FIELD SAMPLING PLAN
PHASE II ENVIRONMENTAL SITE ASSESSMENT

The Landing – Mt. Shasta Business Park
Former Roseburg Lumber "Old Mill"
Mt. Shasta, California

PREPARED FOR:

SISKIYOU COUNTY ECONOMIC DEVELOPMENT COUNCIL
1512 S. OREGON STREET
YREKA, CALIFORNIA 96097
EPA GRANT NUMBER: BF-00T69101-0

SISKIYOU COUNTY
ECONOMIC DEVELOPMENT

PREPARED BY:

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GEOCON

GEOCON PROJECT NO. S9717-06-01

NOVEMBER 2013

GEOCON
CONSULTANTS, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. S9717-06-01
November 19, 2013

VIA ELECTRONIC MAIL

Robert Coox, Program Manager
Siskiyou County Economic Development Council
1512 S. Oregon Street
Yreka, California 96097

Subject: FIELD SAMPLING PLAN
PHASE II ENVIRONMENTAL SITE ASSESSMENT
THE LANDING – MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

Dear Mr. Coox:

We are pleased to provide the Siskiyou County Economic Development Council (the SCEDC) with the enclosed Field Sampling Plan (FSP) for the Phase II Environmental Site Assessment (ESA) to be conducted at The Landing – Mt. Shasta Business Park, formerly the Roseburg Lumber "Old Mill," site in the City of Mt. Shasta. The Phase II ESA will be performed under the Brownfields assessment grants received from the United States Environmental Protection Agency for properties that are potentially impaired by the presence of hazardous substances and/or petroleum.

The FSP describes the investigative procedures for the Phase II ESA that we will implement. Data generated will be of the quality necessary to meet the objectives of the assessment.

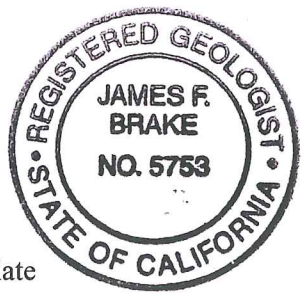
We appreciate the opportunity to provide our services to the SCEDC for this Brownfields program. Please contact us if you have any questions regarding the FSP or to discuss additional projects to be conducted going forward.

Sincerely,

GEOCON CONSULTANTS, INC.

Matt Lesh
Senior Project Geologist

Jim Brake, PG
Senior Geologist/Associate



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PHASE II ENVIRONMENTAL SITE ASSESSMENT
THE LANDING – MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

APPROVAL PAGE

Approved by: _____ _____

Robert Coox **Date**
Siskiyou County Economic Development Council
Program Manager

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Geocon Consultants, Inc. **Date**
Quality Assurance Manager

Approved by: _____ _____

Glenn Kistner, USEPA Region 9 **Date**
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Approved by: _____ _____

Eugenia E. McNaughton, Ph.D., USEPA Region 9 **Date**
Quality Assurance Manager

FIELD SAMPLING PLAN
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LIST OF ABBREVIATIONS AND ACRONYMS

APN	Assessor's Parcel Number
ATL	Advanced Technology Laboratories, Inc.
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CGS	California Geological Survey
CHHSL	California Human Health Screening Level
COC	chain-of-custody
COPC	constituent of potential concern
CVRWQCB	Central Valley Regional Water Quality Control Board
DOT	Department of Transportation
DQI	data quality indicator
DQO	data quality objective
DRO	diesel-range organics
DTSC	Department of Toxic Substances Control
E&E	Ecology and Environment
EPA	Environmental Protection Agency
ESA	environmental site assessment
ESL	Environmental Screening Levels
FSP	Field Sampling Plan
GPS	global positioning system
GRO	gasoline-range organics
HSP	health and safety plan
IDW	investigation-derived waste
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
MS/MSD	matrix spike/matrix spike duplicate
MCL	maximum contaminant level
MQO	measurement quality objective
M&E	Metcalf and Eddy
mg/kg	milligram per kilogram
µg/l	micrograms per liter
ng/kg	nanograms per kilogram
NELAP	National Environmental Laboratory Accreditation Program

ORO	oil-range organics
OSHA	Occupational Safety and Health Administration
PCP	pentachlorophenol
PPE	personal protective equipment
PAH	polycyclic aromatic hydrocarbon
PAL	project action level
PG	Professional Geologist
QA	quality assurance
QC	quality control
QAPP	Quality Assurance Program Plan
RFP	Roseburg Forest Products
RSL	Regional Screening Level
SCEDC	Siskiyou County Economic Development Council
SFRWQCB	San Francisco Bay Regional Water Quality Control Board
SOP	standard operating procedure
SVOC	semi-volatile organic compound
START	Superfund Technical Assessment and Response Team
TSA	Targeted Site Assessment
TSI	Targeted Site Investigation
USA	Underground Service Alert
USCS	Unified Soil Classification System
USGS	United States Geological Survey
VOC	volatile organic compound

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APPENDICES

1.0 INTRODUCTION

Geocon Consultants, Inc. (Geocon) has prepared this Field Sampling Plan (FSP) on behalf of the Siskiyou County Economic Development Council (SCEDC) for a Phase II Environmental Site Assessment (ESA) of The Landing – Mt. Shasta Business Park, Former Roseburg Lumber – Old Mill, (the Site) located west of the intersection of South Mt. Shasta Boulevard and Loveta Lane in Mt. Shasta City, California (Figure 1). The Phase II ESA will be funded by United States Environmental Protection Agency (EPA) hazardous substance and petroleum assessment grants (EPA Grant No. BF-00T69101-0) awarded to the City of Mt. Shasta (the City) and managed by the SCEDC.

The purpose of the Phase II ESA is to further evaluate the extent of hazardous substance and petroleum impacts at the Site related to the historical use of the Site as a lumber mill that were identified during previous investigations by others and to determine if cleanup may be necessary. The results of the Phase II ESA will be used to evaluate potential mitigation measures (if any) that may require implementation prior to the possible redevelopment of the Site as a community park. The redevelopment plan for the Site is currently in the conceptual stage, and formal design parameters have not yet been developed.

The purpose of the FSP is to describe the planned field activities, laboratory analysis, and reporting that will performed as part of the Phase II ESA. This FSP was prepared in general accordance with the EPA guidance document: *Field Sampling Plan Guidance and Template Version 1, Brownfields Projects R9QA/009.1, October 2009*. We previously prepared a Quality Assurance Program Plan (QAPP) dated December 17, 2012, for Phase II ESAs conducted under the City of Mt. Shasta Brownfields Assessment Project. We submitted the QAPP (Quality Assurance [QA] Document Control Number BNFD0597QV2) to the EPA, and they approved it on December 19, 2012. Information included in the Project QAPP that is relevant to this FSP will be referenced in the appropriate sections of this document.

This FSP summarizes the site background information and previous environmental investigations at the Site and describes proposed investigative activities, laboratory analyses to be performed, and site-specific QA objectives.

1.1 Site Name

The Site is most commonly referenced as the "The Landing" or "Old Mill." Throughout this FSP, the property will be referred to as "the Site."

1.2 Site Location and Description

The Site is located west of the intersection of South Mt. Shasta Boulevard and Loveta Lane in Mt. Shasta City, California (Figure 2). There is no physical address associated with the Site. The Site consists of approximately 20 acres of property identified by Siskiyou County Assessor's Parcel Number (APN) 067-010-010. The Site is in the southern portion of the City within a commercially and residentially developed area.

Based on the United States Geological Survey's (USGS) City of Mt. Shasta, California 7.5-minute topographic map, the Site is in Section 21 in Township 40 North, Range 4 West (USGS, 2012). The Site is vacant with only remnants of former structure foundations and paving and is heavily overgrown with vegetation. A more detailed description of the Site is provided in Section 2.1.

1.3 Responsible Agency

The City contracted with the SCEDC to administer and manage the hazardous substance and petroleum assessment grants that will fund the Phase II ESA. The SCEDC's and City's goal is to eliminate blighted conditions, promote economic development, and make properties within the City available for redevelopment.

Geocon prepared and will implement the FSP for the SCEDC. Geocon is a consulting firm that specializes in environmental and geotechnical engineering and materials testing services. Summary information about Geocon is available at http://www.geoconinc.com.

1.4 Project Contact Information

The title/responsibility, name, phone numbers, and email address of personnel associated with the Phase II ESA are summarized in the following table:

Agency/Company	Name	Title/Responsibility	Phone Number	Email Address
SCEDC	Robert Coox	Program Manager	(530) 684-4234	robert@siskiyoucounty.org
EPA Region 9	Glenn Kistner	EPA Brownfields Project Officer	(415) 972-3004	kistner.glenn@epa.gov
EPA Region 9	Eugenia E. McNaughton, Ph.D.	Quality Assurance Manager	(415) 972-3411	mcnaughton.eugenia@epa.gov
Geocon	Jim Brake	Program Manager/Technical Manager	(916) 852-9118	brake@geoconinc.com
Geocon	John Juhrend	Quality Assurance Manager	(916) 852-9118	juhrend@geoconinc.com
Geocon	Matt Lesh	Project Manager	(916) 852-9118	lesh@geoconinc.com

2.0 BACKGROUND

This section summarizes current site conditions including geologic and hydrogeologic conditions, site history, previous investigations and regulatory involvement, and potential environmental and human impacts associated with the Site based on information provided by the City and documents available on the Department of Toxic Substances Control (DTSC) EnviroStor website.

2.1 Site and Vicinity Description

The Site encompasses approximately 20 acres and is generally rectangular in shape. The Site gently slopes to the west and lies at an elevation of approximately 3,500 feet above mean sea level (USGS, 2012). A former log pond occupies the northern portion of the Site, and the base of the pond is approximately 10 feet below the surrounding grade of the Site. An intermittent stream, locally referred to as Mill Creek, that originates offsite to the east enters the Site through a culvert beneath South Mt. Shasta Boulevard, flows through the former log pond area towards the west, and exits the pond through a culvert at the western edge of the pond (Figure 2). During a site visit in May 2013, we observed water flowing in the stream and shallow standing water in the central portion of the former log pond.

South Mt. Shasta Boulevard bounds the Site to the east, and the Union Pacific Rail Road is adjacent to the west of the Site. Commercial and residential properties are located to the north of the Site, and the former "New Mill" operated by Roseburg Forest Products (RFP) is located to the south.

Structures associated with historical mill operations have been removed, and the Site is currently vacant. Remnants of the former structures and work areas are present in the form of concrete pads and foundations, but much of the former mill operations area (Figure 2) is covered in dense vegetation. We recently removed vegetation in the areas where we will perform sampling under this FSP.

2.2 Geological and Hydrogeological Information

The Site is located on the southwestern side of Mt. Shasta, a composite volcano near the southern end of the Cascade Range. The geologic surface conditions at and in proximity to the Site were obtained from the *Geologic Map of the Weed Quadrangle, California* (California Geological Survey [CGS], 1987). The Site is mapped as underlain by volcanic rocks, primarily andesite, basalt, and pyroclastic deposits. Based on soil conditions observed at the Site during their 2007 *Targeted Site Investigation* (TSI), URS described the site soils as gravelly sandy loams and loamy sands with some volcanic cobbles (URS, 2007b).

According to the Central Valley Regional Water Quality Control Board (CVRWQCB), groundwater in the site vicinity has existing beneficial uses for municipal and domestic supply (CVRWQCB, 2011). In their June 2007 TSI Report, URS indicated that groundwater was encountered at depths ranging from 8 to 10 feet in borings advanced near the western end of the former dip tank (URS, 2007b). URS also

installed four monitoring wells near a former dip tank at the "New Mill" (adjacent to the south of the Site) in 2009. The direction of groundwater flow during monitoring events in January and March 2009 was estimated to be to the west at an average gradient of 0.135 (URS, 2009).

As discussed in Section 2.1, an intermittent stream enters the Site through a culvert beneath South Mt. Shasta Boulevard, flows through the former log pond area towards the west, and exits the pond through a culvert at the western limit of the pond (Figure 2). During a site visit in May 2013, we observed water flowing in the stream and shallow standing water in the central portion of the former log pond.

2.3 Operational History

The Site was first developed by the Pioneer Box Company in 1900. Lumber mill operations were reportedly conducted by several parties, most recently RFP, at the Site from 1900 until the late 1960s when operations were moved south to the "New Mill" (URS, 2007a). Historical mill operations at the Site included the use of a dip tank, where lumber was treated with pentachlorophenol (PCP) and placed into an adjacent transfer pit, a boiler room, refuse burner, and a log pond (Figure 2).

According to the former City Manager, Mr. Ted Marconi, the Site was deeded to the City in 1989. At the time of the property transfer, all of the former mill structures at the Site had been removed and the log pond had been filled with various lumber scrap debris. During future inspections and assessment activities, the debris was referred to locally as the "wood pile" (Marconi, 2013).

2.4 Previous Investigations/Regulatory Involvement

Previous environmental investigations and/or activities conducted at the Site involving regulatory oversight are summarized in the following subsections.

2.4.1 Regulatory Inspections and Wood Pile Cleanup

According to previous reports available on EnviroStor, the CVRWQCB periodically conducted inspections at the Site from 1964 to 1995 to observe and document waste discharging practices (Ecology and Environment [E&E], 2005 and URS, 2007a). During an initial site inspection in 1964, the CVRWQCB noted that PCP was used in the dip tank at the Site and that the tank was cleaned three times per year by discharging the liquid to the ground. They also noted that the log pond was full of water, was used to store logs, and continuously drained to an offsite drainage west of the Site. In subsequent inspections reports, the CVRWQCB noted that by 1974, the log pond was void of water and the wood pile occupied the pond.

In 1988, at the direction of the CVRWQCB, three groundwater monitoring wells were installed by Steffen, Robertson and Kirsten in the vicinity of the wood pile. One well was upgradient (east) of the pile, and two wells were downgradient (west) of the pile. Reportedly, the depth to water in the wells

was less than 10 feet. Groundwater samples were collected on a quarterly basis until at least 1993 and analyzed for metals and phenols (including PCP). PCP was reportedly not detected in the samples analyzed and detected metals appeared to be consistent with local background concentrations.

In 1991, the City retained Metcalf and Eddy (M&E) to develop mitigation plan for the wood pile. M&E collected three surface debris samples from the pile and submitted them for analysis of gasoline-range organics (GRO), benzene, toluene, ethylbenzene, and total xylenes (BTEX), oil and grease, and phenols (including PCP). GRO was detected in the samples at concentrations up to 57 milligrams per kilogram (mg/kg), PCP up to 0.059 mg/kg, and oil and grease up to 580 mg/kg. BTEX was not detected. The City subsequently arranged for the wood pile to be transported offsite for use as cover at a local landfill. The CVRWQCB issued a letter in October 1995 indicating the wood pile removal was nearly complete and that further mitigation regarding the wood pile was not required. According to the former City Manager, Mr. Ted Marconi, the three monitoring wells installed in 1988 were subsequently destroyed (Marconi, 2013).

2.4.2 1998 Targeted Site Assessment

In 1998, the EPA conducted a Targeted Site Assessment (TSA) at the Site under their Regional Brownfields Program (E&E, 1998). Field activities were conducted by E&E's Superfund Technical Assessment and Response Team (START) on behalf of the EPA. The assessment focused on areas of historical lumber mill operations and included soil, sediment, surface water, and groundwater sampling. Samples were analyzed for petroleum hydrocarbons, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), dioxins/furans, and metals. VOCs were not detected in any of the samples analyzed. Analytical results showed the following areas warranted further assessment:

- The footprint of the former dip tank (Figure 3-1) where soil and groundwater samples contained PCP at concentrations up to 32 mg/kg and 12 micrograms per liter (µg/l), respectively.
- The footprint of the former dip tank and transfer pit (Figure 3-2) where shallow soils contained diesel-range organics (DRO) at concentrations up to 47,000 mg/kg and a groundwater sample contained GRO at a concentration of 734 µg/l.
- The area of the former boiler room (Figure 3-3) where a shallow soil sample collected within the footprint of the former structure contained DRO at a concentration of 784 mg/kg.
- The northeastern portion of the former log pond (Figure 3-4) where a shallow soil sample contained DRO at a concentration of 594 mg/kg.
- The former refuse burner (Figure 3-5) where a five-point composite sample collected from shallow soils contained dioxins/furans (reported as 2,3,7,8,-tetrachlorodibenzodioxin – TCDD using toxicity equivalence factors) at a concentration of 30 nanograms per kilogram (ng/kg). It should be noted that at the time of the E&E assessment, the EPA's recommended cleanup level for this compound was cited by E&E as ranging from 5,000 to 20,000 ng/kg. As such, further assessment was not recommended by E&E. However, the detected concentration exceeds the current California Human Health Screening Level (CHHSL) established by the California

Environmental Protection Agency of 4.6 ng/kg 2,3,7,8-TCDD for residential land use and 19 ng/kg for commercial/industrial land use. The EPA's Regional Screening Levels (RSLs) for 2,3,7,8-TCDD are similar to the CHHSLs at 4.5 and 18 ng/kg for residential and commercial/industrial land use, respectively. The residential CHHSL is the project action level (PAL) for this compound in soil and, as discussed in Section 3.1, further assessment is proposed.

- The convergence of three onsite drainages southwest of the log pond where a surface water sample contained lead at a concentration of 18.5 μg/l. It should be noted that this sample was collected during a period of high rainfall.

2.4.3 2005 Targeted Site Assessment

In 2005, E&E conducted a second TSA at the Site to further assess previously identified areas of contamination in soil and groundwater and re-evaluate onsite surface water conditions (E&E, 2005). Analysis of the collected samples showed the following:

- Elevated concentrations of PCP in soil samples collected to the west and south of the former dip tank and transfer pit and in groundwater to the west of the former dip tank (Figure 3-1).
- Elevated concentrations of DRO in groundwater samples collected to the west of the former dip tank and oil-range organics (ORO) in groundwater samples collected to the south of the former dip tank (Figure 3-2).
- Elevated concentrations of ORO in soil samples collected from within the footprint and to the southwest of the former boiler room.
- Elevated concentrations of DRO and ORO soil samples collected from the southeastern portion of the former log pond.
- Lead below drinking water standards in a surface water sample (WT-2-B on Figure 2) collected at the same general location as the sample collected in 1998. However, elevated concentrations of beryllium and nickel were detected in the 2005 sample. As with the 1998 sample, the 2005 sample was collected during a period of high rainfall.

2.4.4 2007 Targeted Site Investigation

In 2007, URS conducted a TSI to further delineate the extent of PCP- and DRO-impacted soil and groundwater west of the former dip tank and transfer pit (URS, 2007b). PCP and DRO were detected in a shallow soil sample collected from boring ODT-3 at the western edge of the former dip tank at respective concentrations of 130 mg/kg and 44 mg/kg. PCP and DRO were also detected in a groundwater sample collected from this boring at respective concentrations of 4.5 μg/l and 93 μg/l (Figures 3-1 and 3-2).

Due to the presence of dense vegetation adjacent to the west of the former tank, URS was only able to collect additional groundwater samples (ODT-4 and ODT-5) approximately 130 feet from the western edge of the former tank. Although PCP and DRO were not detected in either sample, the lack of samples collected closer to the likely source area represents a significant data gap.

2.5 Scoping Meeting

We visited the Site in May 2013 with Mr. Ted Marconi, the former City Manager, to observe the investigation area and determine the accessibility of the areas to be investigated. We observed that some of the areas (particularly west and north of the former dip tank) were significantly overgrown with vegetation, which would require thinning and/or removal prior to conducting field investigation activities. We also determined the majority of the field sampling activities could likely be conducted using direct-push equipment and/or hand-augering.

We subsequently provided a scope of work to complete the Phase II ESA to the SCEDC on June 10, 2013. The SCEDC approved the proposed scope of work and provided authorization to conduct the Phase II ESA services.

2.6 Environmental and/or Human Impact

As discussed in Section 2.4, the results of previous site assessment activities indicate the following areas of the Site have been impacted and warrant further assessment:

- **Former dip tank and transfer pit area** - PCP and petroleum hydrocarbons (primarily DRO and ORO) in shallow soil and groundwater in the vicinity of these former features. The lateral and vertical extent of impacts has not been defined based on the results of assessment conducted to date.
- **Former boiler and eastern portion of the former log pond** - DRO and ORO in shallow soil in the vicinity of these former features. The lateral and vertical extent of soil impacts has not been defined. In addition, it does not appear that an evaluation of groundwater has been previously conducted in these areas.
- **Former refuse burner** - dioxins/furans in shallow soil samples in the vicinity of this former feature. The lateral and vertical extent of impacts has not been defined and due to the sample compositing approach that was used, it is unclear where the primary impacts are located. In addition, we did not find reference to analysis for metals or polycyclic aromatic hydrocarbons (PAHs), which are common constituents of concern in areas of burned organic materials.
- **Convergence of three onsite drainages southwest of the log pond** - elevated concentrations of beryllium and nickel in surface water samples. Additional surface water or sediment sampling will be needed to evaluate if concentrations of these compounds continue to be a concern.

3.0 PROJECT AND DATA QUALITY OBJECTIVES

This section qualitatively defines the problem and associated tasks to be addressed by the Phase II ESA, and summarizes information regarding the data quality objectives (DQOs), data quality indicators (DQIs), data review and validation procedures, data management tasks, and assessment oversight associated with project activities.

3.1 Project Task and Problem Definition

The problems that will be addressed by the Phase II ESA include filling the following data gaps:

1. The extent of PCP and petroleum hydrocarbons in soil and groundwater in the vicinity of the former dip tank and transfer pit.

