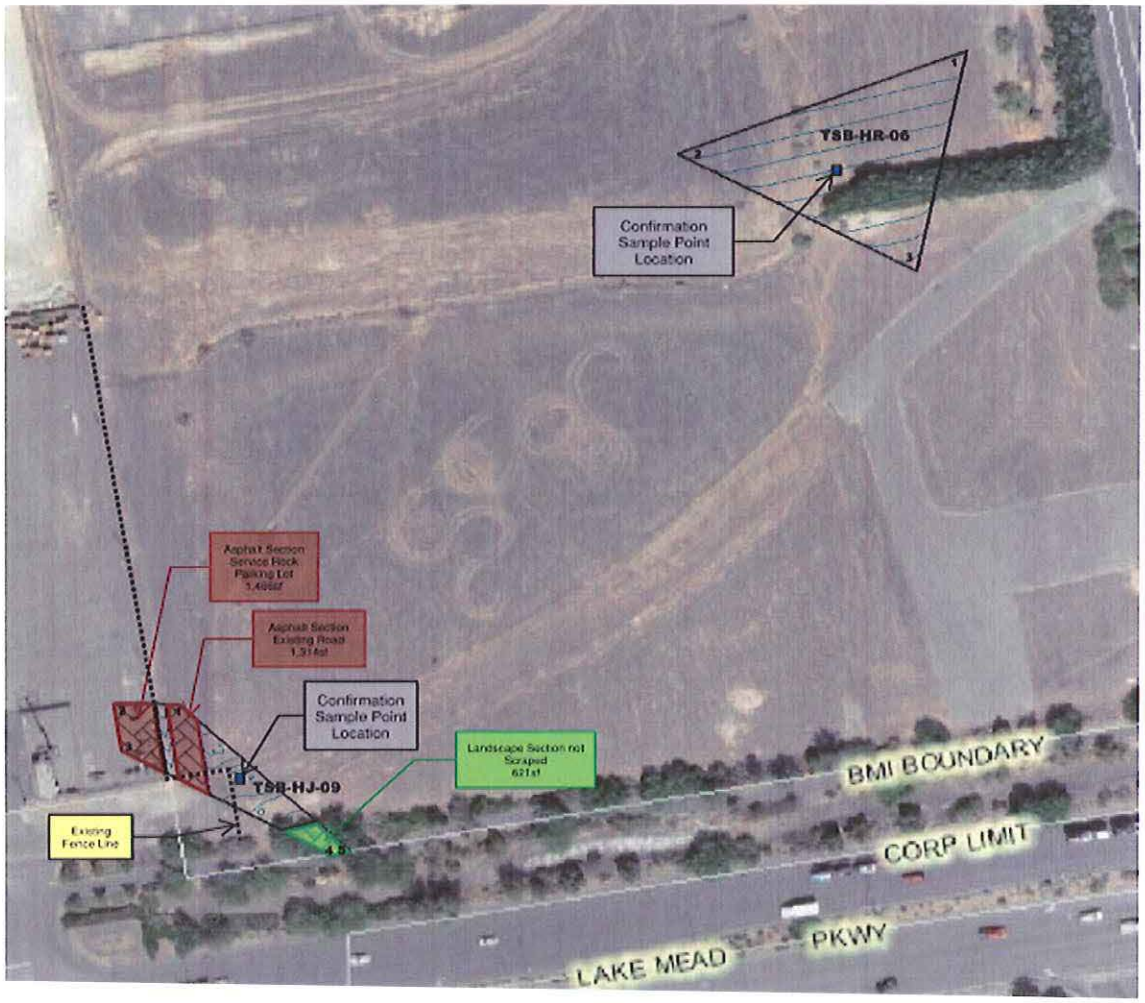
Basic Environmental COMPANY

Prepared by:	Date	JOB No. 0069073
MKJ	07/01/08	FILE: GIS/BEC/TRONOX/FIGURE_5.MXD

APPENDIX C
LAS VEGAS PAVING SCRAPE CLEAN UP FIGURES

Tronox Parcel C,D,F,G,&H Scrape Clean Up

Parcel H Scrape Areas Information



Source: Las Vegas Paving, 2010

APPENDIX D
SOIL DISPOSAL MANIFESTS FOR PARCEL H

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Customer: 81121/Tronox (Parcels)
Truck: 192456

Master Ticket: 2870240
Site Ticket: 4128
Date: 4/7/2010
Time: 11:46:50-12:05:24
Gross: 131740LB 5 In Scale
Tare: 52680LB 3 Out Scale
Net: 79060LB
Net Tons: 39.53

PO: 3825102909

Comment: G#3/S194

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WAS	39.53 Tons	Tons

Driver: _____ Deputy Weighmaster: JUAN MORENO

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
	1	(800) 482-8355	Manifest # 8194

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 651-7707

Generator's Site Address (if different than mailing address)

Tronox LLC
501 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986766174

7. Transporter 2 Company Name — U.S. EPA ID Number:

8. Designated Facility Name and Site Address

Republic Services of Nevada
Apex Regional Landfill (702) 433-2138

U.S. EPA ID Number:

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	SW	39	Ton
2.	Parcel H, # 1	2	Ton		
3.					
4.					

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 353-4355, David Breault and return to Generator if undeliverable.
Republic Waste Profile #3825102509

14. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Sternquist — Signature: Mike Sternquist — Month: 4 Day: 7 Year: 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: [illegible] Lee — Signature: [signature] — Month: 4 Day: 7 Year: 10

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: [illegible] Barker — Signature: [signature] — Month: [illegible] Day: 17 Year: 10

169-BLC-O 6 10498 (Rev. 8/06)

TRANSPORTER #2

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Customer: 81121/Tronox (Parcels)
Truck: 192458

Master Ticket: 2870336
Site Ticket: 4129
Date: 4/7/2010
Time: 12:25:26-12:26:37
Gross: 135060LB M In Manual Wt
Tare: 51920LB 6 Out Scale
Net: 83140LB
Net Tons: 41.57

PO: 3825 10 2909

Comment: H#1 /S195 Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WAS	41.57 Tons	Tons

Driver: _____ Deputy Weighmaster: _____ JUAN MORENO

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, an reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to an property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, it employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Wast (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/ resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiario companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demand penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida perso a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en e Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimie basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costo obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptabl

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number: NVR000000330
2. Page 1 of: 1
3. Emergency Response Phone: (800) 482-1555
4. Waste Tracking Number: Manifest # 5195

GENERATOR

5. Generator's Name and Mailing Address
Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 892-7737

Generator's Site Address (if different than mailing address)
Tronox LLC
360 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

U.S. EPA ID Number: NVD986768174

6. Transporter 1 Company Name: Las Vegas Paving Corporation
U.S. EPA ID Number:

7. Transporter 2 Company Name
U.S. EPA ID Number:

8. Designated Facility Name and Site Address
Republic Services of Nevada
Apex Regional Landfill (702) 433-2128

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal Parcel H # 1	2	Side Dump	39	TON
2.				41.57 TON	
3.					
4.					

13. Special Handling Instructions and Additional Information
No special handling instructions. Call (702) 253-4253, David Breault and return to Generator if undeliverable.
Republic Waste Profile #38251027909

14. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.
Generator's/Offeror's Printed/Typed Name: Mike Skorcz
Signature: Mike Skorcz
Month: 4 Day: 7 Year: 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Date leaving U.S.:

TRANSPORTER

Transporter Signature (for exports only):
16. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Ed Hughes
Signature:
Month: 4 Day: 6 Year: 10
Transporter 2 Printed/Typed Name
Signature
Month: Day: Year:

DESIGNATED FACILITY

17. Discrepancy
17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
U.S. EPA ID Number
17b. Alternate Facility (or Generator)
Month: Day:
Facility's Phone:
17c. Signature of Alternate Facility (or Generator)

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a
Printed/Typed Name: Juan Moreno
Signature: Juan Moreno
Month: 4 Day: 7
TRANSPORTE

169-BLC-O 6 10498 (Rev. 8/06)

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Customer: 81121/Tronox (Parcels)
Truck: 192460

Master Ticket: 2870348
Site Ticket: 4130
Date: 4/7/2010
Time: 12:03:13-12:29:18
Gross: 133580LB 1 In Scale
Tare: 51680LB 3 Out Scale
Net: 81900LB
Net Tons: 40.95

PO: 3825 10 2909

Origin	Comment: H#1 /S196 Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WAS	40.95 Tons	Tons

Driver: Greig Hoesh Deputy Weighmaster: JUAN MORENO

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Service Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claim penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, an reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to ar property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, i employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Was (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/ resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiari companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demand penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida perso a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en e Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimie basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costo obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptabl

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
[illegible]		[illegible]	Manifest # 5196

GENERATOR

5. Generator's Name and Mailing Address
Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 892-7727

Generator's Site Address (if different than mailing address)
Tronox LLC
360 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

U.S. EPA ID Number
NVD986768714

6. Transporter 1 Company Name
Las Vegas Paving Corporation

U.S. EPA ID Number

7. Transporter 2 Company Name

U.S. EPA ID Number

8. Designated Facility Name and Site Address
Republic Services of Nevada
Apex Regional Landfill (702) 433-2129

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	Soil Dump	39	Ton
2.	Parcel H # 1				
3.				40.95 Ton	
4.					

13. Special Handling Instructions and Additional Information
No special handling instructions. Call (702) 353-4355, David Breault and return to Generator if undeliverable.
Republic Waste Profile #3825102909

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skramovis
Signature: Mike Skramovis
Month 4 Day 7 Year 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Date leaving U.S.:

TRANSPORTER

Transporter Signature (for exports only):

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Craig Hanish
Signature: Craig Hanish
Month 4 Day 7 Year 10

Transporter 2 Printed/Typed Name
Signature
Month Day Year

DESIGNATED FACILITY

17. Discrepancy
17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
U.S. EPA ID Number

17b. Alternate Facility (or Generator)
Facility's Phone:
Month Day Ye

17c. Signature of Alternate Facility (or Generator)

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Juan Moreno
Signature: Juan Moreno
Month 4 Day 7 Y

TRANSPORTER

69-BLC-O 6 10498 (Rev. 8/06)

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Customer: 81121/Tronox (Parcels)
Truck: 192457

Master Ticket: 2870363
Site Ticket: 4131
Date: 4/7/2010
Time: 12:31:39-12:32:46
Gross: 132060LB M In Manual Wt
Tare: 51760LB 3 Out Scale
Net: 80300LB
Net Tons: 40.15

PO: 3825 10 2909

Comment: H#1 / S197

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WAS	40.15 Tons	Tons

Driver: _____ Deputy Weighmaster: _____ JUAN MORENO

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVD008290130	1	(702) 353-4355	Manifest # 5197

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 593-7927

Generator's Site Address (if different than mailing address)

Tronox LLC
361 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986792174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address — U.S. EPA ID Number

Republic Services of Nevada
Apex Regional Landfill (702) 433-2128

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	SOF DMP	3	TON
2.	Parcel H, # 1				
3.				40.15	
4.					

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 353-4355, David Breault and return to Generator if undeliverable.
Republic Waste Profile #3825102309

14. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skaggs — Signature: Mike Skaggs — Month 4 Day 7 Year 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Victor Soto — Signature — Month 4 Day 7 Year 10

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Juan Moreno — Signature: Juan Moreno — Month 4 Day 7 Year 10

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Customer: 81121/Tronox (Parcels)
Truck: 192459

Master Ticket: 2870386
Site Ticket: 4132
Date: 4/7/2010
Time: 12:36:50-12:38:46
Gross: 130460LB M In Manual Wt
Tare: 52060LB 3 Out Scale
Net: 78400LB
Net Tons: 39.20

PO: 3825 10 2909

Comment: G#1 /S 198

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WAS	39.20 Tons	Tons

Driver: _____ Deputy Weighmaster: _____ JUAN MORENO

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVD000290330	1	(702) 353-4355	Manifest # 9193

GENERATOR

5. Generator's Name and Mailing Address
Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 592-7727
Generator's Phone:

Generator's Site Address (if different than mailing address)
Tronox LLC
501 West Lake Mead Parkway
Henderson, Nevada 89015

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD988168174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address
Republic Services of Nevada
Apex Regional Landfill (702) 633-2128
Facility's Phone:

U.S. EPA ID Number

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	Side Dump	39	TON
2.	Parcel A1 # 1				
3.				39.20	Ton
4.					

13. Special Handling Instructions and Additional Information
No special handling instructions Call (702) 353-4355, David Breault and return to Generator if undeliverable
Republic Waste Profile #3825102909

INT'L

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Erika Skrenyda — Signature: Mike Skrenyda — Month 4 Day 7 Year 10

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Juliette Young — Signature: Juliette Young — Month 9 Day 7 Year 10

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number
Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Ivan Moreno — Signature: Ivan Moreno — Month Day Year

169-BLC-O 6 10498 (Rev. 8/06)

TRANSPORTER #2

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Customer: 81121/Tronox (Parcels)
Truck: 192453

Master Ticket: 2870543
Site Ticket: 4135
Date: 4/7/2010
Time: 13:07:22-13:27:48
Gross: 132320LB 2 In Scale
Tare: 52020LB 3 Out Scale
Net: 80300LB
Net Tons: 40.15

PO: 3825 10 2909

Comment: H#1 /S201

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WAS	40.15 Tons	Tons

Driver: _____ Deputy Weighmaster: _____
JUAN MORENO

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVD006890330	1	(702) 353-4355	Manifest # 5201

GENERATOR

5. Generator's Name and Mailing Address
Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 593-7727

Generator's Site Address (if different than mailing address)
Tronox LLC
560 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name
Las Vegas Paving Corporation

U.S. EPA ID Number
NVD986768174

7. Transporter 2 Company Name

U.S. EPA ID Number

8. Designated Facility Name and Site Address
Republic Services of Nevada
Apex Regional Landfill (702) 433-2138

U.S. EPA ID Number

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	Dmp	39	TON
2.	Parcel H # 1				
3.				40.15	TON
4.					