2. The extent of petroleum hydrocarbons in soil in the vicinity of the former boiler room. Evaluate the potential presence of these compounds in groundwater, which does not appear to have been conducted previously.

3. The extent of petroleum hydrocarbons in soil in the eastern portion of the former log pond. Evaluate the potential presence of these compounds in groundwater, which does not appear to have been conducted previously.

4. Dioxins/furans were detected in a five-point composite soil sample in 1998 collected from the area of the former refuse burner at a concentration exceeding current health risk-based screening levels. Due to the sample compositing approach, it is unclear where the primary impacts are located. In addition, evaluation of metals or PAHs, which are common constituents of concern in areas of burned organic materials, does not appear to have been conducted.

5. Confirm the presence of beryllium and nickel in surface water southwest of the former log pond. If an insufficient amount of surface water is present in this area, a sediment sample will be collected and tested.

The Phase II ESA tasks to fill these data gaps are described in the following subsections.

3.1.1 Former Dip Tank and Transfer Pit

We will advance 23 direct-push borings within the footprint and to the south and west of the former dip tank to depths ranging from 5 to 12 feet. Continuous core soil samples will be collected to the total depth of each boring. Selected soil samples will be analyzed for GRO, DRO, ORO, and SVOCs. Grab groundwater samples will be collected from 14 of the borings and also analyzed for GRO, DRO, ORO, and SVOCs. To minimize matrix interferences from naturally occurring organics, silica gel cleanup will be utilized in conjunction with analysis for DRO and ORO.

3.1.2 Former Boiler Room

We will advance 13 direct-push borings within the footprint and to the southwest of the former boiler room to depths ranging from 5 to 12 feet. Continuous core soil samples will be collected to the total depth of each boring. Selected soil samples will be analyzed for DRO and ORO. Grab groundwater samples will be collected from three of the borings and also analyzed for DRO and ORO. To minimize matrix interferences from naturally occurring organics, silica gel cleanup will be utilized in conjunction with analysis for DRO and ORO.

3.1.3 Former Log Pond

We will advance ten direct-push borings in the eastern portion of the log pond in the vicinity of previously identified impacts to depths ranging from 5 to 12 feet. Continuous core soil samples will be collected to the total depth of each boring. Selected soil samples will be analyzed for DRO and ORO. Grab groundwater samples will be collected from two of the borings and also analyzed for DRO and ORO. To minimize matrix interferences from naturally occurring organics, silica gel cleanup will be utilized in conjunction with analysis for DRO and ORO.

3.1.4 Former Refuse Burner

We will advance five direct-push borings in the vicinity of the former refuse burner to depths of 5 feet. Continuous core soil samples will be collected to the total depth of each boring. The 1-foot sample from each boring will be analyzed for dioxins/furans (reported as 2,3,7,8 – TCDD), Title 22 metals, and PAHs.

3.1.5 Drainages Southwest of the Log Pond

We will collect a surface water sample in the vicinity of the 2005 sample located at the convergence of three onsite drainages southwest of the log pond. The sample will be analyzed for Title 22 metals. It should be noted that during a site visit in May 2013, we observed only a shallow pond of stagnant water in the area of the 2005 sample. If there is an insufficient amount of water in this area of the Site during Phase II ESA field activities, we will collect a sediment sample instead. If we are able to collect a surface water sample , then we will also collect an offsite background water sample and have that sample analyzed for Title 22 metals as well.

3.1.6 Reporting

Upon receipt of the analytical results of the samples from the laboratory, we will prepare a report summarizing the results of the Phase II ESA field investigation and laboratory analysis of samples. We will initially prepare a draft report for review by the SCEDC and the EPA. We will then prepare a final report that incorporates the SCEDC's and EPA's comments regarding the draft report. More detailed information concerning investigative boring and sampling depths is provided in Section 4.0.

3.2 Data Quality Objectives

DQOs are qualitative and quantitative statements for establishing criteria for data quality and for developing data collection designs. DQOs are developed by a seven-stage strategic planning approach based on the scientific method that is used to prepare for a data collection activity. DQOs are developed to clarify the study objective, define the most appropriate data to collect and the conditions under which to collect the data, and specify tolerable limits on decision-making. DQOs are used to develop a scientific and resource-effective design for data collection. Using the DQO process ensures that the type, quantity, and quality of environmental data used in decision-making will be appropriate for the intended application.

The purpose of the DQOs proposed herein is to provide data of known and sufficient quality and quantity to support decisions regarding cleanup and redevelopment goals for the Site. Data quality requirements will be flexible, but based on specific decisions made as a result of specific project activities. In general, data will be of sufficient quality to determine whether the constituents of potential concern (COPCs) in soil, groundwater, or surface water are at concentrations that exceed the PALs. For the Phase II ESA, if a COPC exceeds its associated PAL, recommendations will be made to the SCEDC for additional investigation, remediation, and/or no further action if appropriate.

The PALs that will be used for the Phase II ESA are the CHHSLs established by the California Environmental Protection Agency, the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) Environmental Screening Levels (ESLs) and the EPA Region 9 RSLs. Based on the possible land use of the Site as a community park, the most conservative (residential) screening levels will be used as PALs.

In general, the primary PALs for soil will be the CHHSLs. If a CHHSL has not been established for a particular compound, the ESLs will be used. If either a CHHSL or ESL has not been established for a particular compound, the RSL will be used. Depending on the depth of soil contamination in relation to shallow groundwater, ESLs and/or RSLs for groundwater protection may also be considered as PALs. The California Maximum Contaminant Levels (MCLs) will be used as PALs for groundwater. If an MCL has not been established for a particular compound, the drinking water ESLs will be used. For surface water, the ESLs for freshwater aquatic habitats will be used as PALs.

Other than metals, detections of the COPCs in soil, groundwater, or surface water will indicate that the Site has been impacted by the former onsite operations.

The seven steps of the DQO process for the Phase II ESA and associated DQO decision-making rules are summarized in Table 1. Analytes for all COPCs, and their respective laboratory detection limits and PALs are summarized in Table 2. Information in Table 3 summarizes the container, preservation, and holding time requirements associated with soil and water samples analyzed for the COPCs.

3.3 Project-specific Measurement Quality Objectives (MQOs)

Measurement quality objectives (MQOs) are criteria established to assess the viability and usability of data. These are based on both field and laboratory protocols that examine whether the DQIs including precision, accuracy, representativeness, completeness, comparability, and sensitivity meet criteria established for various aspects of data gathering, sampling, or analysis activity. Quantitative DQIs include precision, accuracy, completeness, and sensitivity. Qualitative DQIs include representativeness and comparability. Section 2.6.3 (Common Data Quality Indicators) of the Project QAPP provides information regarding the

DQIs associated with Phase II ESAs to be conducted under the City of Mt. Shasta Brownfields assessment grant. Sample analytical results and laboratory quality control (QC) data associated with the Phase II ESA will be assessed for compliance with the DQIs.

Soil, groundwater, and surface water samples collected during this Phase II ESA will be submitted to Advanced Technology Laboratories, Inc. (ATL) of Signal Hill, California, for analysis of the COPCs. Laboratory QC procedures as well as reporting limits for analytical methods that will be utilized during the Phase II ESA are presented in ATL's Quality Assurance Program Plan in Appendix C of the Project QAPP. Comparison of the laboratory reporting limits with respective PALs in Table 2 indicates that it is expected (barring unusual and unanticipated circumstances) that the analytical laboratory will be capable of quantifying the COPCs at concentrations below PALs.

3.4 Data Review and Validation

Data review and validation is addressed Section 4.0 (Data Validation and Usability) of the Project QAPP.

3.5 Data Management

Geocon's Project Manager (Section 1.4) will be responsible for the collection, storage, review, and use of all field and laboratory data. Geocon's Technical Manager (Section 1.4) will provide data management support, as necessary and appropriate. Geocon Field Supervisors will be responsible for field data acquisition and documentation (e.g., in field logbooks) as summarized in this FSP and for appropriately transmitting data obtained in the field to Geocon's Project Manager.

Analytical laboratory department managers will be responsible for management of analytical data as specified in Section 2.6.2 (Laboratory Quality Control Requirements) of the Project QAPP. The analytical laboratory project manager assigned to the Phase II ESA will be responsible for transmittal of laboratory reports to Geocon's Project Manager.

Field and laboratory data will be archived in Geocon's files in hard-copy form and electronically as PDF or other appropriate format. Files and individual documents will be designated and dated according to a consistent convention to facilitate retrieval and review. Analytical data may be transferred to a spreadsheet or word processing program for analysis and/or presentation.

Activities and responsibilities associated with data use and review are summarized in Section 3.4.

3.6 Assessment Oversight

Assessment oversight is addressed in Section 1.2 (Project/Task Organization) and Section 3.0 (Assessment/Oversight) of the Project QAPP.

4.0 SAMPLING DESIGN AND RATIONALE

As indicated in Section 3.1, the Phase II ESA tasks include the advancement of direct-push borings to obtain soil and groundwater samples to further delineate the extent of impacts (fill data gaps) identified during previous environmental assessment of the Site. In addition, surface water sampling will be conducted to evaluate if elevated metals concentrations, identified during the 2005 assessment, continue to be present in surface water southwest of the log pond. This section summarizes the rationale for the Phase II ESA field investigation.

4.1 Soil Sampling

Soil sampling for the Phase II ESA will involve the advancement of borings using a Geoprobe 5400 direct-push rig. Subsurface soil samples will be collected in the vicinity of areas of environmental concern identified during previous site assessment. The areas of environmental concern and the associated sampling locations are shown on Figures 3-1 through 3-5. Table 4 is a Sampling Collection and Analysis Matrix.

At least 48 hours prior to initiating field work, the proposed boring locations will be marked on the surface with white paint or white-tipped stakes, and we will contact Underground Service Alert (USA) as required by law to notify subscribing local utility companies to locate underground utilities in the vicinity of the onsite investigation area.

The areas of environmental concern and the rationale for collecting subsurface soil samples within these areas are summarized in the following subsections.

4.1.1 Former Dip Tank and Transfer Pit

Elevated concentrations of PCP and petroleum hydrocarbons (primarily DRO and ORO) were detected in soil samples collected in the vicinity of these former structures, but the extent of impacts was not defined, particularly to the south and west of the former structures. To further evaluate the extent of soil impacts, 20 soil borings will be advanced to a depth of 5 feet and 3 soil borings to a depth of 10 feet within the footprint and adjacent to these former structures. The three deeper soil borings will be located to the west of the former dip tank as previous data indicates that PCP-impacted soil extends to a depth of at least 7.5 feet in this area.

Soil samples will be collected from each boring at depths of 1, 2, and 5 feet. A deeper soil sample (approximately 8 feet) will also be collected from the three borings west of the former dip tank. Soil samples will be analyzed for one or more of the following: SVOCs, GRO, DRO, and ORO. To minimize matrix interferences from naturally occurring organics, silica gel cleanup will be utilized in conjunction with analysis for DRO and ORO.

4.1.2 Former Boiler Room

Elevated concentrations of DRO and ORO were detected in soil samples collected within the footprint and to the southwest of this former structure, but the extent of impacts was not defined. To further evaluate the extent of soil impacts, 13 soil borings will be advanced to a depth of 5 feet and samples will be collected at depths of 1, 2, and 5 feet. Each sample will be analyzed for DRO and ORO with silica gel cleanup.

4.1.3 Former Log Pond

Elevated concentrations of DRO and ORO were detected in soil samples collected from the eastern portion of the former log pond, but the extent of impacts was not defined. To further evaluate the extent of soil impacts, ten soil borings will be advanced to a depth of 5 feet and samples will be collected at depths of 1, 2, and 5 feet. Each sample will be analyzed for DRO and ORO with silica gel cleanup.

4.1.4 Former Refuse Burner

An elevated concentration of 2,3,7,8-TCDD was detected in a five-point composite soil sample previously collected from the area of the former refuse burner. Due to the sample compositing approach that was used, it is unclear where the primary impacts are located. In addition, evaluation of metals or PAHs, which are common constituents of concern in areas of burned organic materials, does not appear to have been conducted. To further investigate soil impacts in the area of this former structure, five soil borings will be advanced to a depth of 5 feet and soil samples will be collected at depths of 1, 2, and 5 feet. Initially, only the 1-foot soil samples will be analyzed for dioxins/furans (reported as 2,3,7,8 – TCDD), PAHs, and Title 22 metals. The remaining samples will be placed on hold by the laboratory pending the results of the initial samples.

4.2 Groundwater Sampling

As shown on Figures 3-1 through 3-4, groundwater samples will be collected from select direct-push borings advanced in the area of the former dip tank and transfer pit, former boiler room, and former log pond. Table 4 is a Sample Collection and Analysis Matrix.

The rationale for collecting groundwater samples in the vicinity of the areas described above is summarized in the following subsections.

4.2.1 Former Dip Tank and Transfer Pit

Elevated concentrations of PCP and petroleum hydrocarbons have been detected in previous grab-groundwater samples collected in the vicinity of these former structures. The majority of the previous samples with significant detections of PCP were collected at the western end of the former dip

tank, but the extent has not been defined downgradient (west) of this area. In addition, groundwater has not been evaluated in areas of known PCP-impacted soil at the eastern end of the former dip tank and north of the former transfer pit.

GRO was detected in a soil sample collected at the eastern end of the former dip tank but further assessment has not been conducted in this area. DRO was detected in samples collected at the western end of the former dip tank, but the extent has not been defined downgradient (west) of this area. In addition, groundwater has not been evaluated in areas of known DRO-impacted soil within the footprint of the former transfer pit. ORO was detected in a sample collected to the south of the former dip tank, but the extent has not been defined.

To further evaluate the presence and extent of impacted groundwater, 14 of the 23 soil borings drilled in the vicinity of these former structures (Section 4.1) will be extended to an approximate depth of 12 feet (about 2 feet below the expected depth to groundwater of 10 feet at the Site) to facilitate grab-groundwater sampling. These groundwater samples will be analyzed for one or more of the following: SVOCs, GRO, DRO, and ORO. To minimize matrix interferences from naturally occurring organics, silica gel cleanup will be utilized in conjunction with analysis for DRO and ORO.

4.2.2 Former Boiler Room

Groundwater does not appear to have been previously evaluated in the vicinity of known DRO- and ORO-impacted soil within the footprint and to the southwest of this former structure. To evaluate the potential presence of impacted groundwater, three of the 13 soil borings drilled in the vicinity of this former structure (Section 4.1) will be extended to an approximate depth of 12 feet to facilitate grab-groundwater sampling. These groundwater samples will be analyzed for DRO and ORO with silica gel cleanup.

4.2.3 Former Log Pond

Groundwater does not appear to have been previously evaluated in the vicinity of known DRO- and ORO-impacted soil in the eastern portion of the former log pond. To evaluate the potential presence of impacted groundwater, two of the ten soil borings drilled in the eastern portion of this former feature (Section 4.1) will be extended into saturated soils to facilitate grab-groundwater sampling. The depth of the water table within the former log pond is unknown but will likely be less than the remainder of the Site since the base of the pond is approximately 10 feet below the surrounding grade of the Site. These groundwater samples will be analyzed for DRO and ORO with silica gel cleanup.

4.3 Surface Water Sampling

Elevated concentrations of beryllium and nickel were detected in a surface water sample collected in 2005 at the convergence of three onsite drainages southwest of the log pond (Figure 2). To evaluate if elevated concentrations of metals continue to be present in this area, a surface water sample will be collected from the same general location as the 2005 sample and analyzed for Title 22 metals. It should be noted that during a site visit in May 2013, we observed only a shallow pond of stagnant water in the area of the 2005 sample. If there is an insufficient amount of water in this area of the Site during Phase II ESA field activities, a sediment sample will be collected instead (Section 4.4). If a surface water sample is collected, an offsite background water sample will be also be collected and analyzed for Title 22 metals.

4.4 Sediment Sampling

As discussed in Section 4.3, if there is an insufficient amount of surface water southwest of the log pond, a sediment sample will be collected in this area. The sediment sample will be collected from the bottom of the drainage channel closest in proximity to the 2005 surface water sample location (Figure 2).

5.0 REQUEST FOR ANALYSES

This section summarizes the laboratory analytical plans associated with samples collected during implementation of this FSP.

5.1 Analyses Narrative

The laboratory reporting limits for the analyses planned for the Phase II ESA are summarized in Table 2. Soil sample container, preservation, and holding time requirements associated with the COPCs are summarized in Table 3.

Since the lateral and vertical extent of COPCs in soil, groundwater, and surface water have not been fully characterized at this time, the proposed quantity and location of soil, groundwater, and surface water samples may necessitate modification during the Phase II ESA field investigation activities based on conditions encountered onsite. Table 4 (Sampling Collection and Analysis Matrix) lists the analyses that are planned to assess the presence of the COPCs in onsite soil, groundwater, surface water, and sediment samples.

The specific analyses requested for each type of sample will be based on cumulative project data and the observations, experience, and judgment of supervisory field personnel in concurrence with the Project Manager and Technical Manager.

At each location we will collect a sufficient volume of sample for analysis and laboratory QC as specified in Appendix C of the Project QAPP. Approximately 10% of the soil and groundwater samples collected will be split in the field with the field-split sample being analyzed as a duplicate to assess field and laboratory precision.

Soil, groundwater, surface water, and sediment samples will be placed in sample coolers, preserved on ice at approximately 4 degrees Celsius (°C), and shipped by courier to the laboratory under standard chain-of-custody (COC) protocol. Unless the observations, experience, and judgment of supervisory field personnel in concurrence with the Project Manager and Technical Manger determine otherwise based on unanticipated field conditions (i.e., emergency conditions that potentially threaten human health or the environment), samples will be analyzed on a standard two-week turnaround time.

5.2 Analytical Laboratory

Soil, groundwater, surface water samples, and sediment collected during implementation of this FSP will be submitted to ATL of Signal Hill, California, for analysis. The ATL Quality Assurance Program Plan is in Appendix C of the Project QAPP and summarizes the policies, practices, and procedures for ensuring that the quality of laboratory measurement data generated by ATL meets requirements of the National Environmental Laboratory Accreditation Program (NELAP).

ATL will document laboratory data in written reports that will include sample results and copies of COCs. In addition, ATL will provide laboratory QC reports for surrogate recoveries, matrix spike/matrix spike duplicate (MS/MSD) samples, and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) samples as applicable. Activities and responsibilities associated with laboratory data review, data management, and assessment oversight processes are summarized in Section 2.12 (Data Management) and Section 4.0 (Data Validation and Usability) of the Project QAPP, as well as in the ATL Laboratory Quality Assurance Program Plan in Appendix C of the Project QAPP.

6.0 FIELD METHODS AND PROCEDURES

This section summarizes the field equipment, field screening and sampling methods, and decontamination procedures associated with the Phase II ESA field activities.

6.1 Field Equipment

Field activities and specific equipment will be based on the observations, experience, and judgment of supervisory field personnel in concurrence with the Project Manager and Technical Manager. The specific depth of the soil borings and the number of samples collected may be modified based on conditions encountered in the field. Therefore, specific quantities of equipment and materials needed for the Phase II ESA activities may also be modified to address unforeseen field conditions.

6.1.1 List of Equipment Needed

Based on our experience with similar investigations, it is anticipated that the following equipment will be required:

- Geoprobe 5400 direct-push rig (operated by Geocon);
    - Threaded steel probe rods (24 to 36 inches in length) – total at least 30 feet
    - Drive/pull caps
    - Sample tubes (24 inches to 36 inches in length) – total of at least 500 feet
    - Blank temporary well casing (0.75" by 5 feet each) – total of at least 200 feet
    - Slotted temporary well casing (0.75" by 5 feet each) – total of at least 100 feet
    - Disposable bailers
    - Vinyl end caps
- Geocon support truck;
- Decontamination equipment
    - 5-gallon buckets (three total)
    - Brushes (three total)
    - Non-phosphate detergent (one quart)
    - Tap and deionized water (approximately 10 gallons of each per day)
- 55-gallon drums (two total);
- Bentonite pellets (50-lb bucket);
- Gallon and quart re-sealable plastic bags (100 total);
- Level D personal protective equipment (PPE) per person per health and safety plan (HSP);
- White marking paint;
- Cellular phone (per person);
- Digital camera;
- Portable global positioning system (GPS) receiver;
- Drum labels, sample container labels, and custody seals (100 total);
- Drilling logs;
- Sample COCs (as needed);
- Ice chests and ice (as needed);
- Temperature blanks (one per shipping cooler);
- Clear packing tape;
- Field logbook; and
- Permanent black-ink pens and markers (as needed)

6.1.2 Maintenance of Field Equipment

The Geoprobe 5400 direct-push rig will be maintained by Geocon; however, before each field-day commences, a cursory inspection of the rig will be made to ensure that there are no fuel or oil leaks from the vehicle, or leaks from the hydraulic-driven boring equipment. Additionally, support vehicles operated by Geocon will also be observed prior to entering the Site for fuel or oil leaks. Geocon vehicles will be operated and maintained in accordance with the equipment manufacturer's specifications.

6.2 Field Screening

Field screening will include observation of soil removed from the Geoprobe sampling tubes for preliminary indications of petroleum products (e.g., soil discoloration and/or hydrocarbon odor). Observations will be made by experienced field supervisory personnel and documented in daily field logs and on drilling logs prepared for each boring. Copies of example field forms that will be used during the Phase II ESA are in Appendix F of the Project QAPP.

Indications of petroleum hydrocarbons in soil samples will be communicated to our Project Manager and/or Technical Supervisor as soon as practical and appropriate. Soil collected from borings will be continuously screened to the total depth of the boring. If soil samples collected from the planned bottom of a boring appear to potentially contain petroleum hydrocarbons (based on field screening), the boring may be advanced to greater depths, as practical, to assess their vertical extent.

6.3 Soil Sampling

Soil samples will be collected using a Geoprobe 5400 direct-push rig in the vicinity of areas of environmental concern identified during previous assessment activities at the Site. The areas of environmental concern and the associated soil sampling locations are shown on Figures 3-1 through 3-5.

6.3.1 Subsurface Utility Clearance

Prior to drilling, the planned boring locations will be marked with white spray paint and/or wooden stakes. USA will be notified a minimum of 48-hours prior to drilling to provide utility clearance.

6.3.2 Surface Soil Sampling

Surface soil sampling is not proposed to be conducted as part of the Phase II ESA.

6.3.3 Subsurface Soil Sampling

The planned soil boring locations have been selected based on the results of previous assessment activities at the Site. However, the exact locations of the borings may be adjusted based on field conditions and the presence of underground utilities identified by utility locators. Modifications to the boring locations will be

noted by field personnel in the field logbook. The locations of all soil borings advanced during the Phase II ESA will be recorded by field personnel in the logbook as sampling is completed, along with any physical reference points near the boring. Boring locations will also be photographed and a hand-held GPS receiver used to record the latitude/longitude coordinates of each boring.

Soil sample collection methods for direct-push borings are addressed in Appendix E of the Project QAPP (Standard Operating Procedure [SOP]-2050, Model 5400 Geoprobe Operation, Section 7.10, Soil Sampling).

The soil borings advanced during the Phase II ESA will be logged in the field by a Geocon geologist under the direction of a Geocon Professional Geologist (PG). The depth, location, description (i.e., Unified Soil Classification System [USCS] description), and identification number of each soil sample will be entered by field personnel onto a soil boring log that will be prepared in the field for each boring. Additional information that will be entered onto the log by the field personnel will include the soil boring identification number, driller's name, sampler's name, date and time of the boring, and indications of potential COPCs (i.e., staining or hydrocarbon odors). An example boring log is in Appendix F of the Project QAPP.

6.4 Sediment Sampling

As discussed in Section 4.4, sediment sampling will be conducted if there is insufficient surface water in the drainage southwest of the log pond. The sediment sample will be collected from the bottom of the drainage channel closest in proximity to the 2005 surface water sample location (Figure 2) using a trowel or scoop as described in Appendix E of the Project QAPP (SOP-2016, Sediment Sampling, Section 7.2, Sample Collection).

The depth, location, description, and identification number of each sediment sample collected will be entered by the field personnel onto the daily field log.

6.5 Water Sampling

This section describes the field methods and procedures associated with groundwater and surface water sampling.

6.5.1 Groundwater Samples

Methods for collecting groundwater samples from direct-push borings are addressed in Appendix E of the Project QAPP (SOP-2050, Model 5400 Geoprobe Operation, Section 7.11, Groundwater Sampling). The depth, location, and identification number of each groundwater sample will be entered onto the boring log for each direct-push boring location. Additional information that will be entered onto the log will include the boring location identification number and indications of potential COPCs (i.e., staining or hydrocarbon odors).

6.5.2 Surface Water Samples

Surface water samples will be collected using the direct-fill method described in Appendix E of the Project QAPP (SOP-2013, Surface Water Sampling, Section 7.3, Sample Collection). The location, description, and identification number of each surface water sample will be entered onto the daily field log.

6.6 Decontamination Procedures

To minimize the need for equipment decontamination, sample-collection materials such as the acetate sleeves used in the sample tubes of the Geoprobe rig will not be reused after the collection of soil samples. Acetate sleeves that have been used will be placed in plastic bags and disposed of appropriately. Soil from the acetate sleeves that is not retained for sample analysis will be removed from the acetate sleeves and placed in 55-gallon drums for subsequent characterization and disposal.

The steel push-rod, sample tube, and bailer (used for groundwater collection) and associated equipment driven by the Geoprobe direct-push rig will be decontaminated prior to use at each boring location by cleaning with Alconox (non-phosphate detergent), tap water, and deionized or distilled water. The decontamination process will involve disassembling the push-rod, sample tube, and associated equipment, rinsing using a pressurized wand, washing with the Alconox/water mixture using a scrub brush, rinsing with cold tap water and deionized or distilled water, and allowing the rods, tubes, and equipment to dry prior to the next use.

Any equipment used for collection of sediment samples including hand-held trowels or scoops will be decontaminated prior to sampling. The decontamination process will involve washing the equipment with the Alconox/water mixture using a scrub brush, rinsing with cold tap water, and rinsing with deionized or distilled water.

Rinseate generated from the cleaning activities will be stored in 55-gallon drums for subsequent characterization, transportation by a licensed waste hauler, and disposal.

7.0 SAMPLE CONTAINERS, PRESERVATION AND STORAGE

Information regarding sample container, preservation, and storage requirements for the Phase II ESA is addressed in ATL's, Quality Assurance Program Plan, Appendix G, which is located in Appendix C of the Project QAPP. Summary information for the analytical methods associated with the site-specific COPCs is in Table 3.

8.0 DISPOSAL OF RESIDUAL MATERIALS

Information regarding sample disposal of wastes or materials derived during the Phase II activities is addressed in Section 2.3 (Management of Investigation-Derived Waste) of the Project QAPP.

9.0 SAMPLE DOCUMENTATION

This section summarizes the procedures regarding sample documentation. Geocon Field Supervisors will be responsible for implementing the documentation procedures summarized in this FSP and for appropriately communicating information obtained in the field to Geocon's Project Manager. If possible, any problems or inconsistencies regarding sample documentation procedures will be resolved immediately by our Project Manager and Technical Manager based on consultation with Field Supervisors.

9.1 Field Notes

Recordkeeping for field activities including field log and photographic log requirements for the Phase II ESA is addressed in Section 1.7 (Documentation and Records) of the Project QAPP.

9.2 Labeling

An appropriate self-adhesive drum label will be affixed to each Department of Transportation (DOT)-approved 55-gallon drum used for the storage of investigation-derived waste (IDW). Drum labels will indicate a unique drum identification number, date, contents (rinseate water or soil), waste generator, site location, consultant name, and contact name and telephone number.

An appropriate self-adhesive sample label will be affixed to each sample container. Sample container labels will indicate the unique sample number, sample date and time, sample location, sampler name or initials, requested analysis, and preservation used.

Information recorded on labels will be written legibly with permanent black ink in a clear and precise manner for proper identification in the field and subsequent tracking in the laboratory and at the disposal facility.

9.3 Sample Chain-of-Custody Forms and Custody Seals

Sample COC forms will be completed as sampling activities progress to record unique sample numbers, sample collection dates and times, and requested analyses and to provide sample tracking documentation in the field and laboratory. Each sample shipment cooler sent to the laboratory for analyses will be accompanied by an original COC specific for the shipment contents that bears the original signatures of sample custodians. A sample ATL COC is in Appendix F of the Project QAPP.

An appropriate self-adhesive custody seal will be affixed across the lid of each drum, sample container, and sample shipment container in such a manner that an attempt to open the container would cause noticeable and irreparable damage to the custody seal and would alert supervisory personnel of the potential for container tampering and custodial discontinuity.

Information recorded on COCs and custody seals will be written legibly with permanent black ink in a clear and precise manner for proper identification in the field and subsequent tracking in the laboratory and/or at the disposal facility. Our Field Supervisors will be responsible for affixing custody seals and for completing/maintaining COCs until samples are shipped to the laboratory. Laboratory procedures and personnel responsibilities with respect to sample receipt, log-in, storage, and tracking in the laboratory are summarized in ATL's Quality Assurance Program Plan (Appendix C of the Project QAPP).

10.0 QUALITY CONTROL

This section summarizes the QC procedures for the Phase II ESA to ensure that the type, quantity, and quality of data used in decision-making are useful for intended applications and will support cleanup and redevelopment goals for the Site. Our Project Manager will be responsible for overall QC for the Phase II ESA. Our Technical Manager will provide QC support and guidance, as necessary and appropriate. Analytical laboratory department managers will be responsible for laboratory QC as indicated in the Appendix C of the Project QAPP.

The following sections summarize QC procedures with respect to field QC samples, background samples, field screening and confirmation samples, and laboratory QC samples.

10.1 Field Quality Control Samples

Field QC samples help to assess the potential for field contamination and variability. Field quality control requirements are addressed in Section 2.6.1 (Field Quality Control Requirements) of the Project QAPP.

The following subsections summarize plans regarding the use of equipment, trip, and temperature blanks.

10.1.1 Equipment Blanks

Equipment rinseate blanks are generally collected when reusable, non-disposable sampling equipment is used during sampling activities. One equipment blank will be collected each field day and analyzed for the appropriate COPCs.

10.1.2 Trip Blanks

Trip blanks are prepared to evaluate the potential for the introduction of VOCs into samples due to shipping/handling procedures and cross-contamination of VOCs between samples. Since VOCs have not been identified as a COPC at the Site, based on the results of previous assessment, trip blanks will not be included in sample shipments.

10.1.3 Temperature Blanks

Temperature blanks are used to measure the temperature inside the cooler upon receipt at the laboratory. A laboratory-provided temperature blank will be included with each sample shipment to the laboratory.

10.2 Assessment of Field Variability (Field Duplicate/Co-located Samples)

Field duplicate or co-located samples are collected simultaneously with a standard sample from the same source under identical conditions into separate sample containers to assess sample heterogeneity and the potential for variability due to sampling technique. Approximately 10% of the samples collected from the Site will be "split" (i.e., a single soil or groundwater sample separated into two samples) into a co-located field duplicate sample.

Co-located soil samples collected from exploratory borings will be selected at sample depths where the sedimentary materials and presence of COPCs (i.e., based on observation or previous analytical data) appear consistent with the adjacent "split" sample. Selection of the co-located samples will be based on the observations, experience, and judgment of supervisory field personnel in concurrence with the Project Manager and Technical Manager. Co-located samples will be collected, preserved, packaged, and shipped in the same manner as adjacent samples. Co-located samples will be assigned a unique sample number and submitted "blind" to the laboratory for the same analysis as the adjacent sample to assess laboratory performance through comparison of results.

10.3 Background Samples

Title 22 metals may occur naturally in soil/sediment, which can affect surface water in contact with the soil/sediment. Concentrations of metals detected in surface water samples will be compared to a designated background surface water sample collected offsite. Detections of metals in soil samples will be compared with published background concentrations in soil.

10.4 Field Screening and Split Samples

The following sections summarize plans regarding the collection and analysis of field screening, confirmation, and split samples.

10.4.1 Field Screening Samples

Field screening samples will include the observation of soil retrieved from the sampling equipment advanced during the direct-push boring activities for preliminary indications of impact by petroleum hydrocarbons (e.g., soil discoloration or hydrocarbon odor). Field screening plans and procedures are summarized in Section 6.2.

10.4.2 Confirmation Split Samples

If subsurface soil collected from the soil borings appears potentially impacted by petroleum hydrocarbons or other COPCs (based on observations and field monitoring/screening results), then a 'split' sample of the soil may be retained and analyzed as a 'blind' duplicate to evaluate the consistency of the laboratory analyses.

10.5 Laboratory Quality Control Samples

Laboratory QC samples are analyzed as part of the standard laboratory practice to monitor the precision and accuracy of laboratory results and procedures. Laboratory QC samples are an aliquot (subset) of the field sample, not a separate, unique sample.

The sample volumes collected will be sufficient for sample analysis and laboratory QC use. On that basis, separate samples for laboratory QC purposes will not be collected. The COCs will indicate the number of sample containers per sample. Laboratory procedures with respect to QC samples are summarized in ATL's Quality Assurance Program Plan (Appendix C of the Project QAPP).

11.0 FIELD VARIANCES

Based on our knowledge of the conditions beneath the Site, through our site visits and review of previous assessment reports, it is unlikely that field conditions will be significantly different than anticipated. However, it may be necessary to implement some minor modifications to the investigation and sampling activities proposed in this FSP such as: advancing borings deeper than anticipated to facilitate groundwater sampling or collecting soil samples manually (hand-augering) instead of direct-push drilling due to access limitations.

Recommendations for significant FSP modifications (if any) will be based on the observations, judgment, and experience of our Field Supervisors, Project Manager, and Technical Manager following consultation with the SCEDC, analytical laboratory, EPA Region 9 QA office, and others, as appropriate.

Our Project Manager will contact the EPA Region 9 QA office as soon as possible and practical to communicate significant unanticipated field conditions and significant problems or inconsistencies with this FSP that would potentially require modification of the proposed activities. Verbal approval of significant FSP modifications will be obtained from the EPA Region 9 QA office prior to implementing changes. Our summary report following investigative activities will document FSP modifications and the factors/rationale that made them necessary.

12.0 HEALTH AND SAFETY PROCEDURES

Our field personnel will have completed on Occupational Safety and Health Administration (OSHA) –approved 40-hour health and safety (Hazardous Waste Operations and Emergency Response) training course and appropriate 8-hour annual refresher courses. Field supervisory and sampling personnel will have read and will understand the investigation and sampling procedures proposed in this FSP and the health/safety requirements and procedures for this project that are documented in the site-specific HSP in Appendix A.

Our field personnel will acknowledge familiarity with, and understanding of, the elements of the HSP by signing the final page of the HSP prior to site work. A copy of the HSP will be provided to subcontractors involved with the Phase II ESA field activities. Our Project Manager and Field Supervisors will conduct an onsite meeting prior to the start of field activities to communicate project roles and responsibilities, discuss key elements of the HSP, and coordinate activities. A copy of the HSP will be maintained at the Site by supervisory field personnel for the duration of the field operations and will be available to affected personnel.

Based on review of the previous assessment reports and our experience with similar investigation projects, the risk of significant exposure to contaminants is considered to be low to moderate while performing tasks required during the Phase II ESA. Sampling methods and work practices to be employed will reduce the potential for significant exposure to potential contaminants. On that basis, it is anticipated that Level D protection will be appropriate for field activities. Level D PPE includes hard hats, safety boots, and safety glasses as appropriate. Soil samplers will wear appropriate disposable gloves. If field conditions warrant upgrading to a higher protection level, all work will cease and the health and safety officer will be notified.

13.0 REFERENCES

California Environmental Protection Agency, *Use of California Human Health Screening Levels in Evaluation of Contaminated Properties*, updated September 2010.

California Geological Survey, Wagner, D. L. and Saucedo, G. J., *Geologic Map of the Weed Quadrangle*, 1:250,000 scale, 1987.

Central Valley Regional Water Quality Control Board, *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins*, Fourth Edition, revised October 2011.

Ecology and Environment, *Draft Brownfields Targeted Site Assessment, City of Mt. Shasta, Roseburg Commerce Park*, September 1998.

Ecology and Environment, *Targeted Brownfields Assessment, City of Mt. Shasta, Roseburg Commerce Park*, May 2005.

Marconi, Ted, former City Manager, City of Mt. Shasta, personal communication with Geocon Consultants, Inc., May 2013.

San Francisco Bay Regional Water Quality Control Board, *Screening Levels for Environmental Concerns at Sites with Contaminated Soil and Groundwater*, updated May 2013.

United States Environmental Protection Agency, *Field Sampling Plan Guidance and Template Version 1, Brownfields Projects R9QA/009.1*, October 2009.

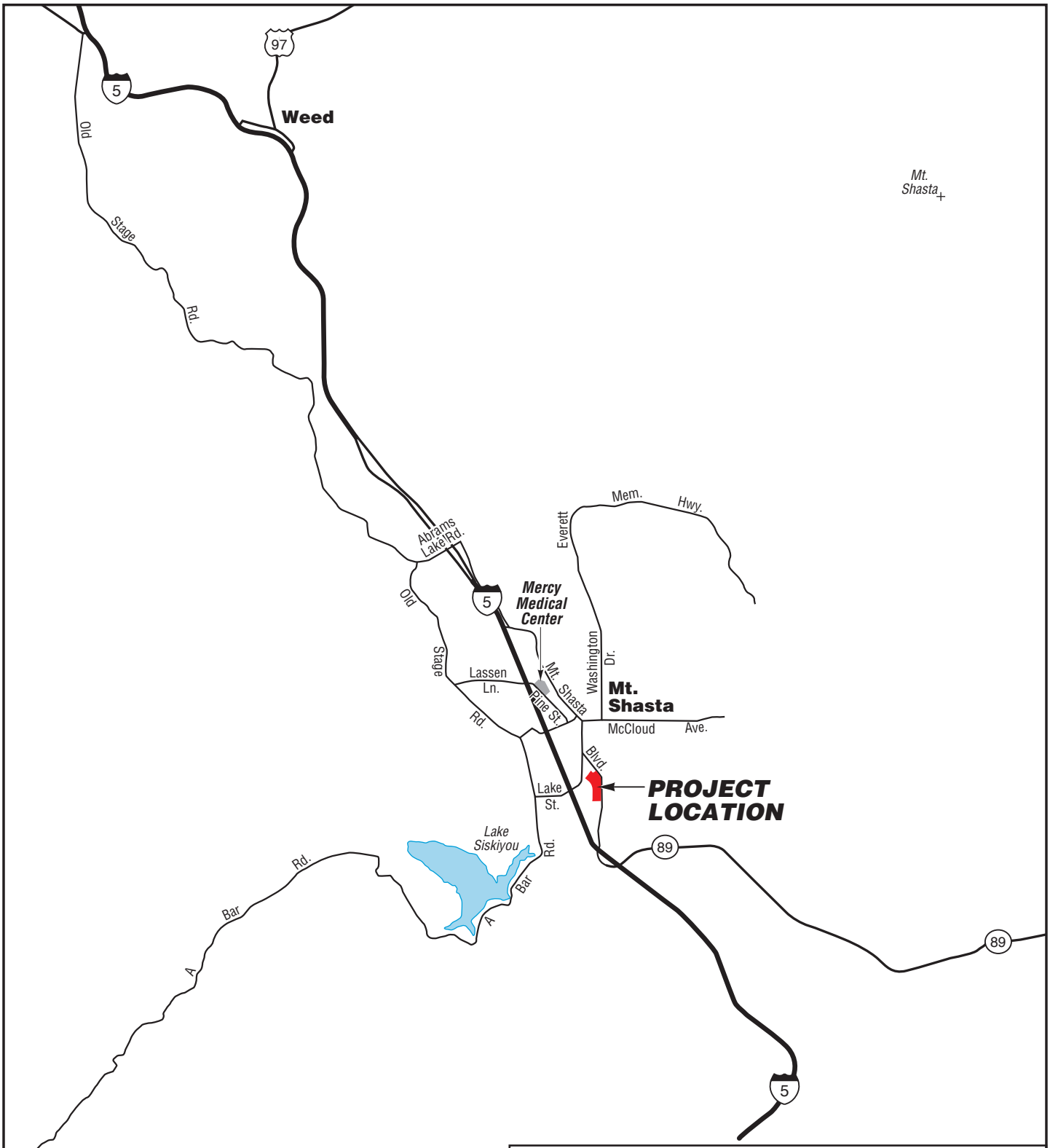
United States Environmental Protection Agency, *Regional Screening Levels for Chemical Contaminants at Superfund Sites*, http://www.epa.gov/region9/superfund/prg, updated May 2013.

United States Geological Survey, *7.5-minute Quadrangle Topographic Map, City of Mt. Shasta, California*, 2012.

URS, *Workplan Addendum for Roseburg Lumber Mill Targeted Site Investigation*, May 21, 2007 (2007a).

URS, *Additional Targeted Site Investigation Report, Roseburg Lumber Mill, Western Property*, June 25, 2007 (2007b).

URS, *Additional Targeted Site Investigation Report, Roseburg Lumber Mill, Western Property*, April 29, 2009.