13. Special Handling Instructions and Additional Information
No special handling instructions. Call (702) 353-4355, David Breault and return to Generator if undeliverable.
Republic Waste Profile #38251026M9

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Dave Breault | Signature | Month 4 | Day 7 | Year 10

INT'L

15. International Shipments ☐ Import to U.S. ☒ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Richard A. Lizon Jr. | Signature | Month 4 | Day 7 | Year 10

Transporter 2 Printed/Typed Name | Signature | Month | Day | Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) | U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) | Month | Day | Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Juan Moreno | Signature: Juan Moreno | Month 4 | Day 7 | Year 10

169-BLC-O 6 10498 (Rev. 8/06)

TRANSPORTER #2

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Customer: 81121/Tronox (Parcels)
Truck: 192451

Master Ticket: 2870564
Site Ticket: 4136
Date: 4/7/2010
Time: 13:09:50-13:32:40
Gross: 133180LB 2 In Scale
Tare: 51720LB 6 Out Scale
Net: 81460LB
Net Tons: 40.73

PO: 3825 10 2909

Comment: H-1 #202

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WAS	40.73 Tons	Tons

Driver: _____ Deputy Weighmaster: _____
JUAN MORENO

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NV2000290350	1	(702) 353-4333	Manifest # 9202

GENERATOR

5. Generator's Name and Mailing Address
Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 992-7727
Generator's Phone:

Generator's Site Address (if different than mailing address)
Tronox LLC
500 West Lake Mead Parkway
Henderson, Nevada 89015

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVR000086174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address
Republic Services of Nevada
Apex Regional Landfill (702) 433-3128
Facility's Phone:
U.S. EPA ID Number

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	Size Dump	39	Ton
2.	Parcel H, # 1				
3.				40.73 Ton	
4.					

13. Special Handling Instructions and Additional Information
No special handling instructions. Call (702) 353-4333; David Breault and return to Generator if undeliverable.
Republic Waste Profile #3833102909

INT'L

14. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skrenyka — Signature: Mike Skrenyka — Month 4 Day 7 Year 10

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Manuel Juarez — Signature — Month 4 Day 7 Year 10

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number
Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Juan Moreno — Signature: Juan Moreno — Month 4 Day 7 Year 10

169-BLC-O 6 10498 (Rev. 8/06)

TRANSPORTER #2

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Truck: 192454
Customer: 81121/Tronox (Parcels)

Ticket: 2870589
Date: 4/7/2010
Time: 13:17:59-13:38:33
Scale
Gross: 132380LB 2 In Scale
Tare: 52180LB 6 Out Scale
Net: 80200LB
Net Tons: 40.10

PO: 3825 10 2909

Comment: H#1 /S203

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of AO03/INDUSTRIAL WA:	40.10 Tons	Tons

Driver: 964

Deputy Weighmaster: NAKIA SMITH

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVD000829556	1	(702) 353-4355	Manifest # 9202

GENERATOR

5. Generator's Name and Mailing Address
Tronox
P.O. Box 15
Henderson, Nevada 89009 (702) 592-7727
Generator's Phone:

Generator's Site Address (if different than mailing address)
Tronox LLC
550 West Lake Mead Parkway
Henderson, Nevada 89015

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986086774

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address
Republic Services of Nevada
Apex Regional Landfill (702) 433-2138
Facility's Phone:

U.S. EPA ID Number

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	Bulk Dump	39	TON
2.	Parcel H # 1				
3.				UP TO 40 TONS	
4.					

13. Special Handling Instructions and Additional Information
No special handling instructions. Call (702) 353-4355, David Breault and return to Generator if undeliverable.
Republic Waste Profile #3825102909

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skougstad — Signature — Month 4 Day 7 Year 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Douglas A Yardley — Signature — Month 4 Day 7 Year 10

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Alicia Duth — Signature — Month 4 Day 7 Year 10

169-BLC-O 6 10498 (Rev. 8/06)

TRANSPORTER #2

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Customer: 81121/Tronox (Parcels)
Truck: 192456

Master Ticket: 2870650
Site Ticket: 4139
Date: 4/7/2010
Time: 13:32:03-13:53:05
Gross: 130640LB 2 In Scale
Tare: 52740LB 6 Out Scale
Net: 77900LB
Net Tons: 38.95

PO: 3825 10 2909

Comment: h#1/s204

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WAS	38.95 Tons	Tons

Driver: _____

Deputy Weighmaster: _____
NAKIA SMITH

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
[illegible]	1	(800) 367-4555	Manifest # 5204

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 323-7787

Generator's Site Address (if different than mailing address)

Tronox LLC
500 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name — U.S. EPA ID Number

Las Vegas Paving Corporation — NVD984768174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address — U.S. EPA ID Number

Republic Services of Nevada
Apex Regional Landfill (702) 433-8138

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	Dump	39	TON
2.	Parcel H, # 1			39.15 TON	
3.					
4.					

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 399-4555, David Breault and return to Generator if undeliverable.
Republic Waste Profile #3833102909

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skrzynda — Signature: Mike Skrzynda — Month: 4 Day: 7 Year: 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name — Signature — Month: 4 Day: 7 Year: 10

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Mike Smith — Signature: Mike Smith — Month: 04 Day: 07 Year: 10

169-BLC-O 6 10498 (Rev. 8/06)

TRANSPORTER #2

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Customer: 81121/Tronox (Parcels)
Truck: 192460

Master Ticket: 2870758
Site Ticket: 4140
Date: 4/7/2010
Time: 13:59:52-14:20:09
Gross: 129580LB 2 In Scale
Tare: 51580LB 6 Out Scale
Net: 78000LB
Net Tons: 39.00

PO: 3025102909

Comment: H#1/S205

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WAS	39.00 Tons	Tons

Driver: Doug Hosick Deputy Weighmaster: NAKIA SMITH

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVR000620250	1	(702) 353-4355	Manifest # 5205

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 592-7727

Generator's Site Address (if different than mailing address)

Tronox LLC
560 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986758174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address

Republic Services of Nevada
Apex Regional Landfill (702) 433-9132

U.S. EPA ID Number

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	Side Dump	39	TON
2.	Parcel H, # 1				
3.					
4.					

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 353-4355, David Breault and return to Generator if undeliverable.
Republic Waste Profile #3825102909

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skramyda — Signature: Mike Skramyda — Month 4 Day 7 Year 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Craig Hamish — Signature: Craig Hamish — Month 4 Day 7 Year 10

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Kevin Smith — Signature: Kevin Smith — Month 4 Day 7 Year 10

169-BLC-O 6 10498 (Rev. 8/06)

TRANSPORTER #2

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Truck: 192455
Customer: 81121/Tronox (Parcels)

Ticket: 2871628
Date: 4/8/2010
Time: 07:26:56-07:48:34
Scale
Gross: 133260LB 2 In Scale
Tare: 53400LB 3 Out Scale
Net: 79860LB
Net Tons: 39.93

PO: 3825 10 2909

Comment: H#1/$208

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of AC03/INDUSTRIAL WA:	39.93 Tons	Tons

Driver: _____ Deputy Weighmaster: _____
NAKIA SMITH

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVD008250320	1	(702) 353-4355	Manifest # 5208

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 592-7727

Generator's Site Address (if different than mailing address)

Tronox LLC
500 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986768174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address — U.S. EPA ID Number

Republic Services of Nevada
Apex Regional Landfill (702) 433-3128

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	Bot Dmp	39	Tan
2.	Parcel A, # 1				
3.				39.93 TON	
4.					

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 353-4355, David Breault and return to Generator if undeliverable.
Republic Waste Profile #3825102909

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skramstad — Signature — Month: 4 Day: 8 Year: 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: [illegible] — Signature — Month: 4 Day: 8 Year: 10

Transporter 2 Printed/Typed Name — Signature — Month — Day — Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month — Day — Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Nikia Smith — Signature: Nikia Smith — Month: 4 Day: 8 Year: 10

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Truck: 192458
Customer: 81121/Tronox (Parcels)

Ticket: 2871641
Date: 4/8/2010
Time: 07:38:16-07:55:49
Scale
Gross: 131480LB 2 In Scale
Tare: 52180LB 3 Out Scale
Net: 79300LB
Net Tons: 39.65

PO: 3825102909

Comment: R#1/S209

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of AC03/INDUSTRIAL WA:	39.65 Tons	Tons

Driver: _____ Deputy Weighmaster: _____
NAKIA SMITH

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number: NVD008290330	2. Page 1 of 1	3. Emergency Response Phone: (702) 353-4355	**4. Waste Tracking Number:** Manifest # 5209

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 593-7727

Generator's Phone:

Generator's Site Address (if different than mailing address)

Tronox LLC
560 West Lake Mead Parkway
Henderson, Nevada 89015

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986768174

7. Transporter 2 Company Name: — U.S. EPA ID Number:

8. Designated Facility Name and Site Address — U.S. EPA ID Number:

Republic Services of Nevada
Apex Regional Landfill (702) 423-2122

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
	1. Soil for Disposal	2	Side dump	39	TON
	2. Parcel A, # 1				
	3.			39.65 Tons	
	4.				

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 353-4355, David Brasult and return to Generator if undeliverable.
Republic Waste Profile #3825102909

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skromyda — Signature: Mike Skromyda — Month 4 Day 8 Year 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Ed Hughes — Signature: Ed Hughes — Month 4 Day 8 Year 10

Transporter 2 Printed/Typed Name: — Signature: — Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number:

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Alonia Smith — Signature: Alonia Smith — Month 4 Day 8 Year 10

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Truck: 192453
Customer: 81121/Tronox (Parcels)

Ticket: 2871659
Date: 4/8/2010
Time: 07:44:06-08:04:28
Scale
Gross: 129640LB 5 In Scale
Tare: 52400LB 6 Out Scale
Net: 77240LB
Net Tons: 38.62

PO: 3825102909

Comment: H#1/$210

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of AO03/INDUSTRIAL WA:	38.62 Tons	Tons

Driver: Deputy Weighmaster: NAKIA SMITH

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
	NVD988290230	1	(800) 353-4355	Manifest # 5210

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 592-7787

Generator's Site Address (if different than mailing address)

Tronox LLC
360 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986768174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address — U.S. EPA ID Number

Republic Services of Nevada
Apex Regional Landfill (702) 433-3128

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	Dump	39	Ton
2.	Parcel H # 1			39.62	
3.				1015	
4.					

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 289-4355, David Breault and return to Generator if undeliverable
Republic Waste Profile #3821102909

14. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skramyda — Signature: Mike Skramyda — Month: 4 — Day: 8 — Year: 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Kyle Hill — Signature — Month: 4 — Day: 8 — Year: 10

Transporter 2 Printed/Typed Name — Signature — Month — Day — Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month — Day — Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Kathleen Smith — Signature — Month: 4 — Day: 8 — Year: 10

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Truck: 192451
Customer: 81121/Tronox (Parcels)

Ticket: 2871668
Date: 4/8/2010
Time: 07:46:19-08:09:52
Scale
Gross: 124480LB 1 In Scale
Tare: 52100LB 3 Out Scale
Net: 72380LB
Net Tons: 36.19

BO: 3826102909

Comment: B#1/S211

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WA	36.19 Tons	Tons

Driver: _____ Deputy Weighmaster: _____
NAKIA SMITH

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of 1	3. Emergency Response Phone	4. Waste Tracking Number
	NVR000520536		(702) 353-4335	Manifest # 3211

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 992-7727

Generator's Site Address (if different than mailing address)

Tronox LLC
500 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name: LVPC Logistics Paving Corporation — U.S. EPA ID Number: NVR000520174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address

Republic Services of Nevada
Apex Regional Landfill (702) 433-3132

U.S. EPA ID Number

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	Dump	39	TON
2.	Parcel A, # 2				
3.				BC. #1 TONS	
4.					

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 353-4335, David Breault and return to Generator if unacceptable.
Republic Waste Profile #3825102909

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skrzynski — Signature: Mike Skrzynski — Month: 4 — Day: 9 — Year: 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Wendell Dorsey — Signature: [signature] — Month: 4 — Day: 9 — Year: 10

Transporter 2 Printed/Typed Name — Signature — Month — Day — Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month — Day — Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Nikki Petty — Signature: [signature] — Month: 4 — Day: 9 — Year: 10

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Truck: 192452
Customer: 81121/Tronox (Parcels)

Ticket: 2871878
Date: 4/8/2010
Time: 09:17:44-09:36:56
Scale
Gross: 129180LB 5 In Scale
Tare: 52500LB 6 Out Scale
Net: 76680LB
Net Tons: 38.34

PO: 3825 10 2909

Comment: H#1/#2l3

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of AO03/INDUSTRIAL WA!	38.34 Tons	Tons

Driver: _____ Deputy Weighmaster: _____
SUE COLLINS

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVR000090830	1	(702) 253-4355	Manifest # 5213

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 35
Henderson, Nevada 89009 (702) 593-7727

Generator's Site Address (if different than mailing address)

Tronox LLC
560 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD982708174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address — U.S. EPA ID Number

Republic Services of Nevada
Apex Regional Landfill (702) 433-8128

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	3rd Party	39	TON
2.	Parcel H #1				
3.				38.34	Tons
4.					