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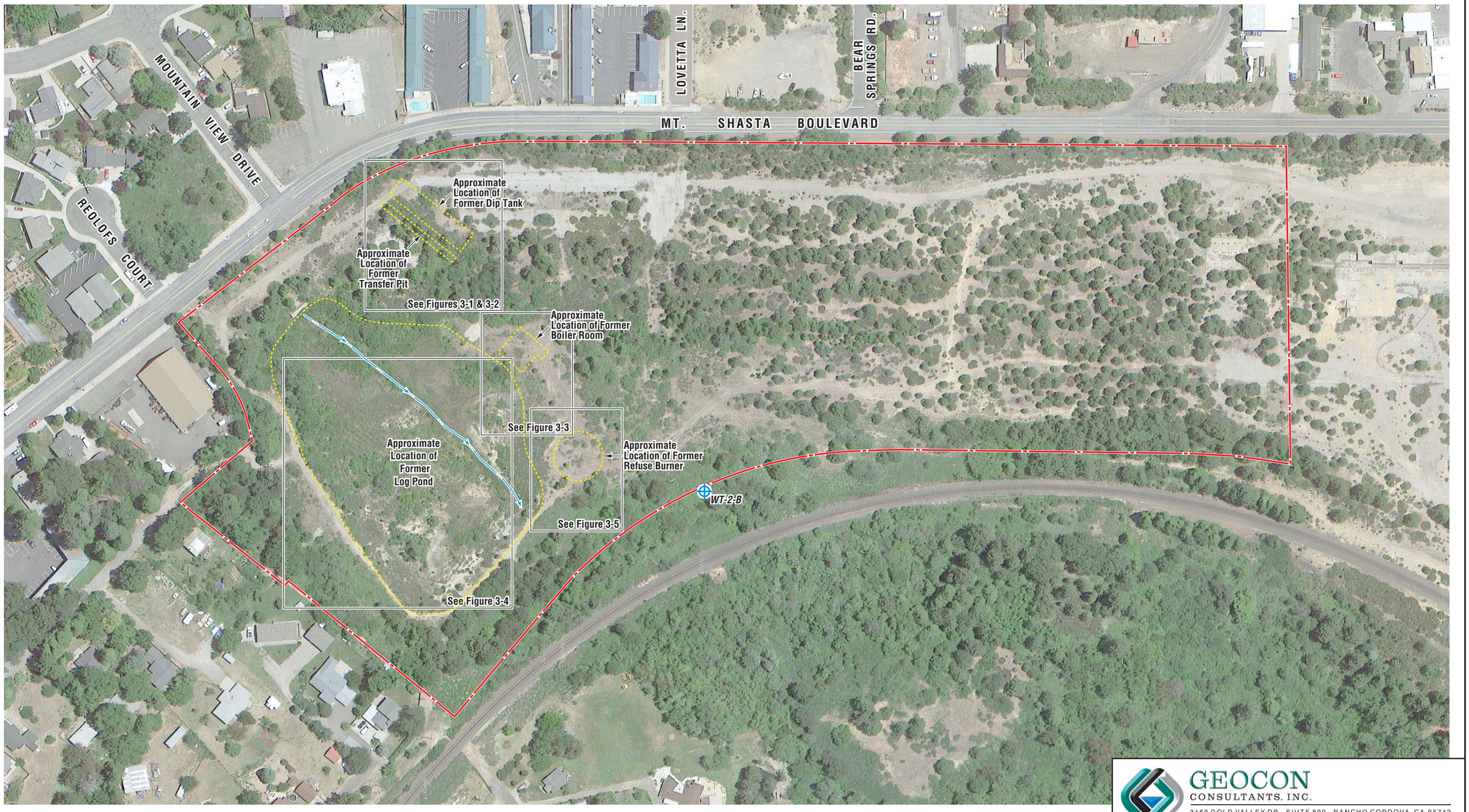
The Landing – Mt. Shasta Business Park
Former Roseburg Lumber "Old Mill"

Mt. Shasta, California

VICINITY MAP

S9717-06-01	November 2013	Figure 1



LEGEND:

WT-2-B ⊕ Approximate Surface Water Sample Location (2005)

Intermittent Drainage

N

0 150

Scale in Feet

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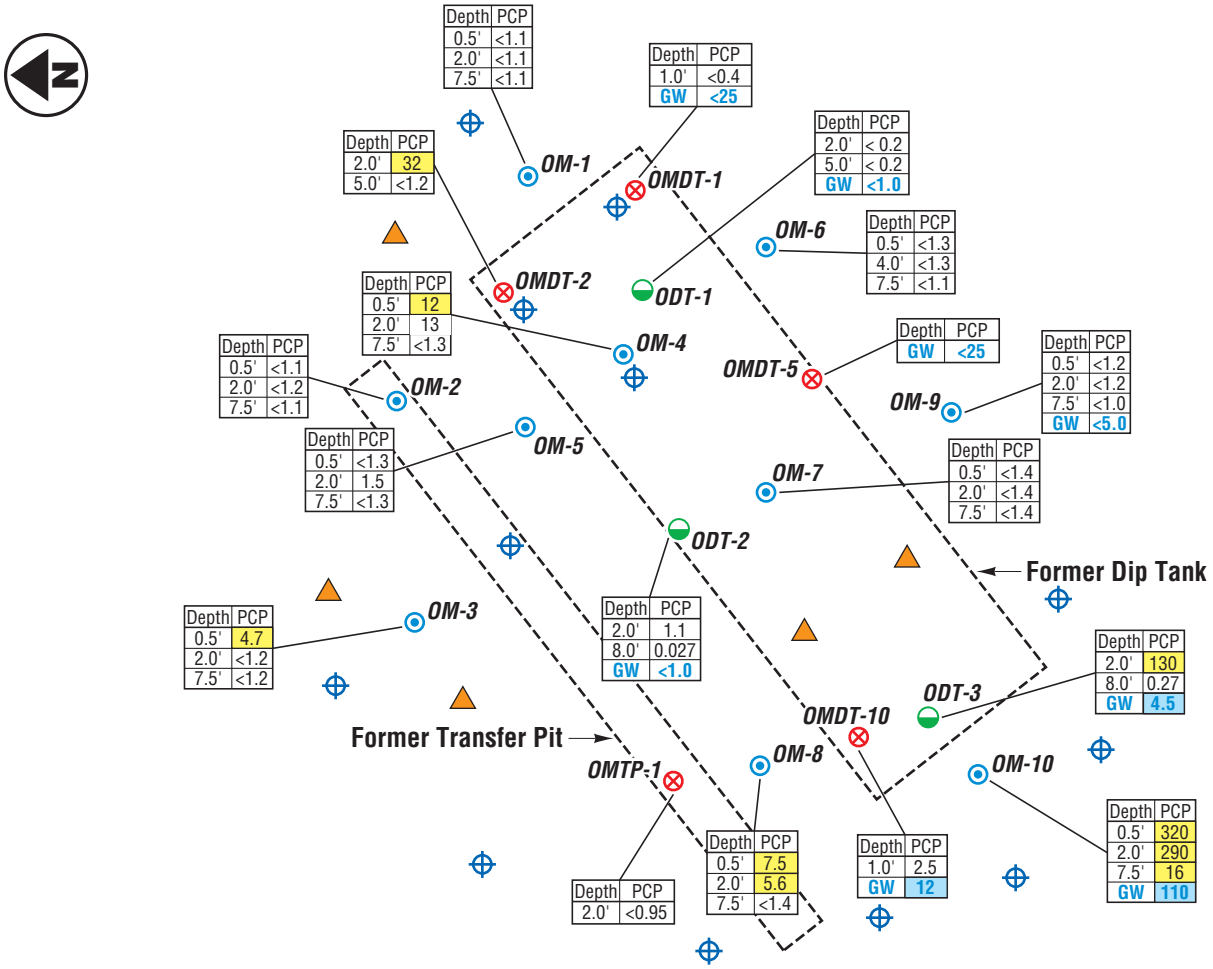
The Landing – Mt. Shasta Business Park
Former Roseburg Lumber "Old Mill"

Mt. Shasta, California

SITE PLAN

S9717-06-01	November 2013	Figure 2



LEGEND:

- Approximate Boring Location (1998)
- Approximate Boring Location (2005)
- Approximate Boring Location (2007)
- Proposed Soil and Grab Groundwater Boring to 12'
- Proposed Soil Boring to 5'
- Exceeds Proposed Project Action Levels

PCP = Pentachlorophenol
GW = Groundwater
Soil Concentrations in Milligrams per Kilogram (mg/kg)
GW Concentrations in Micrograms per Liter (µg/l)

0 40
Approx. Scale in Feet

Ref: Ecology and Environment, Inc., 2005 and URS, 2007

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Former Roseburg Lumber "Old Mill"

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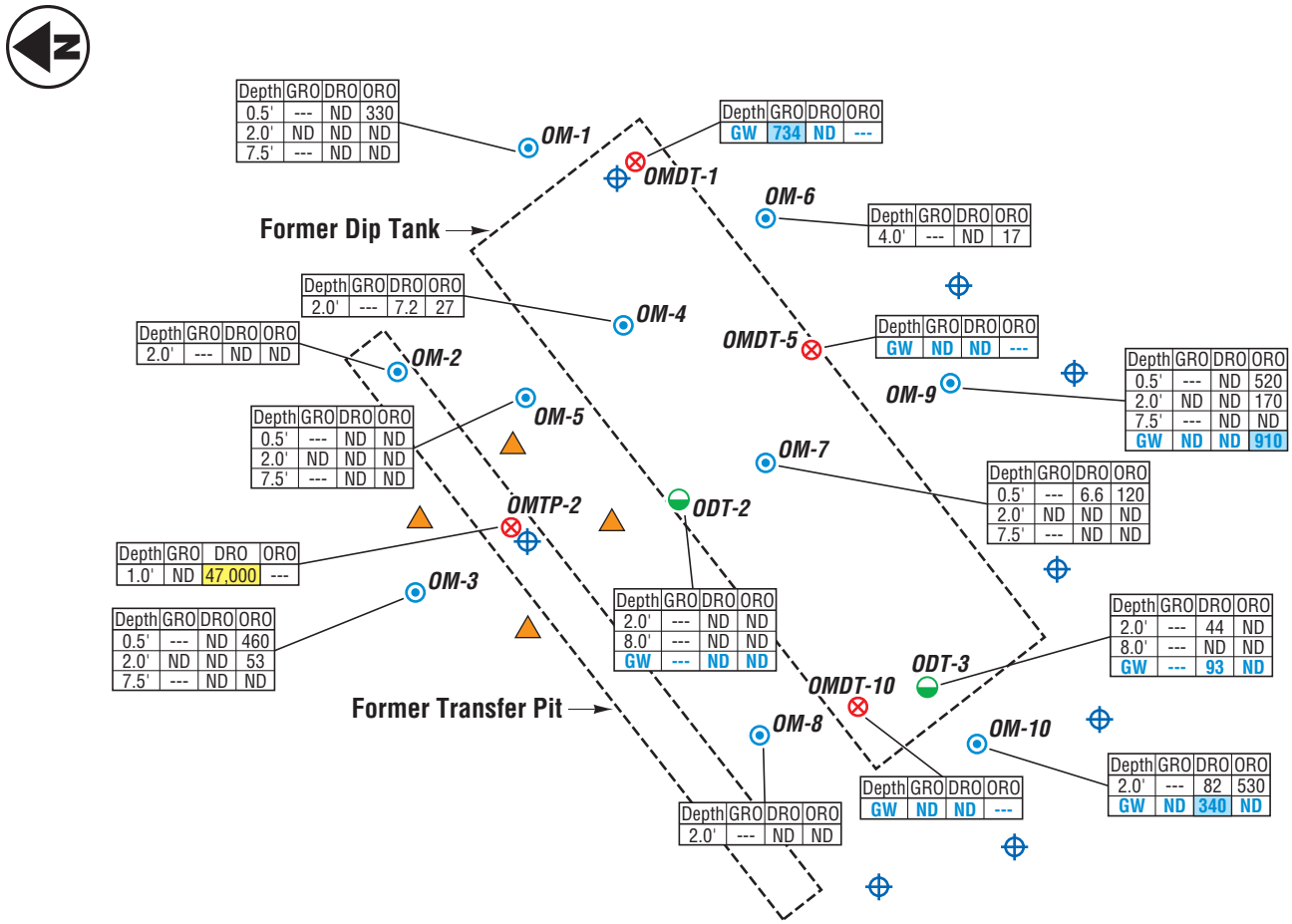
PCP in Soil and Groundwater – Former Dip Tank and Transfer Pit

S9717-06-01	November 2013	Figure 3-1



LEGEND:

- Approximate Boring Location (1998)
- Approximate Boring Location (2005)
- Approximate Boring Location (2007)
- Proposed Soil and Grab Groundwater Boring to 12'
- Proposed Soil Boring to 5'
- Exceeds Proposed Project Action Levels

GRO = Gasoline Range Organics
DRO = Diesel Range Organics
ORO = Oil Range Organics
GW = Groundwater
--- = Not Analyzed
ND = Not Detected
Soil Concentrations in Milligrams per Kilogram (mg/kg)
GW Concentrations in Micrograms per Liter (µg/l)

Ref: Ecology and Environment, Inc., 2005 and URS, 2007

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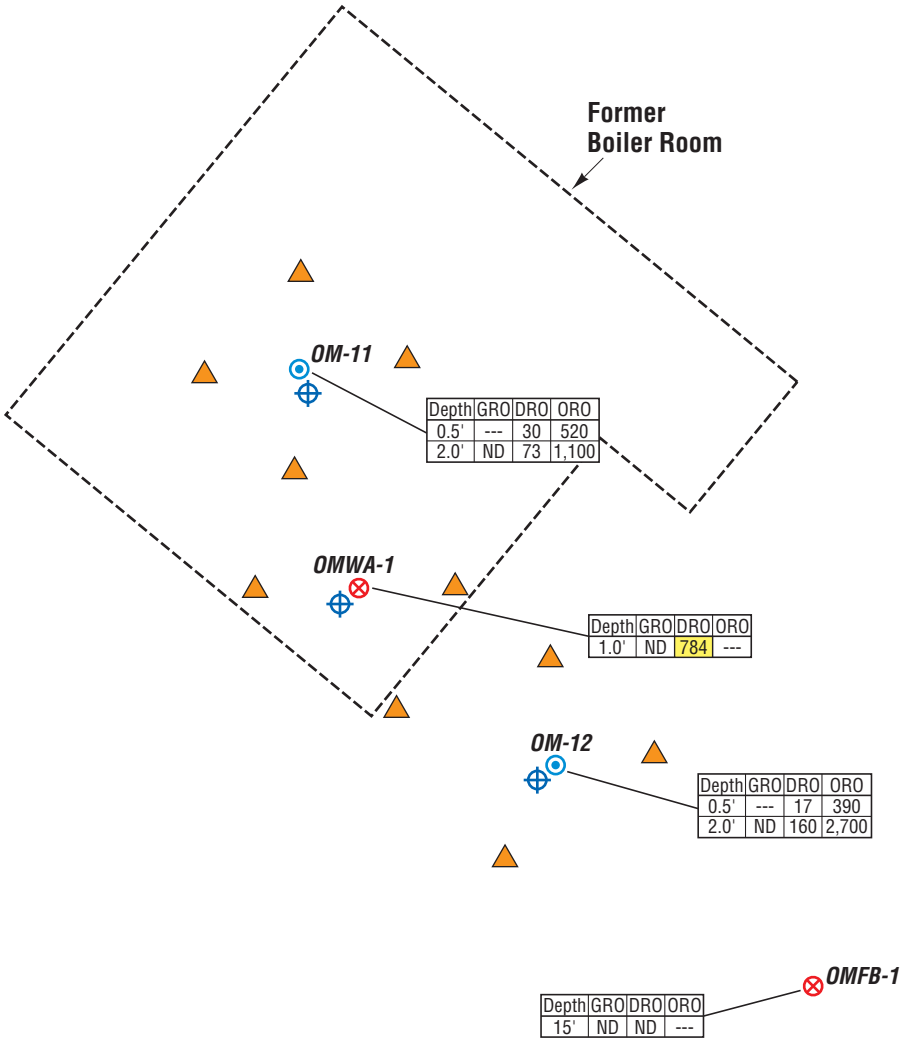
Petroleum Hydrocarbons in Soil and Groundwater – Former Dip Tank and Transfer Pit

S9717-06-01	November 2013	Figure 3-2



LEGEND:

- Approximate Boring Location (1998)
- Approximate Boring Location (2005)
- Proposed Soil and Grab Groundwater Boring to 12'
- Proposed Soil Boring to 5'
- Exceeds Proposed Project Action Levels

GRO = Gasoline Range Organics
DRO = Diesel Range Organics
ORO = Oil Range Organics
--- = Not Analyzed
ND = Not Detected
Concentrations in Milligrams per Kilogram (mg/kg)

0 20
Approx. Scale in Feet

Ref: Ecology and Environment, Inc., 2005

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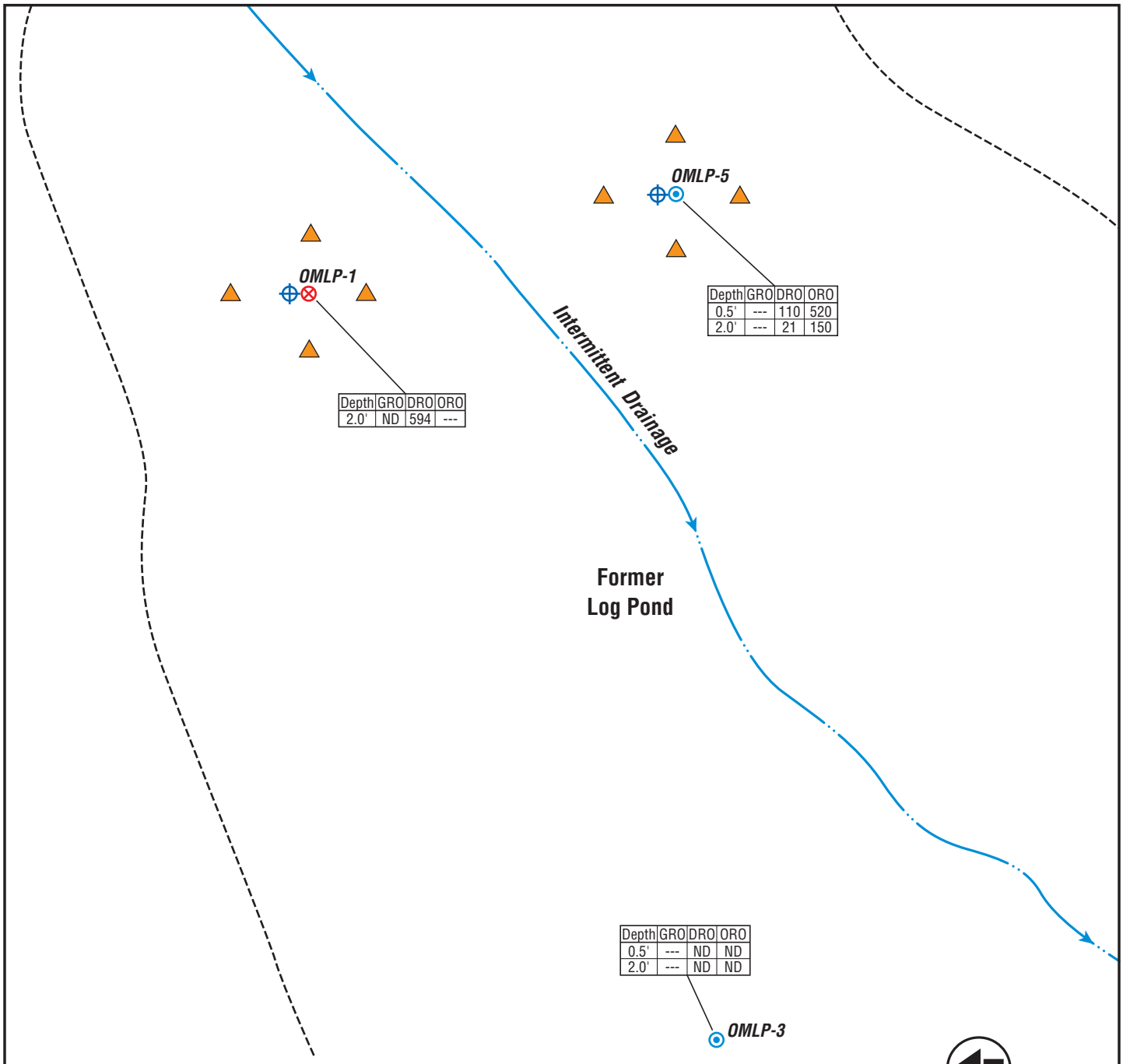
Petroleum Hydrocarbons in Soil – Former Boiler Room

S9717-06-01	November 2013	Figure 3-3



LEGEND:

- Approximate Boring Location (1998)
- Approximate Boring Location (2005)
- Proposed Soil and Grab Groundwater Boring to 12'
- Proposed Soil Boring to 5'
- Exceeds Proposed Project Action Levels

GRO = Gasoline Range Organics
DRO = Diesel Range Organics
ORO = Oil Range Organics
--- = Not Analyzed
ND = Not Detected
Concentrations in Milligrams per Kilogram (mg/kg)

Ref: Ecology and Environment, Inc., 2005

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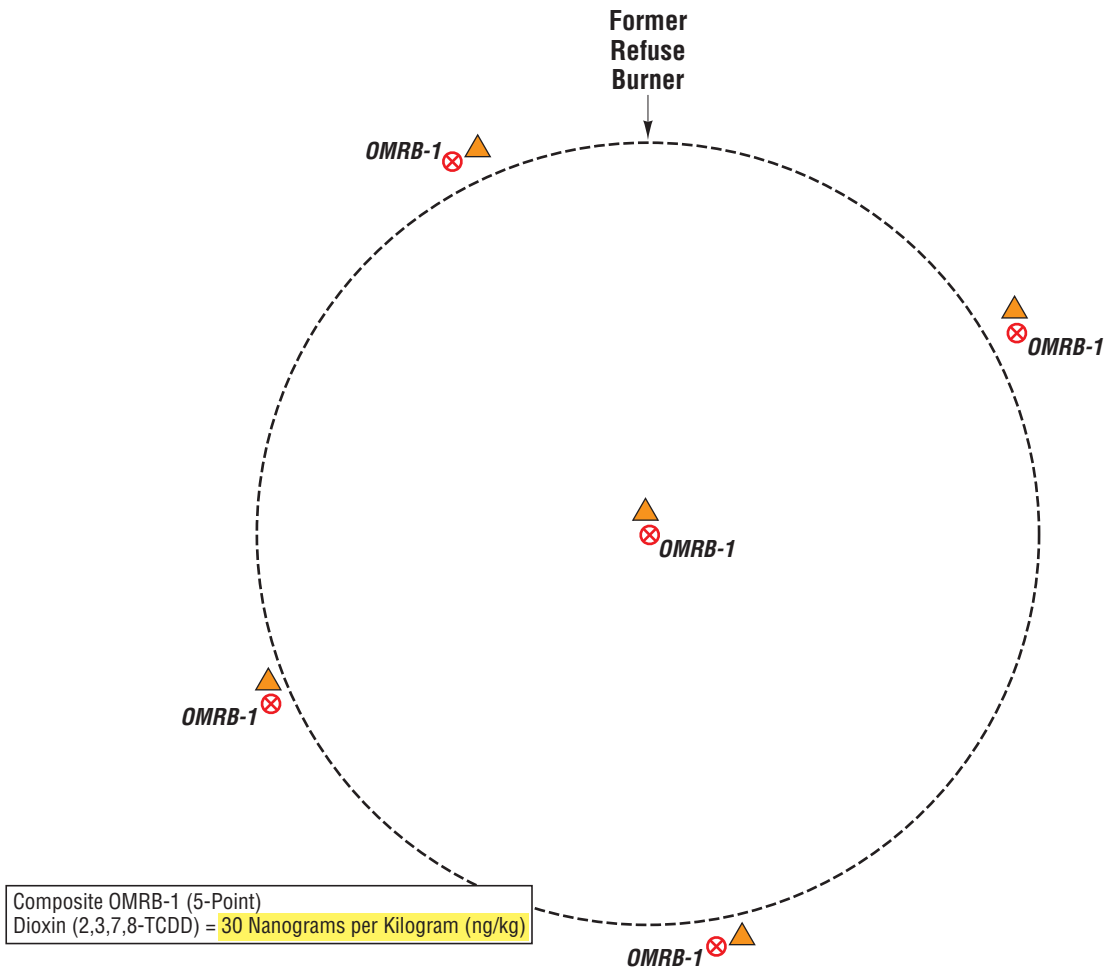
Petroleum Hydrocarbons in Soil – Former Log Pond

S9717-06-01	November 2013	Figure 3-4



0 20

Approx. Scale in Feet

LEGEND:

- Approximate Sample Location (1998)
- Proposed Soil Boring to 5'
- Exceeds Proposed Project Action Levels

Ref: Ecology and Environment, Inc., 1998

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Former Roseburg Lumber "Old Mill"

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**Dioxins / Furans in Soil –
Former Refuse Burner**

S9717-06-01	November 2013	Figure 3-5

TABLE 1
SUMMARY OF DATA QUALITY OBJECTIVES

THE LANDING – MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

Step 1 **State the Problems**	**Stakeholder:** Siskiyou County Economic Development Council **Site History:** The Site was utilized as a lumber mill from approximately 1900 to the late 1960s, when mill operations were relocated offsite to the south. Historical mill operations included the use of a dip tank for treating wood products with pentachlorophenol (PCP) and an adjacent transfer pit, a boiler room, a log pond, and refuse burner. Previous site assessment in 1998, 2005, and 2007 revealed PCP and petroleum hydrocarbons (gasoline, diesel, and oil) in soil and groundwater in the vicinity of the former dip tank and transfer pit, petroleum hydrocarbons (diesel and oil) in soil in the eastern portion of the former log pond and the boiler room, and dioxins/furans in soil in the area of the former refuse burner. In addition, elevated concentrations of beryllium and nickel were reported for a surface water sample collected from the convergence of three drainages along the western site boundary, southwest of the former log pond. **Problems:** 1. Further evaluate the extent of PCP and petroleum hydrocarbons in soil and groundwater in the vicinity of the former dip tank and transfer pit. 2. Further evaluate the extent of petroleum hydrocarbons in soil in the vicinity of the former boiler room. Evaluate the potential presence of these compounds in groundwater, which does not appear to have been conducted previously. 3. Further evaluate the extent of petroleum hydrocarbons in soil in the eastern portion of the former log pond. Evaluate the potential presence of these compounds in groundwater, which does not appear to have been conducted previously. 4. Dioxins/furans were detected in a five-point composite soil sample in 1998 collected from the area of the former refuse burner at a concentration exceeding current health risk-based screening levels. Due to sample compositing, it is currently unclear where the primary impacts are located. In addition, evaluation of metals or polycyclic aromatic hydrocarbons (PAHs), which are common constituents of concern in areas of burned materials, does not appear to have been conducted. 5. Confirm the presence of beryllium and nickel in surface water southwest of the former log pond. If an insufficient amount of surface water is present in this area, a sediment sample will be evaluated.
Step 2 **Identify the Decisions**	**Information Inputs:** 1. Agency goals and plans for the Site 2. Operational history of the Site 3. Findings of previous investigations associated with the Site 4. Regulatory agency decisions regarding the Site 5. Geological information associated with the Site 6. Potential environmental and/or human impacts of the Site 7. Observations and monitoring/screening results during field activities 8. Analytical results of soil, groundwater, and surface waste samples 9. Potential exposure scenarios and pathways for receptors of concern 10. PALs associated with the site investigation (RSLs, CHHSLs, ESLs) 11. Laboratory quality control (QC) results and overall project QC evaluations

TABLE 1
SUMMARY OF DATA QUALITY OBJECTIVES

THE LANDING – MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

Step 3 **Identify Inputs to the Decisions**	**Spatial Boundaries:** The Site's property boundaries will define the maximum lateral extent of direct-push drilling and sampling activities. First-encountered groundwater (estimated depth of 10 feet) will define the maximum vertical extent of soil sampling activities. For borings designated for grab-groundwater sampling, the borings will be extended approximately 2 feet into saturated soils. Decisions regarding the specific lateral/vertical extent of the direct-push drilling and sampling locations will be made by supervisory field personnel based on observations and monitoring/screening results during field activities and sampling analyses in the Field Sampling Plan (FSP). **Temporal Boundaries:** The temporal limits of the field activities are defined by contractual budgeted resources for the Phase II Environmental Site Assessment (ESA), which includes an estimated 5 days for field activities.
Step 4 **Define Study Boundaries**	**Decision-Making "If/Then" Statements:** **1a**: If subsurface soil encountered in the direct-push borings does not appear to be impacted by chemicals of potential concern (COPCs) at the depths outlined in the FSP (based on field observations and field monitoring/screening readings), then subsurface samples will be collected at the depths described in the FSP and analyzed for the COPCs to evaluate whether the limit of potentially hazardous subsurface soil in the boring has been defined. **1b**: If subsurface soil encountered in the direct-push borings appears to contain COPCs at depths greater than outlined in the FSP (based on field observations and field monitoring/screening readings), then recommendations will be made to the Agency to conduct additional investigation near the boring in which the COPC is encountered to greater depths to assess the vertical depth of the COPC in subsurface soil. If soil impacts appear to extend into groundwater, then recommendations will be made to evaluate groundwater for the presence of COPCs. **2a:** If analytical results for subsurface soil samples (1b above) exceed PALs (RSLs, CHHSLs, or ESLs) for respective COPCs (Table 2 in FSP), then additional investigation and sample analysis will be recommended to the Agency to characterize the lateral and vertical distribution of the COPCs in subsurface soil. **2b:** If analytical results for subsurface soil samples (1b above) are less than laboratory reporting limits, or if sample results do not exceed PALs for respective COPCs (Table 2 of the FSP), or if there is no PAL established for a detected COPC, or if the detected concentration of a Title 22 metal is within the range of published background concentrations, then no additional investigation will be recommended, and it will be concluded that the lateral and vertical distribution of COPCs in soil have been characterized. **3a:** If analytical results for groundwater and surface water samples exceed PALs (RSLs or ESLs) for respective COPCs (Table 2 in FSP), then additional investigation and sample analysis will be recommended to the Agency to characterize the lateral distribution of the COPCs. **3b:** If analytical results for groundwater and surface water samples are less than laboratory reporting limits, or if sample results do not exceed PALs for respective COPCs (Table 2 of the FSP), or if there is no PAL established for a detected COPC, or if the detected concentration of a Title 22 metal is within the range of published background concentrations, then no additional investigation will be recommended and it will be concluded that the lateral distribution has been characterized.

TABLE 1
SUMMARY OF DATA QUALITY OBJECTIVES

THE LANDING – MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

Step 5 **Develop Decision Rules**	**Baseline Assumption:** The baseline assumption, based on the results of previous investigations, is that soil, groundwater, and surface water in proximity to the former lumber mill operational areas is impacted with one or more COPCs (PCP, petroleum hydrocarbons, dioxins/furans, PAHs, and/or metals) due to former onsite operations. **Potential Baseline Deviation:** Analytical results for samples collected from areas previously documented as impacted that are less than laboratory reporting limits, or if sample results do not exceed PALs for respective COPCs, will indicate that although a historical release may have occurred, the residual impacts are currently less than significant. Concentrations of metals detected in soil and/or surface water will be compared with published background concentrations to evaluate whether concentrations are likely naturally occurring or attributable to former operations. **Decision Limitations:** The data collection design includes making observations and collecting data at specific potential source areas (i.e., the locations of operational areas where COPCs were typically used and identified through previous investigations) and is not a general area-wide characterization data collection design. Specific areas are targeted for data collection and specific decision outcomes with respect to sampling various media are defined by the decision rules in Step 5 above. Based on the previous investigations, development of an FSP, and laboratory quality control procedures, there is very low probability that a significant chemical release at the Site would go undetected. On that basis, the potential for decision error is considered very low and is acceptable.
Step 6 **Specify Tolerable Limits of decision Errors**	**Basic Data Collection Design:** Collection and analysis of samples from the former operational areas is biased based the results of previous investigations as summarized in the Background section of the FSP. Data collection at these areas is designed to further evaluate the extent of impacts and if COPCs are currently present at concentrations that could threaten human health or limit site development. Design Flexibility: If concentrations of COPCs reported in various media exceed respective PALs, then additional investigation or appropriate remediation measures will be recommended to the Agency to characterize the distribution and/or limits of potentially hazardous materials so that appropriate remediation measures can be developed before the Site is redeveloped.
Step 7 **Optimize the Sampling Design**	**Basic Data Collection Design:** Collection and analysis of samples from the former operational areas is biased based the results of previous investigations as summarized in the Background section of the FSP. Data collection at these areas is designed to further evaluate the extent of impacts and if COPCs are currently present at concentrations that could threaten human health or limit site development. Design Flexibility: If concentrations of COPCs reported in various media exceed respective PALs, then additional investigation or appropriate remediation measures will be recommended to the Agency to characterize the distribution and/or limits of potentially hazardous materials so that appropriate remediation measures can be developed before the Site is redeveloped.

TABLE 1
SUMMARY OF DATA QUALITY OBJECTIVES

THE LANDING – MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

Notes:
CHHSL = California Environmental Protection Agency, California Human Health Screening Level, Updated September 2010
COPC = constituent of potential concern
ESA = Environmental Site Assessment
ESL = Environmental Screening Levels
FSP = Field Sampling Plan
PAH = polycyclic aromatic hydrocarbons
PAL = Project Action Levels
PCP = pentachlorophenol
QC = quality control
RSL = Regional Screening Levels

TABLE 2
SUMMARY OF COPCs, LABORATORY REPORTING LIMITS, AND PROJECT ACTION LEVELS
THE LANDING – MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

Consituent of Potential Concern	Soil					Groundwater			Surface Water	
	Laboratory Reporting Limit	Residential Health Risk-Based PAL	PAL Source	Groundwater Protection Based PAL	PAL Source	Laboratory Reporting Limit [1]	Groundwater PAL	PAL Source	Surface Water PAL	PAL Source
Semi-Volaitile Organic Compounds	Soil EPA Method 8270C (mg/kg)					Groundwater EPA Method 8270C (µg/l)			Surface Water EPA Method 8270C (µg/l)	
Acenaphthene	3.3E-01	3.4E+03	ESL	1.6E+01	ESL	1.0E+01	2.0E+01	ESL	2.3E+01	ESL
Acenaphthylene	3.3E-01	--	--	1.3E+01	ESL	1.0E+01	2.0E+03	ESL	3.0E+01	ESL
Anthracene	3.3E-01	2.3E+04	ESL	2.8E+00	ESL	1.0E+01	2.2E+01	ESL	7.3E-01	ESL
Benzidine	1.6E+00	5.0E-04	RSL	2.4E-07	RSL	5.0E+01	9.2E-05	RSL	--	--
Benzo(a)anthracene	3.3E-01	3.8E-01	ESL	1.2E+01	ESL	1.0E+01	5.6E-02	ESL	2.7E-02	ESL
Benzo(b)fluoranthene	3.3E-01	3.8E-01	ESL	4.6E+01	ESL	1.0E+01	5.6E-02	ESL	5.6E-02	ESL
Benzo(k)fluoranthene	3.3E-01	3.8E-01	ESL	5.1E+00	ESL	1.0E+01	5.6E-02	ESL	3.7E+00	ESL
Benzo(a)pyrene	3.3E-01	3.8E-02	CHHSL	1.3E+02	ESL	1.0E+01	2.0E-01	Primary MCL	1.4E+00	ESL
Benzo(g,h,i)perylene	3.3E-01	--	--	2.7E+01	ESL	1.0E+01	1.3E-01	ESL	1.0E-01	ESL
Benzoic acid	1.6E+00	2.4E+05	RSL	1.4E+01	RSL	5.0E+01	--	--	--	--
Benzyl alcohol	6.6E-01	6.1E+03	RSL	3.7E-01	RSL	2.0E+01	--	--	--	--
Bis(2-chloroethoxy)methane	3.3E-01	1.8E+02	RSL	1.1E-02	RSL	1.0E+01	--	--	--	--
Bis(2-chloroethyl)ether	3.3E-01	1.1E-01	ESL	7.0E-05	ESL	1.0E+01	5.5E-03	ESL	6.1E+01	ESL
Bis(2-chloroisopropyl)ether	3.3E-01	2.1E-01	RSL	1.3E-01	ESL	1.0E+01	3.2E+02	ESL	6.1E+01	ESL
Bis(2-ethylhexyl)phthalate	3.3E-01	1.6E+02	ESL	7.8E+02	ESL	1.0E+01	4.0E+00	Primary MCL	3.2E+01	ESL
Bromophenyl phenyl ether, 4-	3.3E-01	--	--	--	--	1.0E+01	--	--	--	--
Butyl benzyl phthlate	3.3E-01	2.6E+02	RSL	2.0E-01	RSL	1.0E+01	--	--	--	--
Chloroaniline, 4-	6.6E-01	3.1E+02	ESL	5.3E-02	ESL	2.0E+01	--	--	--	--
Chloro-3-methylphenol, 4-	6.6E-01	--	--	--	--	1.0E+01	--	--	--	--
Chloronaphthalene, 2-	3.3E-01	6.3E+03	RSL	2.9E+00	RSL	1.0E+01	--	--	--	--
Chlorophenol, 2-	3.3E-01	3.9E+02	ESL	1.2E-02	ESL	1.0E+01	1.8E-01	ESL	4.4E+02	ESL
Chlorophenyl phenyl ether, 4-	3.3E-01	--	--	--	--	1.0E+01	--	--	--	--
Chrysene	3.3E-01	3.8E+00	ESL	2.8E+01	ESL	1.0E+01	5.6E-01	ESL	3.5E-01	ESL
Dibenz(a,h)anthracene	3.3E-01	1.1E-01	ESL	9.9E+00	ESL	1.0E+01	1.6E-02	ESL	7.5E+00	ESL
Dibenzofuran	3.3E-01	--	--	--	--	1.0E+01	--	--	--	--
Dichlorobenzene, 1,2-	3.3E-01	2.1E+03	ESL	1.1E+00	ESL	1.0E+01	6.0E+02	Primary MCL	1.4E+01	ESL
Dichlorobenzene, 1,3-	3.3E-01	--	--	7.4E+00	ESL	1.0E+01	5.0E+04	ESL	7.1E+01	ESL
Dichlorobenzene, 1,4-	3.3E-01	2.8E+00	ESL	5.9E-01	ESL	1.0E+01	5.0E+00	Primary MCL	1.5E+01	ESL
Dichlorobenzidine, 3,3'-	6.6E-01	5.3E-01	ESL	1.5E-02	ESL	2.0E+01	5.6E-02	ESL	2.5E+02	ESL
Dichlorophenol, 2,4-	1.6E+00	2.3E+02	ESL	3.0E-01	ESL	1.0E+01	3.0E-01	ESL	1.8E+02	ESL
Diethyl phthalate	3.3E-01	4.9E+04	ESL	3.5E-02	ESL	1.0E+01	2.9E+04	ESL	1.5E+00	ESL
Dimethylphenol, 2,4-	3.3E-01	1.6E+03	ESL	6.7E-01	ESL	1.0E+01	1.0E+02	ESL	5.3E+02	ESL
Dimethyl phthalate	3.3E-01	6.1E+05	ESL	3.5E-02	ESL	1.0E+01	5.0E+04	ESL	1.5E+00	ESL
Di-n-butyl phthalate	3.3E-01	--	--	--	--	1.0E+01	--	--	--	--

TABLE 2
SUMMARY OF COPCs, LABORATORY REPORTING LIMITS, AND PROJECT ACTION LEVELS
THE LANDING – MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

Consituent of Potential Concern	Soil					Groundwater			Surface Water	
	Laboratory Reporting Limit	Residential Health Risk-Based PAL	PAL Source	Groundwater Protection Based PAL	PAL Source	Laboratory Reporting Limit [1]	Groundwater PAL	PAL Source	Surface Water PAL	PAL Source
Dinitro-2-methylphenol, 4,6-	1.6E+00	--	--	--	--	5.0E+01	--	--	--	--
Dinitrophenol, 2,4-	1.6E+00	1.6E+02	ESL	4.2E-02	ESL	5.0E+01	7.3E+01	ESL	7.5E+01	ESL
Dinitrotoluene, 2,4-	3.3E-01	9.4E-01	ESL	7.4E-04	ESL	1.0E+01	9.9E-02	ESL	1.2E+02	ESL
Dinitrotoluene, 2,6-	3.3E-01	3.3E-01	RSL	5.8E-05	RSL	1.0E+01	--	--	--	--
Di-n-octyl phthalate	3.3E-01	--	--	--	--	1.0E+01	--	--	--	--
Diphenylhydrazine, 1,2-	3.3E-01	6.1E-01	RSL	2.2E-04	RSL	1.0E+01	--	--	--	--
Fluoranthene	3.3E-01	2.3E+03	ESL	6.0E+01	ESL	1.0E+01	1.3E+02	ESL	8.1E+00	ESL
Fluorene	3.3E-01	3.1E+03	ESL	8.9E+00	ESL	1.0E+01	9.5E+02	ESL	3.9E+00	ESL
Hexachlorobenzene	3.3E-01	3.1E-01	ESL	7.9E+02	ESL	1.0E+01	1.0E+00	Primary MCL	3.7E+00	ESL
Hexachlorobutadiene	6.6E-01	8.2E+00	ESL	4.3E+00	ESL	2.0E+01	8.6E-01	ESL	4.7E+00	ESL
Hexachlorocyclopentadiene	6.6E-01	3.7E+02	RSL	1.6E-01	RSL	1.0E+01	1.7E+00	ESL	8.0E-02	ESL
Hexachloroethane	3.3E-01	1.2E+01	ESL	5.8E+00	ESL	1.0E+01	1.7E+00	ESL	1.2E+02	ESL
Indeno(1,2,3-c,d)pyrene	3.3E-01	3.8E-01	ESL	1.5E+01	ESL	1.0E+01	5.6E-02	ESL	5.6E-02	ESL
Isophorone	3.3E-01	5.1E+02	RSL	2.2E-02	RSL	1.0E+01	--	--	--	--
Methylnaphthalene, 2-	3.3E-01	2.3E+02	ESL	2.5E-01	ESL	1.0E+01	1.0E+01	ESL	2.1E+00	ESL
Naphthalene	3.3E-01	3.1E+00	ESL	1.2E+00	ESL	1.0E+01	6.2E+00	ESL	2.4E+01	ESL
Nitroaniline, 2-	1.6E+00	6.1E+02	RSL	6.2E-02	RSL	5.0E+01	--	--	--	--
Nitroaniline, 3-	1.6E+00	--	--	--	--	5.0E+01	--	--	--	--
Nitroaniline, 4-	1.6E+00	2.4E+01	RSL	1.4E-03	RSL	2.0E+01	--	--	--	--
Nitrobenzene	3.3E-01	4.8E+00	RSL	7.9E-05	RSL	1.0E+01	--	--	--	--
Nitrophenol, 2-	3.3E-01	--	--	--	--	1.0E+01	--	--	--	--
Nitrophenol, 4-	3.3E-01	--	--	--	--	5.0E+01	--	--	--	--
Nitroso-di-N-propylamine, N-	3.3E-01	6.9E-02	RSL	7.0E-06	RSL	1.0E+01	--	--	--	--
Nitrosodimethylamine, N-	3.3E-01	2.3E-03	RSL	1.0E-07	RSL	1.0E+01	--	--	--	--
Nitrosodiphenylamine, N-	3.3E-01	9.9E+01	RSL	5.7E-02	RSL	1.0E+01	--	--	--	--
Pentachlorophenol	1.6E+00	4.4E+00	CHHSL	2.7E+06	ESL	1.0E+00	1.0E+00	Primary MCL	1.5E+01	ESL
Phenanthrene	3.3E-01	--	--	1.1E+01	ESL	1.0E+01	4.1E+02	ESL	6.3E+01	ESL
Phenol	3.3E-01	2.3E+04	ESL	7.6E-02	ESL	1.0E+01	5.0E+00	ESL	1.3E+03	ESL
Pyrene	3.3E-01	3.4E+03	ESL	8.5E+01	ESL	1.0E+01	6.8E+01	ESL	2.0E+00	ESL
Trichlorobenzene, 1,2,4-	3.3E-01	1.4E+02	ESL	1.5E+00	ESL	1.0E+01	5.0E+00	Primary MCL	2.5E+01	ESL
Trichlorophenol, 2,4,5-	3.3E-01	7.8E+03	ESL	1.8E-01	ESL	1.0E+01	2.0E+02	ESL	6.3E+01	ESL
Trichlorophenol, 2,4,6-	3.3E-01	7.8E+00	ESL	1.2E+00	ESL	1.0E+01	3.7E+00	ESL	4.9E+02	ESL
Inorganic Compounds	**Soil EPA Method 6010B/7471A (mg/kg)**					**Groundwater EPA Method 6010B/7471A (µg/l)**			**EPA Method 6010B/7471A (µg/l)**	
Antimony	2.0E+00	3.0E+01	CHHSL	2.7E-01	RSL	3.0E+00	6.0E+00	Primary MCL	3.0E+01	ESL
Arsenic	1.0E+00	7.0E-02	CHHSL	2.9E-01	RSL	1.0E+01	1.0E+01	Primary MCL	1.5E+02	ESL