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 253-4355, David Brandt and return to Generator if undeliverable.
Republic Waste Profile #3825102900

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skramyda — Signature: Mike Skramyda — Month 4 Day 8 Year 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: ERNEST DEFRICK — Signature — Month 4 Day 8 Year 10

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Sue Collins — Signature: Sue Collins — Month 04 Day 08 Year 10

169-BLC-O 6 10498 (Rev. 8/06)

TRANSPORTER #2

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Truck: 192455
Customer: 81121/Tronox (Parcels)

Ticket: 2871929
Date: 4/8/2010
Time: 09:31:20-09:52:20
Scale
Gross: 129720LB 2 In Scale
Tare: 53220LB 3 Out Scale
Net: 76500LB
Net Tons: 38.25

PO: 3825 10 2909

Comment: H#1/$214

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of AO03/INDUSTRIAL WA:	38.25 Tons	Tons

Driver: _____ Deputy Weighmaster: _____
SUE COLLINS

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVD008290339	1	(702) 353-4355	Manifest # 5914

GENERATOR

5. Generator's Name and Mailing Address
Tranzac
P.O. Box 55
Henderson, Nevada 89009 (702) 592-7727
Generator's Phone:

Generator's Site Address (if different than mailing address)
Tranzac LLC
560 West Lake Mead Parkway
Henderson, Nevada 89015

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986078774

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address
Republic Services of Nevada
Apex Regional Landfill (702) 433-9125
Facility's Phone:

U.S. EPA ID Number

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	
1.	Soil for Disposal	2	SOF Grp	39	TON	
2.	Parcel H, # 1					
3.						
4.						

13. Special Handling Instructions and Additional Information
No special handling instructions. Call (702) 353-4355, David Breault and return to Generator if undeliverable.
Republic Waste Profile #3825102909

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skramyda — Signature: Mike Skramyda — Month: 4 — Day: 8 — Year: 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Edward Tejada — Signature — Month: 4 — Day: 8 — Year: 10

Transporter 2 Printed/Typed Name — Signature — Month — Day — Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number
Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month — Day — Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Sue Collins — Signature — Month: 04 — Day: 05 — Year: 10

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Truck: 192458
Customer: 81121/Tronox (Parcels)

Ticket: 2871940
Date: 4/8/2010
Time: 09:38:36-09:57:15
Scale
Gross: 127720LB 5 In Scale
Tare: 52020LB 3 Out Scale
Net: 75700LB
Net Tons: 37.85

PO: 3825 10 2909

Comment: H-1 § 215

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of AO03/INDUSTRIAL WA	37.85 Tons	Tons

Driver: _____ Deputy Weighmaster: _____
SUE COLLINS

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVD069290330	1	(702) 352-4355	Manifest # 5215

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 293-7727

Generator's Phone:

Generator's Site Address (if different than mailing address)

Tronox LLC
360 West Lake Mead Parkway
Henderson, Nevada 89015

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986768174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address — U.S. EPA ID Number

Republic Services of Nevada
Apex Regional Landfill (702)-433-3128

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	
1.	Soil for Disposal	2	Side Dump	39	TON	
2.	Parcel H, # 1					
3.					3151	
4.					TNS	

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 433-4655, David Breault and return to Generator if undeliverable.
Republic Waste Profile #3825102909

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skramyda — Signature: Mike Skramyda — Month: 4 — Day: 8 — Year: 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: ED HUGHES — Signature — Month: 4 — Day: 8 — Year: 10

Transporter 2 Printed/Typed Name — Signature — Month — Day — Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month — Day — Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Dan Collins — Signature — Month: 4 — Day: 15 — Year: 10

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Truck: 192453
Customer: 81121/Tronox (Parcels)

Ticket: 2871946
Date: 4/8/2010
Time: 09:39:57-10:02:40
Scale
Gross: 121560LB S In Scale
Tare: 52480LB S Out Scale
Net: 69080LB
Net Tons: 34.54

PO: 3625 10 2909

Comment: H1/S-215

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of AC03/INDUSTRIAL WA:	34.54 Tons	Tons

Driver: _____ Deputy Weighmaster: _____
SUE COLLINS

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
	NVD082990850	1	(702) 353-4355	Manifest # 5216

GENERATOR

5. Generator's Name and Mailing Address
Tronox
PO Box 55
Henderson, Nevada 89009 (702) 592 7727
Generator's Phone:

Generator's Site Address (if different than mailing address)
Tronox LLC
520 West Lake Mead Parkway
Henderson, Nevada 89015

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD982782174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address — U.S. EPA ID Number
Republic Services of Nevada
Apex Regional Landfill (702) 433-2136
Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	
1.	Soil for Disposal	2	SOF Dump	39	TON	
2.	Parcel H, # 1					
3.				34.54 TONS		
4.						

13. Special Handling Instructions and Additional Information
No special handling instructions. Call (702) 353-4355, David Breault and return to Generator if undeliverable.
Republic Waste Profile #3825102909

14. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skramyda — Signature — Month: 4 Day: 8 Year: 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name — Signature — Month: 4 Day: 8 Year: 10

Transporter 2 Printed/Typed Name — Signature — Month — Day — Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number
Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month — Day — Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Luc Collins — Signature — Month: 4 Day: 8 Year: 10

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Truck: 192461
Customer: 81121/Tronox (Parcels)

Ticket: 2871959
Date: 4/8/2010
Time: 09:49:02-10:07:24
Scale
Gross: 123720LB 2 In Scale
Tare: 52020LB 6 Out Scale
Net: 71700LB
Net Tons: 35.85

PO: 3825 10 2909

Comment: H1/S-217

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of AO03/INDUSTRIAL WA	35.85 Tons	Tons

Driver: _____ Deputy Weighmaster: _____
SUE COLLINS

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVD985269830	1	(702) 362-4355	Manifest # 5217

GENERATOR

5. Generator's Name and Mailing Address

Tracon
P.O. Box 35
Henderson, Nevada 89009 (702) 593-7787

Generator's Site Address (if different than mailing address)

Tracon LLC
360 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986769174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address — U.S. EPA ID Number

Republic Services of Nevada
Apex Regional Landfill (702) 433-2128

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	Side Dump	39	TON
2.	Parcel H, # 1				
3.				35.85 Tons	
4.					

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 363-4355, David Breault and return to Generator if undeliverable.
Republic Waste Profile #3823102909

INT'L

14. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skrzynski — Signature: Mike Skrzynski — Month: 4 — Day: 8 — Year: 10

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Warren Spicer — Signature — Month — Day — Year

Transporter 2 Printed/Typed Name — Signature — Month — Day — Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month — Day — Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Joe Collins — Signature — Month: 10 — Day: 08 — Year: 10

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Customer: 81121/Tronox (Parcels)
Truck: 192458

Master Ticket: 2873679
Site Ticket: 4171
Date: 4/9/2010
Time: 07:21:07-07:36:56
Gross: 114120LB 2 In Scale
Tare: 52280LB 6 Out Scale
Net: 61840LB
Net Tons: 30.92

PO: 3825 10 2909

Comment: H-1 /S230

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WAS	30.92 Tons	Tons

Driver: _____ Deputy Weighmaster: _____
JUAN MORENO

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVD008390330	1	(702) 353-4355	Manifest # 8230

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 592-7727

Generator's Site Address (if different than mailing address)

Tronox LLC
566 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD985768774

7. Transporter 2 Company Name — U.S. EPA ID Number:

8. Designated Facility Name and Site Address — U.S. EPA ID Number:

Republic Services of Nevada
Apex Regional Landfill (702) 433-2132

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	
1.	Soil for Disposal	2	Dump Bags	1.9	TON	
2.	Parcel H, # 1					
3.				30.92 Ton		
4.						

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 353-4355, David Breault and return to Generator if undeliverable.
Republic Waste Profile #3825102909

14. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skramyda — Signature: Michael Skramyda — Month: 4 — Day: 9 — Year: 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: E.O. Hughes — Signature — Month: 4 — Day: 9 — Year: 10

Transporter 2 Printed/Typed Name — Signature — Month — Day — Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month — Day — Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Juan Moreno — Signature: Juan Moreno — Month: 4 — Day: 9 — Year: 10

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Customer: 81121/Tronox (Parcels)
Truck: 192454

Master Ticket: 2873765
Site Ticket: 4178
Date: 4/9/2010
Time: 07:59:38-08:19:49
Gross: 122640LB 1 In Scale
Tare: 52940LB 6 Out Scale
Net: 69700LB
Net Tons: 34.85

PO: 3825 10 2909

Comment: H#1/S231

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WAS	34.85 Tons	Tons

Driver: 904

Deputy Weighmasters: JUAN MORENO

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVD000690330	1	(702) 253-4355	Manifest # 3231

GENERATOR

5. Generator's Name and Mailing Address

Tranor
P.O. Box 55
Henderson, Nevada 89009 (702) 593-7727

Generator's Site Address (if different than mailing address)

Tranor LLC
500 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986765174

7. Transporter 2 Company Name — U.S. EPA ID Number:

8. Designated Facility Name and Site Address — U.S. EPA ID Number:

Republic Services of Nevada
Apex Regional Landfill (702) 433-2138

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	1	Dump	39	TON
2.	Parcel 4, # 1				
3.				34.85 TON	
4.					

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 253-4355, David Breault and return to Generator if undeliverable.
Republic Waste Profile #38251029009

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skramyda — Signature: Michael Skramyda — Month 4 Day 9 Year 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Douglas A Yardley — Signature — Month 4 Day 9 Year 10

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month 4 Day 9 Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Ivan Moreno — Signature: Ivan Moreno — Month 4 Day 9 Year 10

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TRANSPORTER #2

Environmental Technologies (81)
Republic Services
Industrial Landfill
702-644-4210 x227

Customer: 81121/Tronox (Parcels)
Truck: 192454

Master Ticket: 2874129
Site Ticket: 4192
Date: 4/9/2010
Time: 10:33:46-10:52:02
Gross: 89400LB 2 In Scale
Tare: 36220LB 6 Out Scale
Net: 53180LB
Net Tons: 26.59

PO: 3825 10 2909

Comment: H#2 /S249

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WAS	26.59 Tons	Tons

Driver: 904 Deputy Weighmaster: JUAN MORENO

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVD982090330	1	(702) 553-4335	Manifest # 8249

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 553-7727

Generator's Site Address (if different than mailing address)

Tronox LLC
360 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986768174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address

Republic Services of Nevada
Apex Regional Landfill (702) 433-2128

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	1	Belly Dump	25	TON
2.	Parcel 4 # 2			26.59	Tan
3.					
4.					

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 553-4335. David Breault and return to Generator if undeliverable.
Republic Waste Profile #3825102909

14. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skaramuts — Signature: Mike Skaramuts — Month 4 Day 9 Year 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Douglas A Yardley — Signature: [signature] — Month 4 Day 9 Year 10

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Juan Moreno — Signature: Juan Moreno — Month 4 Day 9 Year 10

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TRANSPORTER #2

Environmental Technologies (01)
Republic Services
Industrial Landfill
702-644-4210 x227

Truck: 19245A
Customer: All/Tronox (Parcels)

Ticket: 2974723
Date: 4/9/2010
Time: 10/21/07-13:42:42
Gross: 162420LB 2 In Scale
Tare: 52380LB 6 Out Scale
Net: 110040LB
Net Tons: 55.02

PO: 5603 10 2909

Comment: BH2/Sx60

Origin	Materials & Services	Quantity	
NA/Not Applicable	100% of A003/INDUSTRIAL WA	55.02 Tons	Tons

Driver: _____

Deputy Weighmaster: _____
NAKIA SMITH

Indemnification. Customer agrees, by signature above, to indemnify, hold harmless, and defend Republic Services, Inc., its subsidiaries, affiliates, employees, officers and directors from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incident thereto, including costs of defense, settlement, and reasonable attorney's fees, which may be incurred, as a result of death or injuries to any person, or damage to any property, contamination of or adverse effects on the environment, caused in whole or in part by the Customer, its employees, or subcontractors in disposing waste at this Facility. In the event Customer delivers Unacceptable Waste (as determined by Republic) Customer agrees to assume all expenses and obligations with the removal and/or resolution of any effects caused by the delivery of such Unacceptable Waste.

Indemnización. Cliente acuerda indemnizar, mantener inmune, y defender Republic Services, Inc., sus subsidiarios, companias, divisiones, empleados, oficiales y directores contra de cualquiera y de todas responsabilidades, demandas, penas, pérdidas, juicios, pleitos y los costos incidente además, incluyendo costos de defensa, de acuerdo judicial, y de honorarios razonables del abogado, que pueden ser incurridos en, o como resultado de, la muerte o herida personal a cualquier persona, o daños a cualquier característica, propiedad, contaminación de la tierra o efectos ilicitos en esta Facilidad, causado entero o en parte por el cliente, sus empleados, o sus subcontratistas en botar basura en esta Facilidad. En el caso que el Cliente entrega, bota, basura (según lo determinado por Republic) en este Establecimiento basura inaceptable en los reglamentos de este Establecimiento, el Cliente se compromete asumar todos los costos y obligaciones con el retiro y/o la resolución de cualquier dano(s) causado por la entrega de tal basura inaceptable.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NVD098290330	1	(702) 352-4355	Manifest # 52260

GENERATOR

5. Generator's Name and Mailing Address

Tronox
P.O. Box 55
Henderson, Nevada 89009 (702) 593-7737

Generator's Site Address (if different than mailing address)

Tronox LLC
590 West Lake Mead Parkway
Henderson, Nevada 89015

Generator's Phone:

6. Transporter 1 Company Name: Las Vegas Paving Corporation — U.S. EPA ID Number: NVD986758174

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address

Republic Services of Nevada
Apex Regional Landfill (702) 433-3132

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Soil for Disposal	2	Imp	40	TON
2.	Parcel H # 2			3.02	
3.				TONS	
4.					

13. Special Handling Instructions and Additional Information

No special handling instructions. Call (702) 363-4355, David Breault and reason for Generator Undeliverable
Republic Waste Profile #3821102909

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mike Skousgard — Signature: Mike Skousgard — Month 4 Day 9 Year 10

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Douglas N Yordley — Signature — Month 4 Day 9 Year 10

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

LVPC Job Number 11418

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Mike Smith — Signature: Mike Smith — Month 4 Day 10 Year 10

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TRANSPORTER #2

APPENDIX E
DATA VALIDATION SUMMARY REPORTS AND TABLES – SOIL (CD)

TABLE E-1. Summary of Soil Samples Removed Due to Remediation
Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Sample Location	Sample ID	Sample Type	Start Depth (ft)	Chemical	Result	Unit	Detection Flag
H	TSB-HJ-09	TSB-HJ-09-0	N	0	Long Amphibole Protocol Structures Count	2	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0	N	0	Long Asbestos Protocol Structures Count	10	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0	N	0	Long Chrysotile Protocol Structures Count	8	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0	N	0	Short Amphibole Protocol Structures Count	1	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0	N	0	Short Asbestos Protocol Structures Count	16	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0	N	0	Short Chrysotile Protocol Structures Count	15	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0	N	0	Total Amphibole Protocol Structures Count	3	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0	N	0	Total Asbestos Protocol Structures Count	26	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0	N	0	Total Chrysotile Protocol Structures Count	23	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0-FD	FD	0	Long Amphibole Protocol Structures Count	1	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0-FD	FD	0	Long Asbestos Protocol Structures Count	4	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0-FD	FD	0	Long Chrysotile Protocol Structures Count	3	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0-FD	FD	0	Short Amphibole Protocol Structures Count	1	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0-FD	FD	0	Short Asbestos Protocol Structures Count	14	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0-FD	FD	0	Short Chrysotile Protocol Structures Count	13	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0-FD	FD	0	Total Amphibole Protocol Structures Count	2	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0-FD	FD	0	Total Asbestos Protocol Structures Count	18	s/samp	Y
H	TSB-HJ-09	TSB-HJ-09-0-FD	FD	0	Total Chrysotile Protocol Structures Count	16	s/samp	Y
H	TSB-HR-06	TSB-HR-06-0	N	0	Long Chrysotile Protocol Structures Count	0	s/samp	N
H	TSB-HR-06	TSB-HR-06-0	N	0	Short Amphibole Protocol Structures Count	0	s/samp	N
H	TSB-HR-06	TSB-HR-06-0	N	0	Short Asbestos Protocol Structures Count	0	s/samp	N
H	TSB-HR-06	TSB-HR-06-0	N	0	Short Chrysotile Protocol Structures Count	0	s/samp	N
H	TSB-HR-06	TSB-HR-06-0	N	0	Total Chrysotile Protocol Structures Count	0	s/samp	N
H	TSB-HR-06	TSB-HR-06-0	N	0	Long Amphibole Protocol Structures Count	1	s/samp	Y
H	TSB-HR-06	TSB-HR-06-0	N	0	Long Asbestos Protocol Structures Count	1	s/samp	Y
H	TSB-HR-06	TSB-HR-06-0	N	0	Total Amphibole Protocol Structures Count	1	s/samp	Y
H	TSB-HR-06	TSB-HR-06-0	N	0	Total Asbestos Protocol Structures Count	1	s/samp	Y

Notes:
FD = Field duplicate
ft = feet
ID = identification
N = Normal (Sample Type)
N = Not detected (Detection Flag)
s/samp = strand per sample
Y = Detected

TABLE E-2. Summary of Soil Data Excluded During Data Processing
Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Sample Location	Sample ID	Sample Type	Start Depth (ft)	Chemical	Result	Unit	Detection Flag	Qualifier	Reason for Exclusion
H	RSAU7	RSAU7-0.5B	N	1	Naphthalene	0.0068	mg/kg	N		Analyzed by both EPA Method 8260 and 8270. The data from EPA Method 8260 was excluded.
H	RSAU7	RSAU7-0.5B	N	1	Hexachlorobenzene	0.0069	mg/kg	N		Analyzed by both EPA Method 8081 and 8270. The data from EPA Method 8270 was excluded.
H	RSAU7	RSAU7009-0.5B	FD	1	Naphthalene	0.0057	mg/kg	N		Analyzed by both EPA Method 8260 and 8270. The data from EPA Method 8260 was excluded.
H	RSAU7	RSAU7009-0.5B	FD	1	Hexachlorobenzene	0.0069	mg/kg	N		Analyzed by both EPA Method 8081 and 8270. The data from EPA Method 8270 was excluded.
H	RSAU6	RSAU6-0.5B	N	1	Hexachlorobenzene	0.007	mg/kg	N		Analyzed by both EPA Method 8081 and 8270. The data from EPA Method 8270 was excluded.
H	RSAU6	RSAU6-0.5B	N	1	Naphthalene	0.0047	mg/kg	N		Analyzed by both EPA Method 8260 and 8270. The data from EPA Method 8260 was excluded.
H	RSAU6	RSAU6-0.5B	N	1	Chromium VI	0.42	mg/kg	N		Analyzed twice by the same method and not detected at the same detection limit. One data point was excluded.
H	RSAU7	RSAU7-0.5B	N	1	Chromium VI	0.41	mg/kg	N		Analyzed twice by the same method and not detected at the same detection limit. One data point was excluded.
H	RSAU7	RSAU7009-0.5B	FD	1	Chromium VI	0.42	mg/kg	N		Analyzed twice by the same method and not detected at the same detection limit. One data point was excluded.
H	TSB-HJ-01	TSB-HJ-01-0_01/25/2008	N	0	Bromide	5.2	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-01	TSB-HJ-01-10_01/25/2008	N	10	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-02	TSB-HJ-02-0_01/25/2008	N	0	Bromide	5.2	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-02	TSB-HJ-02-10_01/25/2008	N	10	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-03	TSB-HJ-03-0 FD_01/25/2008	FD	0	Bromide	5.2	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-03	TSB-HJ-03-0_01/25/2008	N	0	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-03	TSB-HJ-03-10_01/25/2008	N	10	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-04	TSB-HJ-04-0_01/24/2008	N	0	Bromide	5.4	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-04	TSB-HJ-04-10_01/24/2008	N	10	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-05	TSB-HJ-05-0_01/24/2008	N	0	Bromide	5.2	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-05	TSB-HJ-05-10_01/24/2008	N	10	Bromide	5.4	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-05	TSB-HJ-05-10_01/24/2008	N	10	Chloride	4.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-06	TSB-HJ-06-0_01/24/2008	N	0	Bromide	5.5	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-06	TSB-HJ-06-10_01/24/2008	N	10	Bromide	5.4	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-07	TSB-HJ-07-0_01/24/2008	N	0	Bromide	5.4	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-07	TSB-HJ-07-0-FD_01/24/2008	FD	0	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-07	TSB-HJ-07-10_01/24/2008	N	10	Bromide	5.4	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-08	TSB-HJ-08-0_01/28/2008	N	0	Bromide	5.4	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-08	TSB-HJ-08-10_01/28/2008	N	10	Bromide	1.1	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-08	TSB-HJ-08-0_01/28/2008	N	0	Bromide	5.4	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-08	TSB-HJ-08-10_01/28/2008	N	10	Bromide	1.1	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-09	TSB-HJ-09-10_01/25/2008	N	10	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-10	TSB-HJ-10-10_01/28/2008	N	10	Bromide	5.2	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-11	TSB-HJ-11-0_01/25/2008	N	0	Bromide	5.2	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-11	TSB-HJ-11-10 FD_01/25/2008	FD	10	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-11	TSB-HJ-11-10_01/25/2008	N	10	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-01	TSB-HR-01-0_01/25/2008	N	0	Bromide	5.5	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-02	TSB-HR-02-0_01/25/2008	N	0	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-02	TSB-HR-02-10_01/25/2008	N	10	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-03	TSB-HR-03-0_01/25/2008	N	0	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-04	TSB-HR-04-0_01/24/2008	N	0	Bromide	5.2	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-04	TSB-HR-04-10_01/24/2008	N	10	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-05	TSB-HR-05-0_01/28/2008	N	0	Bromide	1.1	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-06	TSB-HR-06-0 FD_01/28/2008	FD	0	Bromide	5.4	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-06	TSB-HR-06-0_01/28/2008	N	0	Bromide	5.2	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-06	TSB-HR-06-10_01/28/2008	N	10	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-07	TSB-HR-07-0_01/24/2008	N	0	Bromide	5.4	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-07	TSB-HR-07-0_01/24/2008	N	0	Chloride	4.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-07	TSB-HR-07-10_01/24/2008	N	10	Bromide	5.4	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-08	TSB-HR-08-0_01/24/2008	N	0	Bromide	5.3	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HR-08	TSB-HR-08-10_01/24/2008	N	10	Bromide	5.5	mg/kg	N		Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	TSB-HJ-01	TSB-HJ-01-0_01/25/2008	N	0	Chloride	2.5	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-01	TSB-HJ-01-10_01/25/2008	N	10	Chloride	41.3	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-02	TSB-HJ-02-0_01/25/2008	N	0	Chloride	4	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-02	TSB-HJ-02-10_01/25/2008	N	10	Chloride	6.7	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-03	TSB-HJ-03-0 FD_01/25/2008	FD	0	Chloride	0.85	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-03	TSB-HJ-03-0_01/25/2008	N	0	Chloride	4.4	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-03	TSB-HJ-03-10_01/25/2008	N	10	Chloride	3.3	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-04	TSB-HJ-04-0_01/24/2008	N	0	Chloride	33.5	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-04	TSB-HJ-04-10_01/24/2008	N	10	Chloride	14.4	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-05	TSB-HJ-05-0_01/24/2008	N	0	Chloride	1	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-06	TSB-HJ-06-0_01/24/2008	N	0	Chloride	13.9	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-06	TSB-HJ-06-10_01/24/2008	N	10	Chloride	33.3	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-07	TSB-HJ-07-0_01/24/2008	N	0	Chloride	18.2	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.