TABLE 2
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THE LANDING – MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

Consituent of Potential Concern	Soil					Groundwater			Surface Water	
	Laboratory Reporting Limit	Residential Health Risk-Based PAL	PAL Source	Groundwater Protection Based PAL	PAL Source	Laboratory Reporting Limit [1]	Groundwater PAL	PAL Source	Surface Water PAL	PAL Source
Barium	1.0E+00	5.2E+03	CHHSL	8.2E+01	RSL	3.0E+00	1.0E+03	Primary MCL	1.0E+03	ESL
Beryllium	1.0E+00	1.6E+01	CHHSL	3.2E+01	RSL	3.0E+00	4.0E+00	Primary MCL	2.7E+00	ESL
Cadmium	1.0E+00	1.7E+00	CHHSL	3.8E-01	RSL	3.0E+00	5.0E+00	Primary MCL	2.5E-01	ESL
Chromium (total)	1.0E+00	1.0E+05	CHHSL	1.8E+05	RSL	3.0E+00	5.0E+01	Primary MCL	1.8E+02	ESL
Cobalt	1.0E+00	6.6E+02	CHHSL	2.1E-01	RSL	3.0E+00	1.1E+01	ESL	3.0E+00	ESL
Copper	2.0E+00	3.0E+03	CHHSL	4.6E+01	RSL	5.0E+00	1.3E+03	Primary MCL	9.0E+00	ESL
Lead	1.0E+00	8.0E+01	CHHSL	1.4E+01	RSL	5.0E+00	1.5E+01	Primary MCL	2.5E+00	ESL
Mercury	1.0E-01	1.8E+01	CHHSL	1.0E-01	RSL	2.0E-01	2.0E+00	Primary MCL	2.5E-02	ESL
Molybdenum	1.0E+00	3.8E+02	CHHSL	1.6E+00	RSL	5.0E+00	1.8E+02	ESL	2.4E+02	ESL
Nickel	1.0E+00	1.6E+03	CHHSL	2.0E+01	RSL	5.0E+00	1.0E+02	Primary MCL	5.2E+01	ESL
Selenium	1.0E+00	3.8E+02	CHHSL	2.6E-01	RSL	1.0E+01	5.0E+01	Primary MCL	5.0E+00	ESL
Silver	1.0E+00	3.8E+02	CHHSL	6.0E-01	RSL	3.0E+00	1.0E+02	ESL	3.4E-01	ESL
Thallium	1.0E+00	5.0E+00	CHHSL	1.4E-01	RSL	1.5E+01	2.0E+00	Primary MCL	2.0E+01	ESL
Vanadium	1.0E+00	5.3E+02	CHHSL	6.3E-01	RSL	3.0E+00	1.5E+01	ESL	1.9E+01	ESL
Zinc	1.0E+00	2.3E+04	CHHSL	2.9E+02	RSL	1.0E+01	5.0E+03	Primary MCL	1.2E+02	ESL
Total Petroluem Hydrocarbons	**Soil EPA Method 8015B (mg/kg)**					**Groundwater EPA Method 8015B (µg/l)**			**Surface Water EPA Method 8015B (µg/l)**	
TPH (gasoline)	1.0E+00	4.9E+02	ESL	5.8E+02	ESL	5.0E+01	1.0E+02	ESL	5.0E+02	ESL
TPH (middle distillates)	1.0E+00	2.4E+02	ESL	5.3E+02	ESL	5.0E+01	1.0E+02	ESL	6.4E+02	ESL
TPH (residual fuels)	1.0E+00	1.0E+04	ESL	--	ESL	5.0E+01	1.0E+02	ESL	6.4E+02	ESL
Polycyclic Aromatic Hydrocarbons	**Soil EPA Method 8310 (mg/kg)**					**Groundwater EPA Method 8310 (µg/l)**			**Surface Water EPA Method 8310 (µg/l)**	
Acenaphthene	1.0E-02	3.40E+03	ESL	1.6E+01	ESL	2.0E-01	2.0E+01	ESL	2.3E+01	ESL
Acenaphthylene	1.0E-02	--	--	1.3E+01	ESL	2.0E-01	2.0E+03	ESL	3.0E+01	ESL
Anthracene	1.0E-02	2.3E+04	ESL	2.8E+00	ESL	2.0E-01	2.2E+01	ESL	7.3E-01	ESL
Benzo(a)anthracene	1.0E-02	3.8E-01	ESL	1.2E+01	ESL	2.0E-01	5.6E-02	ESL	2.7E-02	ESL
Benzo(a)pyrene	1.0E-02	3.8E-02	CHHSL	1.3E+02	ESL	2.0E-01	2.0E-01	Primary MCL	1.4E+00	ESL
Benzo(b)fluoranthene	1.0E-02	3.8E-01	ESL	4.6E+01	ESL	2.0E-01	5.6E-02	ESL	5.6E-02	ESL
Benzo(g,h,i)perylene	1.0E-02	--	--	2.7E+01	ESL	2.0E-01	1.3E-01	ESL	1.0E-01	ESL
Benzo(k)fluoranthene	1.0E-02	3.8E-01	ESL	5.1E+00	ESL	2.0E-01	5.6E-02	ESL	3.7E+00	ESL
Chrysene	1.0E-02	3.8E+00	ESL	2.8E+01	ESL	2.0E-01	5.6E-01	ESL	3.5E-01	ESL
Dibenz(a,h)anthracene	1.0E-02	1.1E-01	ESL	9.9E+00	ESL	2.0E-01	1.6E-02	ESL	7.5E+00	ESL
Fluoranthene	1.0E-02	2.3E+03	ESL	6.0E+01	ESL	2.0E-01	1.3E+02	ESL	8.1E+00	ESL
Fluorene	1.0E-02	3.1E+03	ESL	8.9E+00	ESL	2.0E-01	9.5E+02	ESL	3.9E+00	ESL
Indeno(1,2,3-c,d)pyrene	1.0E-02	3.8E-01	ESL	1.5E+01	ESL	2.0E-01	5.6E-02	ESL	5.6E-02	ESL
Naphthalene	1.0E-02	3.1E+00	ESL	1.2E+00	ESL	2.0E-01	6.2E+00	ESL	2.4E+01	ESL

TABLE 2
SUMMARY OF COPCs, LABORATORY REPORTING LIMITS, AND PROJECT ACTION LEVELS
THE LANDING – MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

Consituent of Potential Concern	Soil					Groundwater			Surface Water	
	Laboratory Reporting Limit	Residential Health Risk-Based PAL	PAL Source	Groundwater Protection Based PAL	PAL Source	Laboratory Reporting Limit [1]	Groundwater PAL	PAL Source	Surface Water PAL	PAL Source
Phenanthrene	1.0E-02	--	--	1.1E+01	ESL	2.0E-01	4.1E+02	ESL	6.3E+01	ESL
Pyrene	1.0E-02	3.4E+03	ESL	8.5E+01	ESL	2.0E-01	6.8E+01	ESL	2.0E+00	ESL
Dioxins and Furans	**Soil EPA Method 8290 (mg/kg)**					**Groundwater EPA Method 8290 (µg/l)**			**Surface Water EPA Method 8290 (µg/l)**	
2,3,7,8-tetrachloro-p-dibenzo-dioxin (2,3,7,8 TCDD)	1.0E-06	4.6E-06	CHHSL	2.6E-07	RSL	1.0E-05	3.0E-05	Primary MCL	5.0E-06	ESL

Notes:
1 - The laboratory reporting limit for groundwater and surface water samples is identical
mg/kg - milligrams per liter
µg/l - micrograms per liter
CHHSL - California Environmental Protection Agency, California Human Health Screening Level, Updated September 2010
ESL - San Francisco Bay Regional Water Quality Control Board, Environmental Screening Level, Updated May 2013
MCL - California Code of Regulations, Title 22, Division 4, Chapter 15, Maxiumum Contaminant Level
PAL - Project Action Level
RSL - U.S. Environmental Protection Agency, Regional Screening Level, Updated May 2013.

TABLE 3
SUMMARY OF SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS

THE LANDING – MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

Analytes	Analytical Method[1]	Sample Containers[1]	Preservation[1]	Holding Time[1]
Soil and Sediment Samples				
Total petroleum hydrocarbons as gasoline, diesel, and oil	EPA 8015B	One 100 gram acetate tube sealed with Teflon and plastic caps or 8 oz glass jar per sample location	Cool 4°C (+/- 2°C)	14 days for gasoline, 14/40 for diesel and oil
SVOCs	EPA 8270C	One 100 gram acetate tube sealed with Teflon and plastic caps or 4 oz glass jar per sample location		14/40 days
PAHs	EPA 8310	One 100 gram acetate tube sealed with Teflon and plastic caps or 4 oz glass jar per sample location		14/40 days
Title 22 Metals	EPA 6010B/7471	One 100 gram acetate tube sealed with Teflon and plastic caps or 4 oz glass jar per sample location		28 days for mercury, 6 months for all other elements
Dioxins/Furans	EPA 8290	8 oz glass jar per sample location		30 days
Groundwater and Surface Water Samples				
Total petroleum hydrocarbons as gasoline	EPA 8015B	3 glass VOAs	Cool 4°C (+/-2°C), HCL	14 days
Total petroleum hydrocarbons as diesel and oil	EPA 8015B	1 L glass amber bottle	Cool 4°C (+/- 2°C)	7/40 days
SVOCs	EPA 8270C	1 L glass amber bottle	Cool 4°C (+/- 2°C)	7/40 days
Title 22 Metals	EPA 6010B/7470	500 mL poly bottle	Cool 4°C (+/- 2°C), HNO_3	28 days for mercury, 6 months for all other elements

Notes:
EPA = U.S. Environmental Protection Agency
PAHs = Polycyclic aromatic hydrocarbons
SVOCs = Semi-volatile organic compounds
NA = Not applicable
7/40 days = 7 days for extraction, 40 days for analysis following extraction
14/40 days = 14 days for extraction, 40 days for analysis following extraction
1 = Based on information from Advanced Technology laboratories, Inc. Laboratory Quality Assurance Program Plan

TABLE 4
SAMPLING COLLECTION AND ANALYIS MATRIX

THE LANDING – MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

Investigation Area	No. of Borings	Sample Depths (in feet)	GRO EPA 8015B	DRO and ORO EPA 8015B	SVOCs EPA 8270C	PAHs EPA 8310	Dioxins/Furans EPA 8290	Title 22 Metals EPA 6010B/7471A
Former Dip Tank and Transfer Pit	9 – Soil Only 14 – Soil and GW	1, 2, and 5 to 8* ~10 for GW	3 – Soil 1 – GW	36 (3) – Soil 8 (1) – GW	51 (5) – Soil 12 (1) – GW	---	---	---
Former Boiler Room	10 – Soil Only 3 – Soil and GW	1, 2, and 5 ~10 for GW	---	39 (4) – Soil 3 – GW	---	---	---	---
Former Log Pond	8 – Soil Only 2 – Soil and GW	1, 2, and 5 ~10 for GW	---	30 (3) – Soil 2 (1) – GW	---	---	---	---
Former Refuse Burner	5 – Soil Only	1	---	---	---	5	5	5
Drainages Southwest of Log Pond	---	1 surface water grab sample or sediment sample	---	---	---	---	---	2 (1)
Background Samples	---	1 surface water grab sample	---	---	---	---	---	1
Equipment Blanks	---	---	1	5	5	1	---	1

Notes:
GRO = Gasoline-range organics
DRO = Diesel-range organics
ORO = Oil-range organics
SVOCs = Semi-volatile organic compounds
PAHs = Polycyclic aromatic hydrocarbons
EPA = U.S. Environmental Protection Agency
GW = Groundwater
(3) = Duplicate samples
* = Where previous analytical data suggests impacts at depths greater than 5 feet, soil samples will be collected from nearby borings at depths up to 8 feet

APPENDIX A

GEOCON
CONSULTANTS, INC.

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

HEALTH AND SAFETY PLAN

PHASE II ENVIRONMENTAL SITE ASSESSMENT

FORMER ROSEBURG LUMBER
"OLD MILL" ASSESSMENT PROJECT
MT. SHASTA, CALIFORNIA

PREPARED FOR
SISKIYOU COUNTY ECONOMIC DEVELOPMENT COUNCIL
1512 S. OREGON STREET
YREKA, CALIFORNIA 96097

PREPARED BY

GEOCON CONSULTANTS, INC.
3160 GOLD VALLEY DRIVE, SUITE 800
RANCHO CORDOVA, CALIFORNIA 95742

PROJECT NO. S9717-06-01

OCTOBER 2013

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HEALTH AND SAFETY PLAN Page

HEALTH AND SAFETY PLAN SUMMARY

Site Name: **Former Roseburg Lumber, "Old Mill" Assessment Project, Mt. Shasta, California**

Site Location/Address: **South Mt. Shasta Blvd. and Loveta Lane, Mt. Shasta City, California**

Project Representatives:

• Project Manager/Cell No.:	**Matt Lesh**	**619.818.0216**
	Geocon Office No.:	**916.852.9118**
• Site Safety Officer/Cell No.:	**Mike O'Brien**	**530.383.1361**
• Geocon Consulting CIH:	**Doug Krause**	**530.758.6397**
	Cell No.:	**530.848.9232**
• Client Project Manager:	**Matt Chesler (Siskiyou)**	**530.684.4234**

Scope:

- General survey activities (non-intrusive)
- Soil sampling (direct-push)

Hazard Summary:

- Mechanical - material handling, slip/trip, struck-by injuries
- Noise – heavy equipment & road traffic
- Underground & Overhead Utilities
- Biological –poison oak, biting insects (vectors) or animals
- Thermal Extremes – heat stress/strain
- Chemical – T22 (CAM 17) Metals, pentachlorophenol, dioxin & petroleum hydrocarbons

Control Summary:

- Site Control & PPE - traffic control/safety vests/hard hats/safety glasses/steel-toed footwear
- Hearing Protection – plugs or muffs
- Isolation & Site Inspection - utility location-identification
- Site inspection/awareness, appropriate dress (long pants), repellent, wasp spray
- Appropriate dress, rest/work cycle; fluids
- Engineering Controls/Isolation/PPE - wet methods to suppress airborne dust & safe work & sampling practices, protective gloves

Hospital Reference: Mercy Medical Center
914 Pine Street, Mt. Shasta, California
530.926.6111

Directions: From the Site, proceed north on Mt. Shasta Blvd for 1 mile. Turn left onto W Lake Street. Take the 2nd right onto Pine Street. Proceed 0.6 mile and hospital will be on the right (see Vicinity Map, Figure 1).

Emergency Assistance:

Fire/Police/Medical Assistance:	**911**
Poison Control:	**(800) 523-2222 (San Francisco)**

1.0 INTRODUCTION

This Health and Safety Plan (HSP) is a compilation of health and safety guidelines, policies and/or performance protocols that, when exercised, are intended to reduce or eliminate the potential for injury and exposure during the performance of the activities at the site described below. Conformance with its contents does not warrant that injuries or exposures will not occur.

This HSP is not a training tool and does not contain the degree of detail necessary to train an employee on the appropriate performance, approach and/or equipment-use protocols referenced, herein. Persons working on this project and referring to this HSP shall meet the minimum training requirements described in Section 2.2.

This HSP has been prepared to specifically support the field activities described herein. The provisions described herein apply to employees of Geocon Consultants, Inc. and its subcontractors, only. Representatives of the Client, Client-retained subcontractors, and representatives of state or local government agencies are expected to observe the safety rules and requirements established by their respective organizations, provided they do not conflict with this HSP. However, Geocon will not be responsible for enforcing the conditions of this HSP on these representatives.

The contents of this HSP are based on factors and conditions understood prior to the start of the field activities. If those factors and conditions change during the performance of the activities, including the service scope, or if conditions exist that were not considered in the preparation of this HSP, then such shall be brought to the immediate attention of the person approving this HSP, and the HSP shall be modified, accordingly

All project personnel, including City of Visalia (City) personnel, will review and become familiar with the elements of the Plan prior to site work. A copy of the Plan will be provided to all subcontractors and the City's Project Manager or designees involved with project activities.

A pre-job conference will be held to delineate roles and responsibilities, discuss key elements of the Plan, and coordinate activities. This Plan is a "working document" to be used by affected personnel. The Plan may be modified at any time in accordance with Section 1.4 to adequately address changing conditions or previously unrecognized exposure hazards which may be encountered during the project. An updated, current copy of the Plan will be maintained at the project site during and be available to all affected personnel.

This Plan expires 6 months from the date of CIH approval unless updated or amended; ref. T8 CCR §1532.1(e)(2)(E) "Written programs shall be revised and updated at least every 6 months…"

1.1 Project Location

Site Location/Address: South Mt. Shasta Blvd. and Loveta Lane, Mt. Shasta City, California

1.2 Project Description

The Site currently consists of approximately 20 acres of vacant land to the west of South Mt. Shasta Boulevard. Lumber mill operations were reportedly conducted by several parties (most recently Roseburg Forest Products) at the Site from 1900 until the late 1960's when operations were relocated offsite to the south. Mill operations included use of a dip tank, where lumber was treated with pentachlorophenol (PCP) and placed into an adjacent transfer pit, a boiler room, refuse burner, and a log pond. An unnamed intermittent stream that originates offsite to the east enters the Site through a culvert beneath South Mt. Shasta Boulevard, flows through the former log pond area towards the west, and exits the pond through a culvert at the western limit of the pond. During a recent site visit, we observed water flowing in the stream and shallow standing water in the central portion of the former log pond.

Several phases of investigation have been conducted at the Site including Brownfields Targeted Site Assessments by Ecology and Environment (E&E) in 1998 and 2005, and a Targeted Site Investigation by URS in 2007. The results of these investigations indicate that the following areas of the Site warrant further investigation:

- **Former dip tank and transfer pit area** - PCP and petroleum hydrocarbons (primarily diesel and oil) were detected in shallow soil and groundwater samples collected in this area, but the lateral and vertical extent of impacts was not defined. It should be noted that during a recent site visit we observed moderate to heavy vegetation growth in the area of these two features that will require thinning and/or removal prior to additional investigation.
- **Former boiler and eastern portion of the former log pond** - Diesel and oil were detected in samples collected from shallow soil in this area, but the lateral and vertical extent of impacts were not defined. In addition to the undefined extent of soil impacts, it does not appear that an evaluation of groundwater has been previously conducted in these areas.
- **Former refuse burner** - Dioxin/furans were detected in shallow soil samples in this area, but the lateral and vertical extent of impacts were not defined. Previous investigation included collection and analysis of a five-point composite sample by E&E in 1998 in the area of this feature. Dioxin/furans were detected in the sample at a concentration exceeding current health risk-based screening levels. However, due to sample compositing, it is currently unclear where the primary impacts are located.

  In addition to the unknown extent of dioxin/furans, we did not find reference to previous evaluation of metals or polycyclic aromatic hydrocarbons (PAHs), which are common constituents of concern in areas of burned materials.

Convergence of three onsite drainages southwest of the log pond - Elevated concentrations of beryllium and nickel were detected in a surface water sample collected from this area by E&E in 2005. It should be noted that this sample was collected in March 2005 during a period of high rainfall. During a recent site visit, we observed only a shallow pond of stagnant water in the area of this sample.

1.3 Project Objectives

The purpose of the Phase II ESA is to further evaluate the extent of hazardous substance and petroleum impacts at the Site, related to the historical use of the site as a lumber mill, identified during previous investigations by others. We understand the results of the Phase II ESA will be used as part of mitigation planning prior to the planned conversion of the Site to a community park. The conversion of the Site is currently in the conceptual stage and formal design parameters have not yet been developed.

1.4 Planned Scope of Services

- Soil sampling – direct-push

1.5 Schedule

Anticipated Period of Performance: September 2013
Anticipated Weather/Temperature: Weather conditions are expected to be moderate to possibly hot.

2.0 ADMINISTRATIVE REQUIREMENTS/CONTROLS

2.1 Personnel

Personnel responsible for project safety include the Project Manager, the Site Safety Officer, the Geocon Certified Industrial Hygiene (CIH) consultant, and participating project personnel.