TABLE E-2. Summary of Soil Data Excluded During Data Processing
Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Sample Location	Sample ID	Sample Type	Start Depth (ft)	Chemical	Result	Unit	Detection Flag	Qualifier	Reason for Exclusion
H	TSB-HJ-07	TSB-HJ-07-0-FD_01/24/2008	FD	0	Chloride	7.7	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-07	TSB-HJ-07-10_01/24/2008	N	10	Chloride	6.4	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-08	TSB-HJ-08-0_01/28/2008	N	0	Chloride	97.2	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-08	TSB-HJ-08-10_01/28/2008	N	10	Chloride	86.8	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-09	TSB-HJ-09-0_01/25/2008	N	0	Bromide	0.77	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-09	TSB-HJ-09-0_01/25/2008	N	0	Chloride	495	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-09	TSB-HJ-09-10_01/25/2008	N	10	Chloride	400	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-10	TSB-HJ-10-0_01/28/2008	N	0	Bromide	2	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-10	TSB-HJ-10-0_01/28/2008	N	0	Chloride	820	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-10	TSB-HJ-10-10_01/28/2008	N	10	Chloride	2.3	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-11	TSB-HJ-11-0_01/25/2008	N	0	Chloride	1.8	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-11	TSB-HJ-11-10 FD_01/25/2008	FD	10	Chloride	8.9	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HJ-11	TSB-HJ-11-10_01/25/2008	N	10	Chloride	10.8	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-01	TSB-HR-01-0_01/25/2008	N	0	Chloride	1.3	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-01	TSB-HR-01-10_01/25/2008	N	10	Bromide	1.5	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-01	TSB-HR-01-10_01/25/2008	N	10	Chloride	266	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-02	TSB-HR-02-0_01/25/2008	N	0	Chloride	0.65	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-02	TSB-HR-02-10_01/25/2008	N	10	Chloride	63.4	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-03	TSB-HR-03-0_01/25/2008	N	0	Chloride	0.99	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-03	TSB-HR-03-10_01/25/2008	N	10	Bromide	2.3	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-03	TSB-HR-03-10_01/25/2008	N	10	Chloride	360	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-04	TSB-HR-04-0_01/24/2008	N	0	Chloride	130	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-04	TSB-HR-04-10_01/24/2008	N	10	Chloride	49.3	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-05	TSB-HR-05-0_01/28/2008	N	0	Chloride	11.2	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-05	TSB-HR-05-10_01/28/2008	N	10	Bromide	1.8	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-05	TSB-HR-05-10_01/28/2008	N	10	Chloride	391	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-06	TSB-HR-06-0 FD_01/28/2008	FD	0	Chloride	0.81	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-06	TSB-HR-06-0_01/28/2008	N	0	Chloride	0.4	mg/kg	Y	J	Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-06	TSB-HR-06-10_01/28/2008	N	10	Chloride	6.1	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-07	TSB-HR-07-10_01/24/2008	N	10	Chloride	5.9	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-08	TSB-HR-08-0_01/24/2008	N	0	Chloride	4.1	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	TSB-HR-08	TSB-HR-08-10_01/24/2008	N	10	Chloride	5.2	mg/kg	Y		Analyzed twice by the same method and both detected. The data with the lower value was excluded.
H	M120	M120-0.5_03/07/2006	N	0.5	1,2-Dichlorobenzene	0.37	mg/kg	N	U	Analyzed by both EPA Method 8260 and 8270. The data from EPA Method 8270 was excluded.
H	M120	M120-0.5_03/07/2006	N	0.5	1,3-Dichlorobenzene	0.37	mg/kg	N	U	Analyzed by both EPA Method 8260 and 8270. The data from EPA Method 8270 was excluded.
H	M120	M120-0.5_03/07/2006	N	0.5	1,4-Dichlorobenzene	0.37	mg/kg	N	U	Analyzed by both EPA Method 8260 and 8270. The data from EPA Method 8270 was excluded.
H	M120	M120-0.5_03/07/2006	N	0.5	gamma-Chlordane	0.11	mg/kg	N	U	Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	M120	M120-0.5_03/07/2006	N	0.5	Hexachlorobutadiene	0.0061	mg/kg	N	U	Analyzed by both EPA Method 8260 and 8270. The data from EPA Method 8260 was excluded.
H	M120	M120-0.5_03/07/2006	N	0.5	Naphthalene	0.0061	mg/kg	N	U	Analyzed by both EPA Method 8260 and 8270 SIM. The data from EPA Method 8260 was excluded.
H	M120	M120-10_03/07/2006	N	10	1,2-Dichlorobenzene	0.35	mg/kg	N	U	Analyzed by both EPA Method 8260 and 8270. The data from EPA Method 8270 was excluded.
H	M120	M120-10_03/07/2006	N	10	1,3-Dichlorobenzene	0.35	mg/kg	N	U	Analyzed by both EPA Method 8260 and 8270. The data from EPA Method 8270 was excluded.
H	M120	M120-10_03/07/2006	N	10	1,4-Dichlorobenzene	0.35	mg/kg	N	U	Analyzed by both EPA Method 8260 and 8270. The data from EPA Method 8270 was excluded.
H	M120	M120-10_03/07/2006	N	10	gamma-Chlordane	0.11	mg/kg	N	U	Analyzed twice by the same method and not detected. The data with the higher detection limit was excluded.
H	M120	M120-10_03/07/2006	N	10	Hexachlorobutadiene	0.0052	mg/kg	N	U	Analyzed by both EPA Method 8260 and 8270. The data from EPA Method 8260 was excluded.
H	M120	M120-10_03/07/2006	N	10	Naphthalene	0.0052	mg/kg	N	U	Analyzed by both EPA Method 8260 and 8270 SIM. The data from EPA Method 8260 was excluded

Notes:

EPA = Environmental Protetion Agency
FD = Field duplicate
ft = feet
ID = Identification
mg/kg = milligram per kilogram
N = Normal (Sample Type)
N = Not detected (Detection Flag)
SIM = Selective ion monitoring
Y = Detected (Detection Flag)
U = Not detected
J = The result is an estimated quantity. the associated numerical value is the approximate concentration of the analyte in the sample.

TABLE E-3. Summary of Rejected Parcel H Soil Data
Nevada Environmental Response Trust Site
Henderson, Nevada

Upgradient Investigation DVSR, September 2006

Field Sample ID	Method	Analyte	Result	Unit	Validation Qualifier	Reason Code
M118-10_03/08/2006	EPA 6020A	Antimony	< 0.579	mg/kg	R	m
M121-5_03/10/2006	EPA 8260B	tert Butyl alcohol	< 61	µg/kg	R	c
M121-5D_03/10/2006	EPA 8260B	tert Butyl alcohol	< 55	µg/kg	R	c
M121-0.5_03/10/2006	EPA 8260B	tert Butyl alcohol	< 51	µg/kg	R	c
M121-10_03/10/2006	EPA 8260B	tert Butyl alcohol	< 48	µg/kg	R	c
M120-10_03/07/2006	EPA 8260B	tert Butyl alcohol	< 52	µg/kg	R	c
M120-0.5_03/07/2006	EPA 8260B	tert Butyl alcohol	< 61	µg/kg	R	c
M120-5_03/07/2006	EPA 8260B	tert Butyl alcohol	< 49	µg/kg	R	c
M118-0.5_03/08/2006	EPA 8260B	tert Butyl alcohol	< 45	µg/kg	R	c
M118-5_03/08/2006	EPA 8260B	tert Butyl alcohol	< 49	µg/kg	R	c
M118-10_03/08/2006	EPA 8260B	tert Butyl alcohol	< 57	µg/kg	R	c
M117-0.5_03/11/2006	EPA 8260B	tert Butyl alcohol	< 48	µg/kg	R	c
M117-5_03/11/2006	EPA 8260B	tert Butyl alcohol	< 52	µg/kg	R	c
M117-10_03/11/2006	EPA 8260B	tert Butyl alcohol	< 51	µg/kg	R	c

Notes:
DVSR = Data Validation Summary Report
EPA = Environmental Protection Agency
ID = Identification
R = Rejected value
c = Rejected due to calibration
m = Qualified due to matrix spike recoveries
mg/kg = milligram per kilogram
µg/kg = microgram per kilogram

TABLE E-4. Summary of Qualified Soil Field Duplicates
Nevada Environmental Response Trust Site
Henderson, Nevada

DATA VALIDATION SUMMARY REPORT - 2008 TRONOX PARCEL H INVESTIGATION (APRIL 2008)

Field Sample ID	Analyte	Result	Unit	RPD or Difference	Limit	Quantitation Limit	Final Qualifier
TSB-HJ-07-0	Calcium	29900	mg/kg	75	≤50		J
TSB-HJ-07-0-FD	Calcium	13600	mg/kg	75	≤50		J
TSB-HJ-11-10	Calcium	57400	mg/kg	93	≤50		J
TSB-HJ-11-10-FD	Calcium	20900	mg/kg	93	≤50		J
TSB-HJ-03-0	Chloride	8.7	mg/kg	7	≤4.3	4.3	J
TSB-HJ-03-0-FD	Chloride	1.7	mg/kg	7	≤4.2	4.2	J
TSB-HJ-07-0	Chloride	36.4	mg/kg	21.1	≤4.2		J
TSB-HJ-07-0-FD	Chloride	15.3	mg/kg	21.1	≤4.2	4.2	J
TSB-HJ-03-0	Nitrate (as N)	10.3	mg/kg	138	≤50		J
TSB-HJ-03-0-FD	Nitrate (as N)	1.9	mg/kg	138	≤50		J
TSB-HR-06-0	Nitrate (as N)	0.26	mg/kg	0.42	≤0.21	0.21	J
TSB-HR-06-0-FD	Nitrate (as N)	0.68	mg/kg	0.42	≤0.22	0.22	J
TSB-HJ-03-0	Perchlorate	19.9	ug/kg	264.1	≤42.5	42.5	J
TSB-HJ-03-0-FD	Perchlorate	284	ug/kg	264.1	≤42.5		J
TSB-HJ-11-10	Perchlorate	< 42.7	ug/kg	166.4	≤42.7	42.7	UJ
TSB-HJ-11-10-FD	Perchlorate	170	ug/kg	166.4	≤42.4	42.4	J
TSB-HJ-07-0	Silicon	98.9	mg/kg	89.1	≤54.1	54.1	J
TSB-HJ-07-0-FD	Silicon	188	mg/kg	89.1	≤53.1	53.1	J
TSB-HJ-11-10	Silicon	155	mg/kg	423	≤66.7	66.7	J
TSB-HJ-11-10-FD	Silicon	578	mg/kg	423	≤66.7		J
TSB-HR-06-0	Silicon	194	mg/kg	110.3	≤65.2	65.2	J
TSB-HR-06-0-FD	Silicon	83.7	mg/kg	110.3	≤67.5	67.5	J
TSB-HJ-03-0	Sodium	514	mg/kg	54	≤50		J
TSB-HJ-03-0-FD	Sodium	295	mg/kg	54	≤50		J
TSB-HR-06-0	Sulfate	<5.2	mg/kg	10.2	≤5.2	5.2	UJ
TSB-HR-06-0-FD	Sulfate	15.4	mg/kg	10.2	≤5.4	5.4	J
TSB-HJ-11-10	Thorium-230	3.02	pCi/g	68	50		J
TSB-HJ-11-10 FD	Thorium-230	1.49	pCi/g	68	50		J

DATA VALIDATION SUMMARY REPORT - 2009 Phase B Area IV Soil Investigation (March 2010)

Field Sample ID	Analyte	Result	Units	RPD or Difference	Limit	Quantitation Limit	Final Qualifier
RSAU7-0.5B	Radium-228	1.91	pCi/g	1.035	≤0.5	0.5	J
RSAU7009-0.5B	Radium-228	0.875	pCi/g	1.035	≤0.5	0.5	J
RSAU7-0.5B	1,2,3,4,5,6,7,8-Octachlorodibenzofuran	164	ng/kg	153.9	≤4.94		J
RSAU7009-0.5B	1,2,3,4,5,6,7,8-Octachlorodibenzofuran	10.1	ng/kg	153.9	≤4.94	4.94	J
RSAU7-0.5B	1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin	< 8.18	ng/kg	7.52	≤4.94	4.94	UJ
RSAU7009-0.5B	1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin	< 15.7	ng/kg	7.52	≤4.94	4.94	UJ
RSAU7-0.5B	1,2,3,4,6,7,8-Heptachlorodibenzofuran	61.6	ng/kg	50.1	≤2.47		J
RSAU7009-0.5B	1,2,3,4,6,7,8-Heptachlorodibenzofuran	11.5	ng/kg	50.1	≤2.47	2.47	J
RSAU7-0.5B	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	< 4.69	ng/kg	3.22	≤2.47	2.47	UJ
RSAU7009-0.5B	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	< 1.47	ng/kg	3.22	≤2.47	2.47	UJ
RSAU7-0.5B	1,2,3,4,7,8,9-Heptachlorodibenzofuran	30.3	ng/kg	29.12	≤2.47		J
RSAU7009-0.5B	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.18	ng/kg	29.12	≤2.47	2.47	J
RSAU7-0.5B	1,2,3,4,7,8-Hexachlorodibenzofuran	46.5	ng/kg	42	≤2.47		J
RSAU7009-0.5B	1,2,3,4,7,8-Hexachlorodibenzofuran	4.5	ng/kg	42	≤2.47	2.47	J
RSAU7-0.5B	1,2,3,6,7,8-Hexachlorodibenzofuran	28.2	ng/kg	24.94	≤2.47		J
RSAU7009-0.5B	1,2,3,6,7,8-Hexachlorodibenzofuran	3.26	ng/kg	24.94	≤2.47	2.47	J
RSAU7-0.5B	1,2,3,7,8,9-Hexachlorodibenzofuran	11.5	ng/kg	11.236	≤2.47	2.47	J
RSAU7009-0.5B	1,2,3,7,8,9-Hexachlorodibenzofuran	< 0.264	ng/kg	11.236	≤2.47	2.47	UJ
RSAU7-0.5B	1,2,3,7,8-Pentachlorodibenzofuran	31.8	ng/kg	30.44	≤2.47		J
RSAU7009-0.5B	1,2,3,7,8-Pentachlorodibenzofuran	1.36	ng/kg	30.44	≤2.47	2.47	J
RSAU7-0.5B	2,3,4,6,7,8-Hexachlorodibenzofuran	15.7	ng/kg	14.88	≤2.47		J
RSAU7009-0.5B	2,3,4,6,7,8-Hexachlorodibenzofuran	< 0.82	ng/kg	14.88	≤2.47	2.47	UJ
RSAU7-0.5B	2,3,4,7,8-Pentachlorodibenzofuran	16.2	ng/kg	14.93	≤2.47		J
RSAU7009-0.5B	2,3,4,7,8-Pentachlorodibenzofuran	1.27	ng/kg	14.93	≤2.47	2.47	J
RSAU7-0.5B	2,3,7,8-Tetrachlorodibenzofuran	15.6	ng/kg	14.11	≤0.989		J
RSAU7009-0.5B	2,3,7,8-Tetrachlorodibenzofuran	1.49	ng/kg	14.11	≤0.989	0.989	J

Notes:
FD = Field duplicate
ID = Identification
J = Estimated value
mg/kg = milligram per kilogram
ng/g = nanogram per gram
pCi/g = picocurie per gram
RPD = Relative percent differenct
ug/kg = microgram per kilogram
UJ = Non-detect estimated quantitation limit

APPENDIX F
POST REMEDIATION SOIL HRA DATA SET FOR PARCEL H

APPENDIX F-1
POST REMEDIATION SOIL HRA DATA SET FOR PARCEL H - CHEMICALS AND RADIONUCLIDES (CD)

APPENDIX F-2
POST REMEDIATION SOIL HRA DATA SET FOR PARCEL H – ASBESTOS

TABLE F-2. Post Remediation Soil HRA Data Set for Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Parcel	Sample ID	Sample Type	Sample Date	Start Depth (ft bgs)	Long Amphibole Count (s/sample)	Long Chrysotile Count (s/sample)	Total Long Asbestos Count (s/sample)	Short Amphibole Count (s/sample)	Short Chrysotile Count (s/sample)	Total Short Asbestos Count (s/sample)	Total Amphibole Count (s/sample)	Total Chrysotile Count (s/sample)	Total Asbestos Count (s/sample)	Analytical Sensitivity (s/gPM10)
H	TSB-HJ-01-0_1/18/2008	N	1/18/2008	0	0	0	0	0	0	0	0	0	0	2999026
H	TSB-HJ-02-0_1/18/2008	N	1/18/2008	0	0	0	0	0	1	1	0	1	1	2991453
H	TSB-HJ-03-0_1/18/2008	N	1/18/2008	0	0	0	0	0	0	0	0	0	0	2986626
H	TSB-HJ-04-0_1/18/2008	N	1/18/2008	0	0	0	0	0	0	0	0	0	0	2999026
H	TSB-HJ-05-0_1/18/2008	N	1/18/2008	0	0	0	0	0	1	1	0	1	1	2960354
H	TSB-HJ-06-0_1/18/2008	N	1/18/2008	0	0	0	0	0	0	0	0	0	0	2960354
H	TSB-HJ-07-0_1/18/2008	N	1/18/2008	0	0	0	0	0	0	0	0	0	0	2310813
H	TSB-HJ-08-0_1/18/2008	N	1/18/2008	0	0	1	1	0	0	0	0	1	1	2974627
H	W4-PH-1-1-0.0	N	4/9/2010	0	0	0	0	0	0	0	0	0	0	2980000
H	TSB-HJ-09-NE-0	N	6/4/2008	0	0	0	0	0	0	0	0	0	0	2973432
H	TSB-HJ-10-0_1/18/2008	N	1/18/2008	0	0	0	0	0	0	0	0	0	0	2985422
H	TSB-HJ-11-0_1/18/2008	N	1/18/2008	0	0	1	1	0	0	0	0	1	1	2868318
H	TSB-HJ-12-0_7/8/2008	N	7/8/2008	0	0	0	0	0	0	0	0	0	0	2952092
H	TSB-HJ-13-0_7/8/2008	N	7/8/2008	0	0	0	0	0	0	0	0	0	0	2914900
H	TSB-HR-01-0_1/18/2008	N	1/18/2008	0	0	0	0	0	0	0	0	0	0	2978516
H	TSB-HR-02-0_1/18/2008	N	1/18/2008	0	0	0	0	0	0	0	0	0	0	2993267
H	TSB-HR-03-0_1/18/2008	N	1/18/2008	0	0	1	1	0	0	0	0	1	1	2985422
H	TSB-HR-04-0_1/18/2008	N	1/18/2008	0	0	0	0	0	1	1	0	1	1	2971046
H	TSB-HR-05-0_1/18/2008	N	1/18/2008	0	0	0	0	0	0	0	0	0	0	2996902
H	V5-PH-1-1-0.0	N	4/9/2010	0	0	0	0	0	0	0	0	0	0	2980000
H	TSB-HR-07-0_1/18/2008	N	1/18/2008	0	0	0	0	0	0	0	0	0	0	2956512
H	TSB-HR-07-0 FD_1/18/2008	FD	1/18/2008	0	0	1	1	0	0	0	0	1	1	2994477
H	TSB-HR-08-0_1/18/2008	N	1/18/2008	0	0	0	0	0	0	0	0	0	0	2978216
H	RSAU6-0.0B	N	8/7/2009	0.5	0	1	1	0	0	0	0	1	1	2980000
H	RSAU7-0.0B	N	8/7/2009	0.5	0	0	0	0	0	0	0	0	0	2980000

Notes:

bgs = below ground surface

ft = feet

s/g PM_{10} = fiber per gram of particulate matter (< 10 micrometer)

s/sample = fiber per sample

FD = Field Duplicate

N = Normal Sample

APPENDIX G
SOIL SUMMARY STATISTICS FOR PARCEL H

TABLE G-1. Summary Statistics for Soil Data - Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
Chlorine Oxyanions	Chlorate	mg/kg	47	9	19	0.22	11	0.42	10	2.2	3.1	3.2	1.0	TSB-HJ-06
	Perchlorate	mg/kg	58	47	81	0.0019	0.053	0.0024	22	0.17	1.0	3.3	3.2	TSB-HR-04
Metals	Aluminum	mg/kg	58	58	100	--	--	4,320	9,970	7,900	7,830	1,050	0.13	TSB-HR-07
	Antimony	mg/kg	57	30	53	0.052	2.1	0.13	0.50	0.18	0.19	0.068	0.36	RSAU7
	Arsenic	mg/kg	58	58	100	--	--	1.3	5.2	2.9	2.8	0.92	0.32	TSB-HJ-01
	Barium	mg/kg	58	58	100	--	--	97	275	166	168	34	0.20	TSB-HR-05
	Beryllium	mg/kg	58	58	100	--	--	0.35	0.74	0.55	0.56	0.081	0.14	TSB-HR-07
	Boron	mg/kg	58	4	6.9	1.4	12	3.0	14	4.7	6.5	4.8	0.74	M-121
	Cadmium	mg/kg	58	19	33	0.0050	0.0050	0.080	0.69	0.40	0.37	0.17	0.45	M-120
	Calcium	mg/kg	58	58	100	--	--	9,250	158,000	23,900	29,300	22,500	0.77	TSB-HR-05
	Chromium (total)	mg/kg	58	58	100	--	--	5.7	14	9.9	9.8	2.1	0.21	TSB-HJ-09
	Chromium VI	mg/kg	16	0	0	0.41	0.58	--	--	--	--	--	--	--
	Cobalt	mg/kg	58	58	100	--	--	4.7	9.5	6.9	6.9	0.98	0.14	TSB-HJ-09
	Copper	mg/kg	50	50	100	--	--	7.2	367	17	27	50	1.9	M-121
	Iron	mg/kg	58	58	100	--	--	7,930	18,200	12,800	12,700	2,100	0.17	RSAU7
	Lead	mg/kg	58	58	100	--	--	4.0	50	7.5	8.9	6.0	0.67	M-121
	Lithium	mg/kg	42	20	48	0.73	0.73	3.2	47	13	17	11	0.66	TSB-HJ-04
	Magnesium	mg/kg	58	58	100	--	--	5,680	17,000	8,820	9,050	2,130	0.24	TSB-HJ-04
	Manganese	mg/kg	57	57	100	--	--	218	684	340	355	98	0.28	M-121
	Mercury	mg/kg	58	22	38	0.0067	0.12	0.0076	0.033	0.014	0.014	0.0061	0.42	TSB-HJ-04
	Methyl mercury	mg/kg	2	1	50	0.000020	0.000020	0.000034	0.000034	0.000034	0.000034	--	--	M-120
	Molybdenum	mg/kg	58	36	62	0.052	0.60	0.16	1.0	0.47	0.49	0.17	0.34	TSB-HJ-06
	Nickel	mg/kg	58	58	100	--	--	10	22	15	15	2.0	0.13	TSB-HJ-05
	Niobium	mg/kg	42	4	9.5	0.76	0.76	5.7	12	8.9	8.8	2.5	0.28	TSB-HJ-05
	Palladium	mg/kg	42	41	98	0.019	0.019	0.16	1.0	0.42	0.46	0.21	0.45	TSB-HR-04
	Phosphorus (total)	mg/kg	47	47	100	--	--	12	2,020	1,250	1,240	388	0.31	TSB-HJ-10
	Platinum	mg/kg	58	3	5.2	0.010	0.023	0.010	0.012	0.010	0.011	0.0012	0.11	RSAU7
	Potassium	mg/kg	58	58	100	--	--	704	2,630	1,700	1,720	412	0.24	M-118
	Selenium	mg/kg	58	13	22	0.16	4.2	0.14	0.80	0.20	0.25	0.17	0.69	RSAU6
	Silicon	mg/kg	42	42	100	--	--	73	578	156	223	141	0.63	TSB-HJ-11
	Silver	mg/kg	58	19	33	0.020	0.58	0.078	0.15	0.10	0.11	0.018	0.17	M-121
	Sodium	mg/kg	58	57	98	1.8	1.8	159	1,230	490	532	268	0.50	M-118
	Strontium	mg/kg	58	58	100	--	--	77	500	188	212	86	0.40	TSB-HR-04
	Sulfur	mg/kg	42	2	4.8	211	211	1,310	2,400	1,860	1,860	771	0.42	TSB-HJ-04
	Thallium	mg/kg	58	7	12	0.10	0.58	0.092	0.34	0.13	0.18	0.094	0.52	M-118
	Tin	mg/kg	58	18	31	0.026	12	0.064	4.9	0.56	1.2	1.5	1.3	RSAU7
	Titanium	mg/kg	58	58	100	--	--	294	950	590	596	102	0.17	RSAU7
	Tungsten	mg/kg	58	7	12	0.10	2.3	0.11	0.67	0.56	0.41	0.26	0.64	M-118
	Uranium (total)	mg/kg	58	58	100	--	--	0.60	26	1.2	2.1	4.2	2.0	M-120

TABLE G-1. Summary Statistics for Soil Data - Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
Metals	Vanadium	mg/kg	58	58	100	--	--	22	56	36	36	7.6	0.21	RSAU7
	Zinc	mg/kg	58	58	100	--	--	22	67	32	34	8.7	0.26	M-120
	Zirconium	mg/kg	42	42	100	--	--	9.0	26	21	21	3.4	0.16	TSB-HJ-09
Other Inorganics	Ammonia	mg/kg	5	2	40	0.52	0.53	2.6	4.6	3.6	3.6	1.4	0.38	M-120
	Bromide	mg/kg	47	5	11	0.063	5.6	1.5	4.5	3.6	3.3	1.1	0.35	TSB-HR-03
	Chloride	mg/kg	47	45	96	0.20	0.20	0.79	1,640	16	153	332	2.2	TSB-HJ-10
	Cyanide (total)	mg/kg	5	0	0	0.27	0.98	--	--	--	--	--	--	--
	Fluoride	mg/kg	44	21	48	0.25	0.25	0.58	2.0	0.95	1.1	0.41	0.38	M-120
	Nitrate	mg/kg	47	43	91	0.086	0.086	0.26	39	1.9	4.8	7.6	1.6	TSB-HR-01
	Nitrite	mg/kg	47	1	2.1	0.050	1.1	0.13	0.13	0.13	0.13	--	--	TSB-HR-03
	Sulfate	mg/kg	47	44	94	0.50	0.50	3.5	640	41	100	153	1.5	TSB-HR-04
	ortho-Phosphate	mg/kg	44	0	0	1.6	5.6	--	--	--	--	--	--	--
Radionuclides	Radium-226	pCi/g	58	58	100	--	--	0.43	2.5	1.2	1.3	0.44	0.35	TSB-HR-02
	Radium-228	pCi/g	58	58	100	--	--	0.88	3.0	1.6	1.6	0.36	0.22	TSB-HJ-07
	Thorium-228	pCi/g	55	55	100	--	--	1.2	3.0	1.9	1.9	0.39	0.20	M-121
	Thorium-230	pCi/g	55	55	100	--	--	0.79	3.0	1.3	1.4	0.52	0.37	TSB-HR-03
	Thorium-232	pCi/g	55	55	100	--	--	1.1	2.7	1.8	1.8	0.37	0.21	TSB-HJ-11
	Uranium-234	pCi/g	55	55	100	--	--	0.78	3.5	1.2	1.5	0.69	0.46	TSB-HR-02
	Uranium-235	pCi/g	58	58	100	--	--	-0.0089	0.20	0.054	0.063	0.042	0.67	M-117
	Uranium-238	pCi/g	58	58	100	--	--	0	2.6	1.2	1.3	0.49	0.37	TSB-HR-03
Dioxin/Furans	2,3,7,8-TCDD TEQ*	mg/kg	47	23	49	0.0000029	0.000094	0.00000000070	0.000021	0.0000053	0.0000048	0.0000042	0.86	RSAU7
Other Organics	Phthalic acid	mg/kg	42	0	0	0.25	0.25	--	--	--	--	--	--	--
PAHs	Acenaphthene	mg/kg	47	0	0	0.0069	0.033	--	--	--	--	--	--	--
	Acenaphthylene	mg/kg	47	0	0	0.0069	0.033	--	--	--	--	--	--	--
	Anthracene	mg/kg	47	0	0	0.0069	0.033	--	--	--	--	--	--	--
	BaPEq*	mg/kg	47	2	4.3	0.0081	0.039	0.0075	0.0090	0.0083	0.0083	0.0010	0.13	RSAU7
	Benzo(g,h,i)perylene	mg/kg	47	1	2.1	0.0069	0.033	0.0028	0.0028	0.0028	0.0028	--	--	RSAU7
	Fluoranthene	mg/kg	47	2	4.3	0.0070	0.033	0.0017	0.0066	0.0042	0.0042	0.0035	0.83	RSAU7
	Fluorene	mg/kg	47	0	0	0.0069	0.033	--	--	--	--	--	--	--
	2-Methylnaphthalene	mg/kg	47	0	0	0.0069	0.033	--	--	--	--	--	--	--
	Naphthalene	mg/kg	58	0	0	0.0045	0.033	--	--	--	--	--	--	--
	Phenanthrene	mg/kg	47	1	2.1	0.0069	0.033	0.0038	0.0038	0.0038	0.0038	--	--	RSAU7
	Pyrene	mg/kg	47	2	4.2	0.0070	0.033	0.0021	0.0063	0.0042	0.0042	0.0030	0.71	RSAU7
PCBs	Aroclor-1016	mg/kg	44	0	0	0.0060	0.056	--	--	--	--	--	--	--
	Aroclor-1221	mg/kg	44	0	0	0.0060	0.056	--	--	--	--	--	--	--
	Aroclor-1232	mg/kg	44	0	0	0.0060	0.056	--	--	--	--	--	--	--
	Aroclor-1242	mg/kg	44	0	0	0.0060	0.056	--	--	--	--	--	--	--