2.1.1 Project Manager

The Project Manager is responsible for development, or assigning development of the Health and Safety Plan (HSP), and auditing compliance with the provisions of this HSP. The Project Manager is also responsible for ensuring the HSP is reviewed and approved by the Site Safety Officer and for distributing the Plan to the client and authorized representative of each project subcontractor. In addition, the Project Manager is responsible for:

- Reviewing the HSP requirements (if prepared by another project member);
- Designating/identifying a qualified project member as the SSO;
- Providing the safety equipment specified herein;
- Collecting and submitting the requisite health and safety documentation (training rosters/certificates, air monitoring records (exposure assessments); site personnel logs, medical approvals), and copying them to the SSO, if appropriate; and,

  Note: Air monitoring and exposure assessment records will be maintained in accordance with the provisions of T8 CCR §3204, Access to Employee Exposure and Medical Records as well as requirements in T8 CCR §§5214 – Inorganic Arsenic, 1532 – Cadmium, 1532.1 – Lead and 1532.2 – Chromium VI.
- Reporting all Plan amendments to the Consulting CIH.

2.1.2 Site Safety Officer

The designated SSO has ultim ate authority and responsibility for project health and safety, including approval and im plementation of this Health and Safety Plan any applicable addenda. Accordingly, he/she has authority to: suspend project activities or modify service practices for health and safety reasons; and, to dism iss from a project site subcont ractors or individuals whose onsite conduct either endangers the health and/or safety of others or is judged not to comply with the provisions of this Plan. Implementation of the Plan includes:

- Presenting an overview of the provisions of the HSP with project participants;
- Enforcing the provisions of this HSP;
- Maintaining project safety equipment supplies;
- Performing air monitoring, if and as specified herein (ref: T8 CCR §§5214(e) Arsenic Exposure Monitoring, 1532 (d) Cadmium Exposure Monitoring, 1532.1(d) Lead Exposure Assessment, and 1532.2(d) Chromium VI Exposure Determination);
- Directing decontamination procedures, as appropriate;
- Setting up Site Controls, if and as specified herein;
- Directing emergency response operations until public emergency personnel arrive; and,
- Reporting all incidents and infractions to the Project Manager.

The SSO has the authority to suspend project activ ities any time he/she determines that the provisions of the HSP are inadequate to provide a service/project environment conducive to employee safety. Further, the SSO is to inform the Project Manage r of any individuals whose onsite actions jeopardize either their health and safety or the health and safety of others.

2.1.3 Consulting Certified Industrial Hygienist

The Consulting CIH provides industrial hy giene and safety technical support to the Project Manager and Site Safety Officer (SSO). In this capacity, s/he:

- Reviews and approves this Plan when ready for implementation;
- Provides training, as requested;
- Approves or recommends airborne sampling strategies and monitoring equipment;
- Provides technical support for the selection and use of Personal Protective Equipment (PPE); and,
- Provides arbitration on project health and safety issues.

2.1.4 Project Field Staff

All project personnel are responsible for:

- Complying with the provisions of this HSP;
- Performing services in a manner that is consistent with good health and safety practice; and
- Reading and being knowledgeable of the contents of this HSP.

2.2 Personnel Training

2.2.1 General Site Employees

Site employees will attend a project orientation prior to starting the project. The orientation will review all elements of the HSP, including: 1) the location of potential health and safety hazards on the site and 2) requirements of the HSP. The training will also address other Cal/OSHA requirements such as the Geocon Hazard Communication Program (T8 CCR §5194), including the potential hazards of exposure to T22 metals (T8 CCR §§5214 Arsenic, 1532 Cadmium, 1532.1 Lead, 1532.2 Chromium VI), pentachlorophenol, dioxin, and TPHg, TPHd, SVOCs, and the Injury and Illness Prevention Program (T8 CCR §§3203 and 1509).

Anticipated characterization tasks to be performed under this HSP are considered Hazardous Waste Operations as defined by T8 CCR §5192 "Hazardous Waste Operations and Emergency Response." All project personnel will have successfully completed all applicable training requirements outlined in T8 CCR §5192(e), "Training" (40-hour Certificate and current annual Refresher Training).

2.2.2 Supervisors and Managers

Geocon employees whose responsibilities include onsite supervising or managing project tasks as defined under T8 CCR §5192(e)(4) shall hold a Supervisor Certificate documenting at least eight additional hours of specialized hazardous waste operations management training.

2.2.3 "Tailgate" Meetings

During the active field components of the project, the Project Manager or designee will conduct regular (i.e., weekly or daily, as appropriate) "tailgate" safety meetings. This meeting will include information on the following subjects, as applicable:

- Changes to project scope;
- Recognized changes to site conditions;
- Review of safe work practices;
- On or off the project safety practices;
- Feedback from employees on hazards, safety suggestions, or concerns; and
- Recognition for compliance, good safety performance or attitude.

Attendance at the tailgate meetings is considered a part of each employee's job responsibilities.

2.3 Medical Surveillance

Based on Negative Exposure Assessments from industrial hygiene monitoring for inorganic lead performed for representative sampling tasks using similar controls, which is representative of potential exposure risks to other toxic metals and dioxin, and carried out within the past twelve months (ref. T8 CCR § 1532.1(d)), medical surveillance is not mandated for these tasks nor is respiratory protective equipment required for this project.

Therefore, additional exposure assessments are not justified and Medical Surveillance as specified under either T8 CCR §§5192 or 1532.1 is not required for personnel assigned for this project.

Geocon and subcontractor employees required to wear respiratory protection shall have a current medical evaluation and approval by a physician or other licensed health care professional (PLHCP). Medical evaluations will be provided in accordance with the Geocon Respiratory Protective Equipment Program (ref. T8 CCR §5144(e) "Medical Evaluation").

Project personnel are to arrive at the jobsite well rested and physically prepared to perform assigned tasks.

3.0 HAZARD AND CONTROL ANALYSIS

The following hazards were assessed to either exist, or have the potential to develop, during the performance of the project activities:

	HAZARDS							
TASKS	MECHANICAL	UNDERGROUND/OVER-HEAD UTILITIES	NOISE	BIOLOGICAL	RADIOLOGICAL	THERMAL	CHEMICAL	OTHER
Work-related driving	**X**							
General non-intrusive activities	**X**	**X**		**X**		**X**	**X**	
Soil Sampling (direct-push)	**X**	**X**	**X**	**X**		**X**	**X**	

3.1 Safe Driving

Hundreds of workers are injured or die in job-related motor vehicle accidents annually. Motor vehicle accidents are one of the number-one causes of employee injuries and deaths. Most accidents can be avoided by practicing defensive driving. Geocon policies mandate that employees:

- Prepare themselves and their vehicle for the road before travel;
- Drive according to posted speed limits unless adverse conditions necessitate slower speeds;
- Never tailgate, employ the three (3) second rule in following vehicles;
- Fully comply with California Vehicle Code and other local laws and regulations regarding the use of cellular phones for communication while driving - talking on a cell phone and/or texting while driving is not only a significant hazard to yourself and others, but also violates Geocon H&S policy; and,
- Use practical driving procedures in cities, on the freeway, and in rural areas.

3.2 Mechanical Hazards

Type(s)/Source:

- Material Handling/Back Injury
- Striking (slips, trips); and
- Struck-by injuries (vehicle traffic)

Qualified Exposure Risk: Moderate

Hazard Control(s):

- Safe Lifting
- Isolation (lane/shoulder closure traffic control/work methods/no work during inclement weather or darkness)
- PPE – ANSI approved yellow-green or orange reflective safety vests; hard hats; safety-toe shoe or boot; safety glasses

3.2.1 Material Handling/Back Injury

Hazard: It is expected that field personnel may be required to lift heavy equipment and supplies and/or perform arduous tasks during this project. Accordingly, back injuries or physical strain may be caused by: routine lifting or one-time-only lifting; the weight of a lifted object; the frequency of lifting; bending, twisting, or rotating during lifting; prolonged sitting; exposure to vibrations; poor arch support in shoes; and, not stretching prior to physical activity. If the following "control" mechanisms are not exercised, debilitating back injury may occur.

Control(s): Before attempting to lift and carry an object, always test its weight first. If it is too heavy, get help. If possible, use mechanical lifting aids. If manageable, the proper method for lifting is:

- Get a good footing;
- Place feet about shoulder width apart;
- Bend knees to pick up load. Never bend from the waist;
- Keep back straight;
- Get a firm hold. Grasp opposite corners of the load, if possible;
- Keep the back as upright as possible;
- Lift gradually by straightening the legs - don't jerk the load;
- Keep the weight as close to the body as possible; and
- When changing directions, turn the entire body, including the feet. Don't twist the body.

If devices are used for handling materials manually (e.g., two-handed lifters, barrel ring clamps, hand trucks, wheelbarrows, etc.), wear protective equipment like gloves and safety shoes to minimize the potential of appendages becoming pinched or smashed between the load and stationary features. Also, avoid overloading the device.

3.2.2 "Striking" Injuries

Hazard: Injuries can, and often, result when a person (a kinetic mass) unexpectedly instigates contact with another kinetic mass. These occurrences typically result from inadvertent slips, trips and falls.

Control(s): To minimize risks of "slip/trip" hazards, personnel shall maintain a constant program of good housekeeping, keeping areas clear of trip hazards and wet and slippery surfaces. All hand tools shall be regularly secured and care shall be taken when entering areas where work is being performed above eye level.

3.2.3 "Struck-by" Injuries

Hazard: Injuries can, and often, result when one becomes an unexpected receptor of contact with a moving vehicle, heavy equipment or another kinetic mass. These occurrences typically result from the worker being struck by a dropped or collapsed mass or a moving piece of equipment or vehicle. Hazards with machines and heavy equipment are created when there is rotating, reciprocating, and transverse motions, or cutting, punching, shearing and bending actions.

When working nears streets engage the vehicle's warning light bar whenever planning to pull off or exit. When stopped or parked on road sides, continue use of the light bar. Employees/workers shall not exit the vehicle until they have successfully pulled off of the pavement. In those instances where it is not possible to clear the shoulder, workers shall exit the vehicle on the side opposite the adjacent traffic flow. Geocon employees will be required to wear hard hats and fluorescent vests and place safety

cones at 10-yard intervals for a minimum of 30 yards (if achievable) from the left rear corner of the vehicle so they may be seen by adjacent traffic.

Workers shall maintain a constant awareness of traffic patterns/conditions throughout the duration of the field services.

3.3 Underground & Overhead Utility Hazards

Type(s)/Source:	Underground – electrical, gas, sewer, communications cables Overhead – electrical and communications cables
Qualified Exposure Risk:	Moderate – Excavation and backfill activities

3.3.1 Underground Utilities

Hazards: Contact with electrical current can cause shock, electrical burns, and/or be instantly fatal. If a drill rig or hand-auger makes contact with electrical wires, it will not be insulated from the ground. The human body, if it simultaneously comes in contact with the auger and the ground, will provide a conductor of the electricity to the ground.

Control(s): Demarcate all drilling/digging locations, first. Contact Underground Service Alert (USA) (1-800-227-2600) and review as-built plans before performing any augering activity. It is advised that a private utility locator be contacted to supplement USA's demarcations, especially when the project is on private property. Soil intrusive work shall not proceed until all locating activities have been completed and fully documented in the site records. The initial site safety orientation meeting for all personnel onsite shall include a review of the underground utility locations and the location of the site map, showing the position of any underground utility lines. The site safety orientation shall include a site walkover of each marked utility or line.

Should a sub-surface condition be encountered that creates suspicion that there may be an unidentified underground line or utility, immediately cease work and secure the equipment. Work will not proceed until the potential risk or condition is resolved.

3.3.2 Overhead Utilities

Hazards: See 3.3.1

Controls: Prior to site work involving extended reach with the backhoe boom, or lifting operations a site inspection will be conducted to identify potential overhead hazards such as power or communication lines. A clearance of at least 10 feet will be maintained between overhead power lines and equipment booms (and hoists).

3.4 Noise Hazards

Excavation equipment may present a noise hazard to employees. In all cases where the sound pressure levels may exceed a time-weighted average noise dose of 85 decibels (the Action Level), the Site Safety Officer will evaluate exposures according to the Geocon Hearing Conservation Program (ref. T8 CCR §§5095-5100). Selection of hearing protection will be made in accordance with the Geocon Safety Equipment Guide. Only hearing protectors (ear plugs or muffs) with a Noise Reduction Rating of 20 dB, or higher, will be used. When worn, ear muffs will be donned in the "over the head" position with the hair pulled back from the sealing surface.

Note: In general, noise levels in excess of 85 dBA interfere with communication between two individuals speaking in a normal tone of voice at a distance of 3 feet from one another.

3.5 Biological Hazards

Type(s)/Source: Poison oak, biting-stinging vectors (mosquitoes, ticks, bees, wasps) and animals.

Qualified Exposure Risk: Low to Moderate

Hazard Control(s):

- Isolation (Attention to detail – avoidance)
- PPE (Gloves/boots/long-sleeve shirts)
- Wear long-sleeve shirts, long pants, and high top stockings
- Repellent, wasp spray, pepper spray

Hazard: Contact with plants, insects, and animals likely to be present at the site should be avoided. Plants (such as poison oak or ivy) can cause an allergic reaction and skin rash in some individuals. Stinging and biting insects, including bees, spiders, and ticks, can cause extreme discomfort and/or serious allergic responses. Insect bites are generally not dangerous, unless they are from a poisonous insect or mosquitoes potentially carrying West Nile virus.

The primary concern with animal bites and scratches is the potential for infection and/or rabies. Snake or scorpion bites can also be dangerous, but more from infection or trauma than the toxins injected by the snake or scorpion.

Control(s): Avoid conducting site activities from dusk to dawn when the risk of encountering biting mosquitoes is higher. Before beginning fieldwork each day, inspect the work area for the presence of standing water, poisonous plants and inhabitant reptiles and take measures necessary to minimize the potential for contact. Specially prepared topical barriers, such as Teknu®, for protection against poison oak, and insect repellent containing approximately 50% DEET for protecting exposed skin from biting insects are commercially available and may minimize the potential for development of skin rashes

and/or irritations due to such exposures. Apply insect repellent sparingly to exposed skin. Note: Avoid contacting plastic zippers or other plastic closure mechanisms on clothing, equipment bags, etc., with DEET containing crème which will cause these materials to degrade.

If you are allergic to bee or wasp stings, be sure to have the appropriate first aid available (e.g., an epi-pen) on the project. If you are stung, administer first aid and seek immediate medical attention.

Be sure a vector or animal bite victim obtains medical attention quickly if a bite or scratch occurs, especially if there is a potential that it was poisonous. In the meantime, administer First Aid by scrubbing the wound with soap and water, and rinsing thoroughly under running water. Dry off and place a clean bandage on the wound. Victims of these bites should lie down and remain calm and motionless; cold packs should be applied and medical attention sought immediately.

If bitten by a tick, remove it by grasping the head close to the skin using fine point tweezers and gently pull it out; DO NOT squeeze the tick body, which may cause it to bite harder and possible inject infected blood into the wound. Place the tick in a plastic bag for identification. If it is identified as a deer tick, a physician may prescribe antibiotics to suppress potential Lyme disease.

3.6 Thermal Hazards – Heat Stress and Heat Strain

Type(s)/Source: Solar load – working outdoors in summer months

Qualified Exposure Risk: Moderate to high

Primary "Control": Compliance with T8 CCR §3395 Heat Illness Prevention
Dress appropriately for the expected weather conditions.

Hazard: In addition to the chemical, physical and operational hazards referenced above, heat stress may present a potential hazard to onsite personnel during the on-site operations. This hazard can be created when individuals work in warm temperatures while wearing relatively impervious chemical protective clothing (CPC), i.e., Tyvek™ coveralls. When ambient air temperatures at a project site exceed approximately 75 degrees Fahrenheit when CPC is worn, heat stress can result.

Also, when ambient air temperatures at a project site exceed 85 to 95 degrees Fahrenheit, heat stress is a potential risk regardless if CPC is worn or not worn. If these conditions are encountered, the following precautions shall be implemented:

Controls: The SSO will regularly monitor daily weather forecasts and monitor ambient air temperatures. In addition, routinely observe and monitor archaeology field staff for signs and symptoms of heat stress including: dizziness, profuse sweating or lack of perspiration (hot dry skin), and skin color change – flush appearance. If necessary, monitor for increased heart rate and potential vision problems. Personnel who exhibit any of these symptoms will immediately be removed from field work to a shaded location, and

required to consume 2 to 4 pints of cool water while resting. Individuals exhibiting symptoms of heat stress should not return to work until the symptoms are no longer recognizable.

Note: If symptoms of hot, dry skin or other critical symptoms appear, immediately implement emergency medical procedures by dialing 911. While awaiting the arrival of emergency medical services attempt to cool the individual's body by saturating their upper clothing (shirt) with cool, but not chilled or cold water.

To control the potential occurrence of heat stress, preventive measures will be evaluated and implemented on a daily basis (ref. T8 CCR §3395 Heat Illness Prevention). These measures will include:

- Schedule periodic cooling and rest (recovery) periods in a shaded area (ref. T8 CCR §3395(d) Heat Illness Prevention);and
- Designated shaded rest areas, or portable shade structures must be available when the ambient daily high temperature is predicted to exceed 85 degrees Fahrenheit, or 75 degrees Fahrenheit if CPC will be required to be worn; and,
- Inducement of water intake, the equivalent quantity of 1 quart of water per hour per on-site archaeology staff (2 gallons per person) be available before work begins unless provisions for immediate water replenishments are available (near by store, plumbed water supply, etc.). Water must always be replenished before running out (ref. T8 CCR §3395(c) Heat Illness Prevention).

The implementation frequency of these measures will be the responsibility of the SSO.

3.7 Chemical Hazards

The risk of significant exposure to soil contaminants is considered to be low to moderate while performing the sampling tasks required on this project. Safe work practices to be employed will reduce the potential for significant exposures to airborne contaminants.

Detailed information regarding the physical description of toxic metals, dioxin, and petroleum hydrocarbons, including health hazards, routes of entry into the body, signs and symptoms of exposure, and target organs, chemical and physical properties are available in Attachments A, B, C & D – T22 (CAM 17) Metals, Attachment E – Pentachlorophenol & Dioxin, and Attachment F – Petroleum Hydrocarbons & Volatile Organic Cpds. The chemical guides for representative T22 (CAM 17) Metals, dioxins, and petroleum hydrocarbons are published by the National Institute for Occupational Safety and Health (NIOSH) 2007; the Substance information sheets for Arsenic, Cadmium and Lead are Appendices A of T8 CCR §§5214, 1532 and 1532.1 respectively; the hazards of Chromium VI, T8 CCR 1532.2 are covered in the NIOSH Guide.

3.7.1 T22 (CAM17) Metals

Type(s)/Source: Pollutants in soil (natural or man-made). Potential former fuel or waste oil constituents.

Title 22 (CAM 17) metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, zinc)

Exposure Route: Inhalation and ingestion; ref. Attachment A - T22 (CAM-17) Metals

Exposure signs/symptoms: See Attachment A (ref. NIOSH Pocket Guide to Chemical Hazards) and Attachments B, C and D.

Qualified Exposure Risk: Low to moderate

Hazard Control:

- Isolation – site control
- Engineering Controls – Safe work practices and wet excavation/backfill procedures, Dampen dry soils prior to and during excavation/backfill activities to suppress dust hazards; ref. T8 CCR §5145

  Negative Exposure Assessment: Results of industrial hygiene monitoring of representative tasks and sampling procedures for aerially deposited inorganic lead (ADL), which is representative of potential exposure to CAM 17 metals and dioxin, using these controls document exposures consistently below the 30 µg/m^3 Action Level for airborne lead (ref. T8 CCR §1532.1(d)(5)(A)).
- PPE – eye (safety glasses or goggles) and, hand protection (leather and/or impermeable gloves)
- Sanitation – good personal hygiene follow sanitation and personal hygiene procedures outline in Section 4.3

CHEMICAL NAME AND CAS #	ROUTES OF ENTRY	PUBLISHED EXPOSURE LIMITS		
		CATEGORY	CONCENTRATION	SOURCE
Title 22 Metals, Elemental, Inorganic Compounds	Inhalation, Ingestion, Dermal Contact	TWA/PEL	0.0005 to 5 mg/m^3	Cal/OSHA

3.7.1.1 Arsenic

T8 CCR GISO Article 110 Regulated Carcinogen §5214

Exposure Route: Inhalation, ingestion, skin contact; ref. Attachment B - T8 CCR §5214 Inorganic Arsenic - Appendix A

Hazard Control: ref. 3.7.1

CHEMICAL NAME AND CAS #	ROUTES OF ENTRY	PUBLISHED EXPOSURE LIMITS		
		CATEGORY	CONCENTRATION	SOURCE
Arsenic 7440-38-2	Inhalation, Ingestion	PEL-TWA Action Level	10 µg/m^3 5 µg/m^3	Cal/OSHA

3.7.1.2 Cadmium

T8 CCR GISO Article 110 Regulated Carcinogen §1532

Exposure Route: Inhalation, ingestion; ref. Attachment C - T8 CCR §5207 Cadmium - Appendix A

Hazard Control: ref. 3.7.1

CHEMICAL NAME AND CAS #	ROUTES OF ENTRY	PUBLISHED EXPOSURE LIMITS		
		CATEGORY	CONCENTRATION	SOURCE
Cadmium 7440-43-9	Inhalation, Ingestion	PEL-TWA	5.0 µg/m^3	Cal/OSHA

3.7.1.3 Inorganic Lead

T8 CCR CSO §1532.1

Exposure Route: Inhalation and ingestion; ref. Attachment D - T8 CCR §1532.1 Lead - Appendix A

Hazard Controls: ref. 3.6.1

CHEMICAL NAME CAS #	ROUTES OF ENTRY	PUBLISHED EXPOSURE LIMITS		
		CATEGORY	CONCENTRATION	SOURCE
Lead, Elemental & Inorganic Compounds 7439-92-1	Inhalation Ingestion	PEL-TWA Action Limit	50 µg/m^3 30 µg/m^3	Cal/OSHA OSHA

3.7.2 Pentachlorophenol and Dioxin

Type(s)/Source: Former wood treatment and refuse burn area

Exposure Route: Inhalation, Ingestion; ref. Attachment E – NIOSH Guide

Qualified Exposure Risk: Low

Hazard Control:

- Site Control – Isolation and control access to work/sampling locations
- Engineering Control – T8 CCR §5145 wet methods to suppress airborne dust and adherence to specific work methods and procedures
- Avoid contact with, and inhalation of potentially contaminated dust
- PPE - Gloves/safety glasses; possible us of respirators

Avoid unnecessary contact with potentially contaminated soils; follow sanitation and personal hygiene procedures outline in Section 4.2.