TABLE G-1. Summary Statistics for Soil Data - Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
PCBs	Aroclor-1248	mg/kg	44	0	0	0.0060	0.056	--	--	--	--	--	--	--
	Aroclor-1254	mg/kg	44	0	0	0.0066	0.056	--	--	--	--	--	--	--
	Aroclor-1260	mg/kg	44	0	0	0.0066	0.056	--	--	--	--	--	--	--
Pesticides - OCPs	Aldrin	mg/kg	47	0	0	0.000088	0.018	--	--	--	--	--	--	--
	alpha-BHC	mg/kg	47	0	0	0.000096	0.018	--	--	--	--	--	--	--
	beta-BHC	mg/kg	47	6	13	0.00035	0.0022	0.0020	0.040	0.0039	0.011	0.015	1.4	TSB-HJ-09
	delta-BHC	mg/kg	47	0	0	0.000083	0.018	--	--	--	--	--	--	--
	gamma-BHC	mg/kg	47	0	0	0.000083	0.018	--	--	--	--	--	--	--
	Chlordane (total)	mg/kg	45	0	0	0.0023	0.088	--	--	--	--	--	--	--
	alpha-Chlordane	mg/kg	47	0	0	0.00010	0.018	--	--	--	--	--	--	--
	gamma-Chlordane	mg/kg	47	0	0	0.000086	0.018	--	--	--	--	--	--	--
	2,4'-DDD	mg/kg	42	0	0	0.00011	0.00011	--	--	--	--	--	--	--
	4,4'-DDD	mg/kg	47	1	2.1	0.00016	0.035	0.0035	0.0035	0.0035	0.0035	--	--	TSB-HJ-09
	2,4'-DDE	mg/kg	42	1	2.4	0.000089	0.000089	0.014	0.014	0.014	0.014	--	--	TSB-HJ-09
	4,4'-DDE	mg/kg	47	2	4.3	0.00025	0.035	0.0036	0.060	0.032	0.032	0.040	1.3	TSB-HJ-09
	4,4'-DDT	mg/kg	47	2	4.3	0.00043	0.035	0.0019	0.089	0.045	0.045	0.062	1.4	TSB-HJ-09
	Dieldrin	mg/kg	47	0	0	0.000073	0.035	--	--	--	--	--	--	--
	Endosulfan I	mg/kg	47	0	0	0.000083	0.018	--	--	--	--	--	--	--
	Endosulfan II	mg/kg	47	0	0	0.00015	0.035	--	--	--	--	--	--	--
	Endosulfan sulfate	mg/kg	47	0	0	0.00012	0.035	--	--	--	--	--	--	--
	Endrin	mg/kg	47	0	0	0.000083	0.035	--	--	--	--	--	--	--
	Endrin aldehyde	mg/kg	47	0	0	0.00011	0.035	--	--	--	--	--	--	--
	Endrin ketone	mg/kg	47	0	0	0.00038	0.035	--	--	--	--	--	--	--
	Heptachlor	mg/kg	47	0	0	0.00059	0.018	--	--	--	--	--	--	--
	Heptachlor epoxide	mg/kg	47	0	0	0.00012	0.018	--	--	--	--	--	--	--
	Hexachlorobenzene	mg/kg	47	1	2.1	0.0018	0.033	0.21	0.21	0.21	0.21	--	--	RSAU6
	Methoxychlor	mg/kg	47	0	0	0.00070	0.18	--	--	--	--	--	--	--
	Toxaphene	mg/kg	47	0	0	0.0071	0.35	--	--	--	--	--	--	--
Pesticides - OPPs	Chlorpyrifos	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Coumaphos	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Dasanit	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Demeton-O	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Demeton-S	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Diazinon	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Dibrom	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Dichlorovos	mg/kg	2	0	0	0.071	0.074	--	--	--	--	--	--	--
	Dimethoate	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Disulfoton	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--

TABLE G-1. Summary Statistics for Soil Data - Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
Pesticides - OPPs	Ethoprop	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Ethyl p-nitrophenyl benzenethiophosphate	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Famphur	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Fenthion	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Guthion	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Malathion	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Merphos	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Methyl parathion	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Mevinphos	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Parathion	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Phorate	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Prothiophos	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Ronnel	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Stirophos	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Sulfotepp	mg/kg	2	0	0	0.071	0.074	--	--	--	--	--	--	--
	Sulprofos	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
	Thionazin	mg/kg	2	0	0	0.071	0.074	--	--	--	--	--	--	--
	o-Ethyl o-2,4,5-trichlorophenyl ethyl-phosphonothioate	mg/kg	2	0	0	0.035	0.037	--	--	--	--	--	--	--
SVOCs	Acetophenone	mg/kg	42	0	0	0.033	0.033	--	--	--	--	--	--	--
	Aniline	mg/kg	42	0	0	0.033	0.033	--	--	--	--	--	--	--
	Azobenzene	mg/kg	42	0	0	0.033	0.033	--	--	--	--	--	--	--
	Benzenethiol	mg/kg	42	0	0	0.12	0.12	--	--	--	--	--	--	--
	Benzoic acid	mg/kg	44	0	0	0.033	0.93	--	--	--	--	--	--	--
	Benzyl alcohol	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	bis(2-Chloro-1-methylethyl) ether	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	bis(2-Chloroethoxy)methane	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	bis(2-Chloroethyl) ether	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	bis(2-Ethylhexyl)phthalate	mg/kg	47	1	2.1	0.033	0.37	0.069	0.069	0.069	0.069	--	--	TSB-HJ-01
	bis(4-Chlorophenyl) disulfide	mg/kg	42	0	0	0.20	0.20	--	--	--	--	--	--	--
	bis(4-Chlorophenyl) sulfone	mg/kg	42	0	0	0.33	0.33	--	--	--	--	--	--	--
	4-Bromophenyl-phenyl ether	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	Butylbenzylphthalate	mg/kg	47	1	2.1	0.033	0.37	0.11	0.11	0.11	0.11	--	--	TSB-HJ-01
	Carbazole	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	4-Chloro-3-methylphenol	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	4-Chloroaniline	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	2-Chloronaphthalene	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	2-Chlorophenol	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--

TABLE G-1. Summary Statistics for Soil Data - Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
SVOCs	4-Chlorophenyl-phenyl ether	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	4-Chlorothioanisole	mg/kg	42	0	0	0.0076	0.0076	--	--	--	--	--	--	--
	4-Chlorothiophenol	mg/kg	42	0	0	0.19	0.19	--	--	--	--	--	--	--
	Di-n-butylphthalate	mg/kg	47	0	0	0.033	0.37	--	--	--	--	--	--	--
	Di-n-octylphthalate	mg/kg	47	0	0	0.015	0.37	--	--	--	--	--	--	--
	Dibenzofuran	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	3,3'-Dichlorobenzidine	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	1,2-Diphenylhydrazine	mg/kg	42	0	0	0.033	0.033	--	--	--	--	--	--	--
	2,4-Dichlorophenol	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	Diethylphthalate	mg/kg	47	0	0	0.033	0.37	--	--	--	--	--	--	--
	2,4-Dimethylphenol	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	Dimethylphthalate	mg/kg	47	0	0	0.033	0.37	--	--	--	--	--	--	--
	4,6-Dinitro-2-methylphenol	mg/kg	2	0	0	0.71	0.74	--	--	--	--	--	--	--
	2,4-Dinitrophenol	mg/kg	44	0	0	0.33	0.74	--	--	--	--	--	--	--
	2,4-Dinitrotoluene	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	2,6-Dinitrotoluene	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	1,4-Dioxane	mg/kg	45	0	0	0.033	0.071	--	--	--	--	--	--	--
	Diphenyl disulfide	mg/kg	42	0	0	0.029	0.029	--	--	--	--	--	--	--
	Diphenyl sulfide	mg/kg	42	0	0	0.0035	0.0035	--	--	--	--	--	--	--
	Diphenyl sulfone	mg/kg	42	0	0	0.0067	0.0067	--	--	--	--	--	--	--
	Hexachlorobutadiene	mg/kg	58	0	0	0.0045	0.37	--	--	--	--	--	--	--
	Hexachlorocyclopentadiene	mg/kg	44	0	0	0.33	0.37	--	--	--	--	--	--	--
	Hexachloroethane	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	Hydroxymethyl phthalimide	mg/kg	42	0	0	0.043	0.043	--	--	--	--	--	--	--
	Isophorone	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	2-Methylphenol	mg/kg	44	0	0	0.12	0.37	--	--	--	--	--	--	--
	4-Methylphenol	mg/kg	2	0	0	0.35	0.37	--	--	--	--	--	--	--
	3&4-Methylphenol	mg/kg	42	0	0	0.067	0.067	--	--	--	--	--	--	--
	2-Nitroaniline	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	3-Nitroaniline	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	4-Nitroaniline	mg/kg	44	0	0	0.33	0.37	--	--	--	--	--	--	--
	Nitrobenzene	mg/kg	47	0	0	0.0069	0.37	--	--	--	--	--	--	--
	2-Nitrophenol	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	4-Nitrophenol	mg/kg	44	0	0	0.33	0.74	--	--	--	--	--	--	--
	n-Nitroso-di-n-propylamine	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	n-Nitrosodiphenylamine	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	Octachlorostyrene	mg/kg	47	0	0	0.0069	0.93	--	--	--	--	--	--	--
	Pentachlorobenzene	mg/kg	42	0	0	0.033	0.033	--	--	--	--	--	--	--
	1,2,4,5-Tetrachlorobenzene	mg/kg	42	0	0	0.033	0.033	--	--	--	--	--	--	--

TABLE G-1. Summary Statistics for Soil Data - Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
SVOCs	2,4,5-Trichlorophenol	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	2,4,6-Trichlorophenol	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
VOCs	Acetone	mg/kg	58	8	14	0.0038	0.027	0.0056	0.024	0.0086	0.010	0.0060	0.59	RSAU6
	Acetonitrile	mg/kg	42	1	2.4	0.0020	0.0020	0.021	0.021	0.021	0.021	--	--	TSB-HR-03
	t-Amyl methyl ether	mg/kg	16	0	0	0.0045	0.0068	--	--	--	--	--	--	--
	Benzene	mg/kg	58	0	0	0.00017	0.0068	--	--	--	--	--	--	--
	Bromobenzene	mg/kg	58	0	0	0.00023	0.0068	--	--	--	--	--	--	--
	Bromochloromethane	mg/kg	58	0	0	0.00041	0.0068	--	--	--	--	--	--	--
	Bromodichloromethane	mg/kg	58	0	0	0.00033	0.0068	--	--	--	--	--	--	--
	Bromoform	mg/kg	58	0	0	0.00024	0.0068	--	--	--	--	--	--	--
	Bromomethane	mg/kg	58	0	0	0.00031	0.012	--	--	--	--	--	--	--
	2-Butanone	mg/kg	58	2	3.5	0.0014	0.012	0.00092	0.0018	0.0014	0.0014	0.00062	0.46	RSAU7
	tert Butyl alcohol	mg/kg	3	0	0	0.095	0.14	--	--	--	--	--	--	--
	n-Butylbenzene	mg/kg	58	0	0	0.00053	0.0068	--	--	--	--	--	--	--
	sec-Butylbenzene	mg/kg	58	0	0	0.00025	0.0068	--	--	--	--	--	--	--
	tert-Butylbenzene	mg/kg	58	0	0	0.00027	0.0068	--	--	--	--	--	--	--
	Carbon disulfide	mg/kg	42	0	0	0.00055	0.00055	--	--	--	--	--	--	--
	Carbon tetrachloride	mg/kg	58	0	0	0.00090	0.0068	--	--	--	--	--	--	--
	Chlorobenzene	mg/kg	58	0	0	0.00012	0.0068	--	--	--	--	--	--	--
	Chloroethane	mg/kg	58	0	0	0.00035	0.0068	--	--	--	--	--	--	--
	Chloroform	mg/kg	58	0	0	0.00014	0.0068	--	--	--	--	--	--	--
	1-Chlorohexane	mg/kg	13	0	0	0.0045	0.0061	--	--	--	--	--	--	--
	Chloromethane	mg/kg	58	0	0	0.00044	0.0068	--	--	--	--	--	--	--
	2-Chlorotoluene	mg/kg	58	0	0	0.00046	0.0068	--	--	--	--	--	--	--
	4-Chlorotoluene	mg/kg	58	0	0	0.00088	0.0068	--	--	--	--	--	--	--
	Cumene	mg/kg	58	0	0	0.00018	0.0068	--	--	--	--	--	--	--
	p-Cymene	mg/kg	58	0	0	0.00024	0.0068	--	--	--	--	--	--	--
	1,2-Dibromo-3-chloropropane	mg/kg	58	0	0	0.00089	0.0068	--	--	--	--	--	--	--
	Dibromochloromethane	mg/kg	58	0	0	0.00029	0.0068	--	--	--	--	--	--	--
	1,2-Dibromoethane	mg/kg	16	0	0	0.0045	0.0068	--	--	--	--	--	--	--
	Dibromomethane	mg/kg	58	0	0	0.00035	0.0068	--	--	--	--	--	--	--
	1,2-Dichlorobenzene	mg/kg	58	0	0	0.00015	0.0068	--	--	--	--	--	--	--
	1,3-Dichlorobenzene	mg/kg	58	0	0	0.00013	0.0068	--	--	--	--	--	--	--
	1,4-Dichlorobenzene	mg/kg	58	0	0	0.00011	0.0068	--	--	--	--	--	--	--
	Dichlorodifluoromethane	mg/kg	58	0	0	0.00037	0.0068	--	--	--	--	--	--	--
	1,1-Dichloroethane	mg/kg	58	0	0	0.00095	0.0068	--	--	--	--	--	--	--
	1,2-Dichloroethane	mg/kg	58	0	0	0.00044	0.0068	--	--	--	--	--	--	--
	1,1-Dichloroethene	mg/kg	58	0	0	0.00055	0.0068	--	--	--	--	--	--	--
	1,2-Dichloroethene	mg/kg	42	0	0	0.00054	0.00054	--	--	--	--	--	--	--

TABLE G-1. Summary Statistics for Soil Data - Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

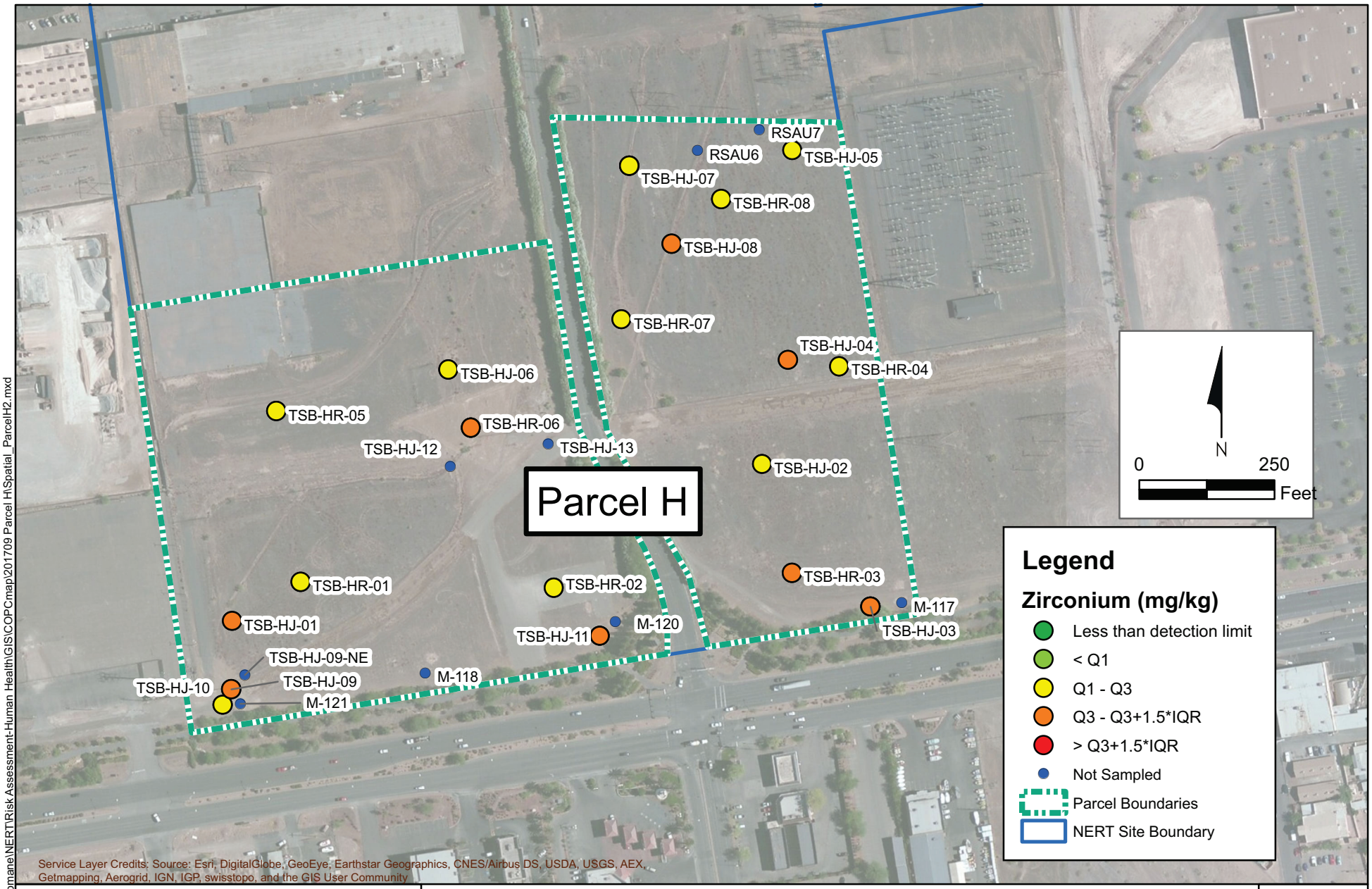
Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
VOCs	cis-1,2-Dichloroethene	mg/kg	58	0	0	0.00043	0.0068	--	--	--	--	--	--	--
	trans-1,2-Dichloroethene	mg/kg	58	0	0	0.00022	0.0068	--	--	--	--	--	--	--
	1,2-Dichloropropane	mg/kg	58	0	0	0.00037	0.0068	--	--	--	--	--	--	--
	1,3-Dichloropropane	mg/kg	58	0	0	0.00018	0.0068	--	--	--	--	--	--	--
	cis-1,3-Dichloropropene	mg/kg	58	0	0	0.00073	0.0068	--	--	--	--	--	--	--
	trans-1,3-Dichloropropene	mg/kg	58	0	0	0.00020	0.0068	--	--	--	--	--	--	--
	2,2-Dichloropropane	mg/kg	58	0	0	0.00017	0.0068	--	--	--	--	--	--	--
	1,1-Dichloropropene	mg/kg	58	0	0	0.00029	0.0068	--	--	--	--	--	--	--
	Diisopropyl ether	mg/kg	16	0	0	0.0045	0.0068	--	--	--	--	--	--	--
	Dimethyl disulfide	mg/kg	42	0	0	0.00021	0.00021	--	--	--	--	--	--	--
	2,2-Dimethylpentane	mg/kg	42	0	0	0.00028	0.00028	--	--	--	--	--	--	--
	2,3-Dimethylpentane	mg/kg	42	0	0	0.00022	0.00022	--	--	--	--	--	--	--
	2,4-Dimethylpentane	mg/kg	42	0	0	0.00019	0.00019	--	--	--	--	--	--	--
	3,3-Dimethylpentane	mg/kg	42	0	0	0.00020	0.00020	--	--	--	--	--	--	--
	Ethanol	mg/kg	42	0	0	0.19	0.19	--	--	--	--	--	--	--
	Ethyl benzene	mg/kg	58	0	0	0.00019	0.0068	--	--	--	--	--	--	--
	Ethyl tert-butyl ether	mg/kg	16	0	0	0.0045	0.0068	--	--	--	--	--	--	--
	3-Ethylpentane	mg/kg	42	0	0	0.00021	0.00021	--	--	--	--	--	--	--
	n-Heptane	mg/kg	42	0	0	0.00016	0.00016	--	--	--	--	--	--	--
	2-Hexanone	mg/kg	58	0	0	0.00028	0.014	--	--	--	--	--	--	--
	Iodomethane	mg/kg	42	0	0	0.00026	0.00026	--	--	--	--	--	--	--
	Methyl tert-butyl ether	mg/kg	58	0	0	0.00046	0.0068	--	--	--	--	--	--	--
	4-Methyl-2-pentanone	mg/kg	58	0	0	0.0016	0.014	--	--	--	--	--	--	--
	Methylene Chloride	mg/kg	58	24	41	0.0025	0.012	0.00066	0.021	0.0077	0.0093	0.0055	0.59	TSB-HJ-01
	2-Methylhexane	mg/kg	42	0	0	0.00020	0.00020	--	--	--	--	--	--	--
	3-Methylhexane	mg/kg	42	0	0	0.00014	0.00014	--	--	--	--	--	--	--
	2-Nitropropane	mg/kg	42	0	0	0.0017	0.0017	--	--	--	--	--	--	--
	n-Nonyl aldehyde	mg/kg	42	0	0	0.00088	0.00088	--	--	--	--	--	--	--
	Pentachlorophenol	mg/kg	44	0	0	0.021	0.33	--	--	--	--	--	--	--
	Phenol	mg/kg	44	0	0	0.033	0.37	--	--	--	--	--	--	--
	n-Propylbenzene	mg/kg	58	0	0	0.00095	0.0068	--	--	--	--	--	--	--
	Pyridine	mg/kg	47	0	0	0.033	0.93	--	--	--	--	--	--	--
	Styrene	mg/kg	58	0	0	0.0012	0.0068	--	--	--	--	--	--	--
	1,1,1,2-Tetrachloroethane	mg/kg	58	0	0	0.00022	0.0068	--	--	--	--	--	--	--
	1,1,2,2-Tetrachloroethane	mg/kg	58	0	0	0.00014	0.0068	--	--	--	--	--	--	--
	Tetrachloroethene	mg/kg	58	0	0	0.00027	0.0068	--	--	--	--	--	--	--
	Toluene	mg/kg	58	7	12	0.00013	0.0061	0.00054	0.0028	0.0010	0.0013	0.00081	0.62	RSAU7
	1,1,2-Trichloro-1,2,2-trifluoroethane	mg/kg	42	0	0	0.00054	0.00054	--	--	--	--	--	--	--
	1,2,3-Trichlorobenzene	mg/kg	58	0	0	0.00078	0.0068	--	--	--	--	--	--	--

TABLE G-1. Summary Statistics for Soil Data - Parcel H
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
						Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
VOCs	1,2,4-Trichlorobenzene	mg/kg	58	0	0	0.00073	0.0068	--	--	--	--	--	--	--
	1,3,5-Trichlorobenzene	mg/kg	42	0	0	0.00068	0.00068	--	--	--	--	--	--	--
	1,1,1-Trichloroethane	mg/kg	58	0	0	0.00015	0.0068	--	--	--	--	--	--	--
	1,1,2-Trichloroethane	mg/kg	58	0	0	0.00028	0.0068	--	--	--	--	--	--	--
	Trichloroethene	mg/kg	58	0	0	0.00036	0.0068	--	--	--	--	--	--	--
	Trichlorofluoromethane	mg/kg	58	1	1.7	0.00050	0.0068	0.0027	0.0027	0.0027	0.0027	--	--	M-117
	1,2,3-Trichloropropane	mg/kg	58	0	0	0.00056	0.0068	--	--	--	--	--	--	--
	1,2,4-Trimethylbenzene	mg/kg	58	8	14	0.00022	0.0068	0.00038	0.00055	0.00040	0.00042	0.000055	0.13	TSB-HJ-04
	1,3,5-Trimethylbenzene	mg/kg	58	0	0	0.00021	0.0068	--	--	--	--	--	--	--
	2,2,3-Trimethylbutane	mg/kg	42	0	0	0.00021	0.00021	--	--	--	--	--	--	--
	Vinyl acetate	mg/kg	42	0	0	0.00018	0.00018	--	--	--	--	--	--	--
	Vinyl chloride	mg/kg	58	0	0	0.00024	0.0068	--	--	--	--	--	--	--
	m,p-Xylene	mg/kg	45	0	0	0.00057	0.0068	--	--	--	--	--	--	--
	o-Xylene	mg/kg	45	0	0	0.00031	0.0068	--	--	--	--	--	--	--
	Xylenes (total)	mg/kg	55	0	0	0.00086	0.012	--	--	--	--	--	--	--

Notes:

-- = No value
mg/kg = milligram per kilogram
pCi/g = picocurie per gram
BaPEq = Benzo(a)pyrene equivalent
BHC = Hexachlorocyclohexane
DDD = Dichlorodiphenyldichloroethane
DDE = Dichlorodiphenyldichloroethylene
DDT = Dichlorodiphenyltrichloroethane
OCP = Organochlorine pesticide
OPP = Organophosphorus pesticide
PAH = Polycyclic aromatic hydrocarbon
PCB = Polychlorinated biphenyl
SVOC = Semivolatile organic compound
TCDD = Tetrachlorodibenzo-p-dioxin
TEQ = Toxicity equivalent
VOC = Volatile organic compound
* Methodology for equivalent calculations explained in text



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RAMBOLL

Spatial Quartile Plot for Parcel H - Zirconium (mg/kg)

[Q1 = 20.2, Q3 = 23.6, Q3+1.5*IQR = 26.4]

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **J-13**

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