CHEMICAL NAME CAS #	ROUTES OF ENTRY	PUBLISHED EXPOSURE LIMITS		
		CATEGORY	CONCENTRATION	SOURCE
Pentachlorophenol 87-86-5	Inhalation Skin Absorption	PEL-TWA	0.5 mg/m^3	Cal/OSHA

NOTE: There is no Cal/OSHA published exposure limit for dioxin. NIOSH lists dioxin as a carcinogen and recommends no exposure be permitted.

3.7.3 Petroleum Hydrocarbons (TPHs) – Volatile Organic Compounds (VOCs)

Types/Source: Fuel, lubricants, and waste oil

- TPH: Total petroleum hydrocarbons
- BTEX: Benzene, toluene, ethylbenzene, and xylenes, including other aromatic hydrocarbons

Exposure Route: Inh., skin abs; ref. Attachment F - NIOSH Guides TPHs & VOCs

Exposure signs/symptoms: ref. NIOSH Pocket Guide to Chemical Hazards)

Qualified Exposure Risk: Low

Hazard Control(s): refer to 3.7.1 and 3.7.2

3.7.2.1 Diesel Fuel

CHEMICAL NAME AND CAS#	ROUTES OF ENTRY	PUBLISHED EXPOSURE LIMITS		
		CATEGORY	CONCENTRATION	SOURCE
Diesel fuel 68476-31-3	Inhalation Skin Absorption	TLV-TWA	100 mg/m^3 (Vapor & Aerosol)	ACGIH

3.7.2.2 Motor Oil

CHEMICAL NAME AND CAS #	ROUTES OF ENTRY	PUBLISHED EXPOSURE LIMITS CATEGORY - CONCENTRATION - SOURCE
Used Waste	Dermal	None Published
Oils (Slop Oil)	Dermal	None Published
Transmission Fluid	Dermal	None Published
Hydraulic Fluid	Dermal	None Published

3.7.2.3 Aromatic Petroleum Distillates

CHEMICAL NAME AND CAS#	ROUTES OF ENTRY	PUBLISHED EXPOSURE LIMITS		
		CATEGORY	CONCENTRATION	SOURCE
Benzene 71-73-2	Inhalation Skin Absorption	PEL-TWA STEL	1 ppm 5 ppm	Cal/OSHA
Naphthalene 91-20-3	Inhalation Skin Absorption	PEL-TWA STEL	10 ppm 15 ppm	Cal/OSHA
Ethylbenzene 100-41-4	Inhalation	PEL-TWA STEL	100 ppm 125 ppm	Cal/OSHA
Toluene 108-88-3	Inhalation Skin Absorption	PEL-TWA	50 ppm	Cal/OSHA
Xylenes 1330-20-7	Inhalation	PEL-TWA STEL	100 ppm 150 ppm	Cal/OSHA
Vinyl Chloride 75-01-4	Inhalation Skin Absorption	PEL-TWA	1 ppm	Cal/OSHA

4.0 GENERAL HEALTH AND SAFETY REQUIREMENTS

4.1 Industrial Hygiene Monitoring – Metals

Industrial hygiene air monitoring will not be performed for metals during the sampling and other tasks for this project. Previous Negative Exposure Assessments for inorganic lead for representative project tasks, using similar controls document exposures consistently below the 30 $\mu g/m^3$ Action Level which is representative of potential exposure to airborne metals (ref. T8 CCR §1532.1(d)(5)(A)).

4.2 Air Monitoring – Petroleum Hydrocarbons

The necessity for evaluating potential airborne concentrations of vapors from petroleum hydrocarbons will be determined during the project by the SSO. Because field activities will be conducted in open, unrestricted ambient air conditions and soil samples will be collected from the backhoe bucket rather than excavated pits (i.e., not in a confined space), the potential for significant exposure to these contaminants is low.

If necessary, based on observations, odors, or other information which becomes available during monitoring activities, potential exposure to volatile organic hydrocarbons will be evaluated using a direct-reading photoionization detector (PID) equipped with a 10.2 electron volt probe; measurements will be made at the top of the monitoring well and in the operators breathing zone.

All measurements shall be recorded in the field logbook. The frequency or need for continued sampling will be based on results from initial measurements. Justification for discontinuing measurements shall also be recorded in the field logbook.

The SSO shall be responsible for interpreting monitoring data and upgrading or downgrading the level of protection during field activities according to the following guide:

Response Criteria For Airborne Vapor Concentrations
(measured at breathing zone level)

READING	LEVEL OF PROTECTION
0 ppm or Background (as measured up-wind of sampling location)	Level D
Background - 5 ppm above background	
> 5 ppm up to 10 ppm above background	Level D w/ continuous monitoring
>10 up to 300 ppm above background	Level C
>300 ppm above background	Stop Operations Move Up-Wind

Note: Readings exceeding 500 ppm in worker breathing zones – suspend sampling activities until conditions can be further assessed. If corrective action cannot be taken, site personnel must remain up-wind or move to a predetermined safe area and contact the Consulting CIH.

The PID shall be calibrated both before and after field operations, or more frequently as deemed necessary by the SSO. The instrument will be calibrated and maintained in accordance with the manufacturer's instructions. The calibration gas and the calibration readings (in ppm equivalent) shall be recorded in the field log book.

It should be noted that high humidity environments can cause a PID instrument to indicate lower organic vapor concentrations than actually exist.

4.3 Personal Hygiene

The SSO will establish hand-wash facilities, including clean water, hand soap, waterless hand cleaner, sanitary wipes and clean towels at the project site. All Geocon personnel, subcontractor employees, and Caltrans engineers leaving the project site (work zones) will clean potential impacted soils from their footwear and wash hands prior to leaving the project site. In addition, the following procedures will be followed to ensure worker protection against potential exposure through ingestion:

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-in-mouth transfer and ingestion of material is prohibited in any area designated as being potentially impacted.
- Hands and face must be thoroughly washed upon leaving the work area, and before eating, drinking, or other non-project activities.
- Kneeling, sitting, leaning, or general contact with potentially impacted surfaces or with surfaces suspected of being potentially impacted by hazardous materials (i.e., puddles, mud, leachate, etc.) should be avoided.

4.4 Buddy System

Project personnel are to work with another person when performing sampling tasks; the client or a subcontractor's representative can serve as the second person while the work is being conducted in the field. Under no circumstances, other than completion of paper work at the end of the day, are field personnel to work alone at the Site.

4.5 Exclusion (Work) Zone Controls

Formal Exclusion (work) Zones will be established under this Plan. Only authorized personnel and equipment operators, trained on this Plan. Only equipment and materials necessary for work will be allowed in the Exclusion Zone

Exclusion Zones will be well defined and public access will be monitored and controlled. Exclusion Zones where excavation and temporary soil stockpiling activities will be conducted will be defined and isolated using temporary barriers, including fencing, traffic cones, sandwich boards and/or hazard tape, and other warning signs. Traffic cones or other safety means will be used to define site boundaries when working near sidewalks, streets, or parking areas.

4.6 Code of Safe Practices

General safe work practices to be utilized by all project personnel are summarized below:

- All nonessential personnel will be kept clear of work areas.
- The use of entertainment and personal communication devices in the work zone shall not be allowed.
- Adequate signs and safety devices will be installed on equipment.
- All site employees will wear assigned personal protective equipment and level of protection as designated by the SSO.
- Eating, drinking, smoking, chewing gum or tobacco, or application of cosmetics is allowed in designated areas only.
- At a minimum, all personnel will wash with soap and water before lunch, using the restroom, and at the end of work. The face and hands shall be washed before eating, drinking, smoking, chewing gum, applying cosmetics, etc.
- Over-the-counter drugs and prescription medications must be reported to the SSO for clearance before an employee is allowed to work near drill rig or other heavy equipment.
- When portable electric tools and equipment are used, three-wire extension cords are required.
- Employees will advise their supervisors of any malfunctioning equipment immediately.
- An ongoing safety maintenance program for tools and equipment will be instituted. Inspections will occur on a regular basis to ensure parts are secure and intact. Defective equipment will be repaired or replaced.
- Appropriate engineering controls and equipment guards will be installed on tools and equipment. This includes seat belts and backup warning lights and signals.
- A list of names of personnel who are trained in CPR and first aid shall be available.
- Labels shall be placed on containers of hazardous materials.
- No one will work alone; the "buddy system" shall be implemented for all field work.
- Employees shall be trained to identify effects and symptoms of toxic exposure and report them immediately.
- Under no circumstances are Geocon personnel authorized to enter a Permit-Required Confined Space, or unshored trench or excavation.

5.0 PERSONAL PROTECTIVE EQUIPMENT

The employment of the aforem entioned engineering controls is the preferred m ethod of providing personal protection from hazards identified at th is and any site. PPE provides acceptable secondary recourse, but only when engineering controls fail or cannot adequately eliminate exposure to the hazard. The use of PPE is intended to provide protection for onsite personnel from operational hazards that cannot be controlled through other safety procedures or work practices.

PPE required to be onsite for each worker during this project will include:

- ☒ Hard Hat (without face Shield)
- ☒ Leather Boots
- ☐ Chem. Resistant Boots
- ☒ Leather Gloves
- ☒ Ear Plugs/Muffs
- ☒ ANSI Approved Safety Vest
- ☐ Other
- ☒ Safety Glasses
- ☒ Disposable gloves (for sample handling)
- ☐ Chem. Resistant gloves
- ☐ Air-Purifying Respirator
- ☐ APR Cartridges
- ☐ Tyvek® coveralls

Only ANSI-approved PPE and NIOSH-approved respirators will be assigned for use. The use applications for this equipment are summarized in the following matrix. Specific procedures are further described below.

	PPE												
TASKS	Hard Hat	Safety Glasses	Leather Boots	Chemical Resistant Boots	Disposable Gloves	Chemical Resistant Gloves	Leather Gloves	Ear Plugs/Muffs	Air-Purifying Respirator	APR Cartridges	ANSI Approved Safety Vest	Tyvek® Coveralls	Other
Non-intrusive general survey	**X**	**X**						**X**			**X**		
Soil sampling (direct-push)	**X**	**X**	**X**		**X**		**X**	**X**			**X**		

5.1 Respiratory Protection

Respiratory protection will not be required during sa mpling activities. The SSO, in consultation with the Site Safety Officer, will determine the need for upgrad ing the level of protection from "D" to "C". If it is determined that respiratory protection is required, personnel shall don a full facepiece or half-m ask air-purifying respirator fitted with a com bination organic vapor (Black), or organic vapor-acid gas (Yellow) and HEPA (P100, Magenta) cartridge.

5.2 PPE – Level D Protection

The protective equipment to be donned by personnel working in the Exclusion Zone includes:

- Body Protection: Body protection shall include the use of "work clothing," including long pants and long- or short-sleeved shirts, and Class II ANSI approve safety vest.
- Head Protection: Non-metallic hard hats shall be worn by all personnel; ref. T8 CCR §§1514 & 3385 Head Protection.
- Hearing Protection: Hearing protection shall include the use of foam ear inserts or muffs; ref. T8 CCR §5098.
- Eye Protection: Protective eye wear (i.e., safety glasses) shall be worn by personnel working in direct proximity to operating heavy equipment and highway traffic; ref. T8 CCR §§1514 & 3385 Eye Protection.
- Hand Protection: Appropriate hand protection shall be required for employees whose work involves unusual and excessive exposure of hands to cuts capable of causing injury or impairments; ref. T8 CCR §§1514 & 3384 Hand Protection.
- Foot Protection: foot protection, such as steel toed shoes or boots shall be required for employees who are exposed to foot injuries from electrical hazards, falling objects, or crushing or penetrating actions; ref. T8 CCR §§1514 & 3385 Foot Protection.

5.3 Level C Protection – Air Purifying Respirator

Level D protection may be up-graded to Level C protection by site personnel with prior notification to the Site Safety Officer. Level C protection (use of APRs and possibly Tyvek® coveralls) shall only be downgraded in consultation with the Geocon Consulting CIH.

5.4 Miscellaneous Safety Equipment

Additional protective equipment to be available to personnel working at the site includes portable radios/walkie-talkies or cell phones shall accompany all personnel.

6.0 DECONTAMINATION

The Site Safety Officer will establish a formal Exclusion Zone around excavation and soil stockpiling areas. Decontamination procedures will be tailored to the specific hazards of the site and may vary in complexity and number of steps, depending on the extent of potentially impacted soils required to be handled, and the Level of Protection and PPE required for potential employee exposure hazards. Decontamination methods and procedures will be routinely evaluated as necessary by the SSO to assure that employees are not exposed to hazards from equipment or by reusing PPE.

Decontamination will be performed within the boundaries of the Exclusion Zone. The primary principle in consideration of decontamination procedure is: avoid unnecessary contamination of heavy equipment, sampling equipment and materials, and PPE worn by project personnel.

6.1 Equipment Decontamination

Only authorized personnel and equipment operators, trained on this Plan, and equipment and materials necessary to complete project sampling tasks will be allowed to work in the Exclusion Zone. The exterior surfaces of excavation equipment, including buckets, tires and/or tracks will be scraped with shovels to remove substantial deposits of potentially contaminated soil prior to being rinsed with water.

Shovels, hand tools, and other equipment will also undergo gross decontamination to remove any potentially contaminated soils. Soil, dust, debris, water and decontamination rinseate will be controlled to prevent entering nearby storm drains, creeks, or streams.

Decontamination of soil sampling equipment shall include washing with a solution of TSP, Alconox®, or Liquinox® and water followed by a double rinse of deionized water between samples and before vacating the work area.

6.2 PPE Decontamination

The SSO will determine the necessity for and level of decontamination appropriate to project tasks and activities. Decontamination of PPE may be accomplished by personnel passing through separate stations or stages, established within the exclusion zone to reduce and remove contaminated clothing and equipment. Decontamination stations may include the following procedures listed sequentially below.

Stage No. 1: Segregated Equipment Drop - Equipment and consumables that require either disposal or special handling (e.g., special and/or equipment decontamination) shall remain in this area and be decontaminated, if appropriate, or disposed of with the excavated materials or other potentially impacted materials.

Stage No. 2: PPE Decontamination - PPE that has been potentially impacted will be placed in drums, buckets or plastic liners and disposed of with the other solid wastes generated.

Stage No. 3: General Field Wash - Personnel shall wash and rinse face and hands with soap and water before leaving the site and/or eating. If changing of clothing is necessary, it shall be done at this time. Respirator decontamination, if required, shall include a wash with soap and water followed by a clean water rinse.

7.0 EMERGENCY RESPONSE PROCEDURES

7.1 Physical Injury

In the event of an accident resulting in physical injury, call emergency service personnel immediately and perform first aid commensurate with training and seriousness of the injury. Severely injured personnel are to be transported only by emergency service personnel and/or by ambulance personnel, unless a life-threatening condition is judged to exist that must be addressed immediately.

The Project Manager is to be notified by the SSO, as soon after the injury as practical, regarding the nature of the accident. The Project Manager or designee will prepare a written report within 24 hours of the accident.

7.2 Catastrophic Event

In the event of a catastrophic event (e.g., severe personal injury, fire, explosion, and/or property damage), notify the fire/safety and rescue department immediately by dialing 911.

Any accident involving serious injury, illness, or death will require suspension of site activities until the Site Safety Officer (or designee) has completed a review of the events and site conditions and authorized work to resume.

The Site Safety Officer (or designee) will notify the nearest Cal/OSHA District Office immediately (within 8-hours) by phone or fax upon learning of a death or serious injury:

Redding District Office
381 Hemstead Drive
Redding, California 96002

Tel: 530.224.4743
Fax: 530.224.4747

The report shall be filed within 8 hours of the Site Safety Officer learning of the incident; unless exigent circumstances can be demonstrated, the report will be made no later than 24 hours after the incident.

7.3 Emergency Telephone Numbers

Fire/Police/Medical Assistance:	**911**
Poison Control:	**(800) 876-4766**

Other phone numbers may be available or required for emergency response at specific sites. Check with onsite representatives before mobilizing to the job site.

7.4 Project Site Address

Site Location/Address: South Mt. Shasta Blvd. and Loveta Lane, Mt. Shasta City, California

7.5 Hospital Address and Route

Hospital Reference: Mercy Medical Center
914 Pine Street, Mt. Shasta, California
530.926.6111

Directions: From the Site, proceed north on Mt. Shasta Blvd for 1 mile. Turn left onto W Lake Street. Take the 2nd right onto Pine Street. Proceed 0.6 mile and hospital will be on the right (see Vicinity Map, Figure 1).

8.0 PLAN APPROVAL

The undersigned has reviewed and approved this Health and Safety Plan prepared for the Phase II Environmental Site Assessment at former Roseburg Lumber "Old Mill" site in Mt. Shasta, California, as described herein.

Douglas S. Krause, CIH
Geocon Consulting Certified Industrial Hygienist
ABIH Certification No. 2123, Exp. June 1, 2015

September 13, 2013
Date

Matt Lesh
Project Manager

10-14-13
Date

The following personnel, including subcontractors involved with the project activities have reviewed, or received a copy of this Plan and Attachments A, B, C, D, E & F, and agree to follow the health and safety procedures described herein.

Print Name	Title	Signature	Date

Antimony	Formula: Sb	CAS#: 7440-36-0	RTECS#: CC4025000	IDLH: 50 mg/m^3 (as Sb)
Conversion:	**DOT:** 1549 157 (inorganic compounds, n.o.s.); 2871 170 (powder); 3141 157 (inorganic liquid compounds, n.o.s.)			

Synonyms/Trade Names: Antimony metal, Antimony powder, Stibium

Exposure Limits:
NIOSH REL*: TWA 0.5 mg/m^3
OSHA PEL*: TWA 0.5 mg/m^3
[***Note:** The REL and PEL also apply to other antimony compounds (as Sb).]

Physical Description: Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder.

Measurement Methods (see Table 1):
NIOSH 7301, 7303, P&CAM 261 (II-4)
OSHA ID121, ID125G, ID206

Chemical & Physical Properties:
MW: 121.8
BP: 2975°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 6.69
VP: 0 mmHg (approx)
MLT: 1166°F
UEL: NA
LEL: NA

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: 95XQ/Sa
12.5 mg/m^3: Sa:Cf/PaprHie
25 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
50 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Noncombustible Solid in bulk form, but a moderate explosion hazard in the form of dust when exposed to flame.

Incompatibilities and Reactivities: Strong oxidizers, acids, halogenated acids
[**Note:** Stibine is formed when antimony is exposed to nascent (freshly formed) hydrogen.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat, mouth; cough; dizz; head; nau, vomit, diarr; stomach cramps; insom; anor; unable to smell properly
TO: Eyes, skin, resp sys, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Arsenic (inorganic compounds, as As)	Formula: As (metal)	CAS#: 7440-38-2 (metal)	RTECS#: CG0525000 (metal)	IDLH: Ca [5 mg/m^3 (as As)]
Conversion:	**DOT:** 1558 152 (metal); 1562 152 (dust)			

Synonyms/Trade Names: **Arsenic metal:** Arsenia
Other synonyms vary depending upon the specific As compound. [**Note:** OSHA considers "Inorganic Arsenic" to mean copper acetoarsenite & all inorganic compounds containing arsenic except ARSINE.]

Exposure Limits:
NIOSH REL: Ca
C 0.002 mg/m^3 [15-minute]
See Appendix A
OSHA PEL: [1910.1018] TWA 0.010 mg/m^3

Physical Description: Metal: Silver-gray or tin-white, brittle, odorless solid.

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 9102, 7900
OSHA ID105

Chemical & Physical Properties:
MW: 74.9
BP: Sublimes
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 5.73 (metal)
VP: 0 mmHg (approx)
MLT: 1135°F (Sublimes)
UEL: NA
LEL: NA

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFAg100/ScbaE

See Appendix E (page 351)

Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame.

Incompatibilities and Reactivities: Strong oxidizers, bromine azide
[**Note:** Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Con, Ing
SY: Ulceration of nasal septum, derm, GI disturbances, peri neur, resp irrit, hyperpig of skin, [carc]
TO: Liver, kidneys, skin, lungs, lymphatic sys [lung & lymphatic cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Barium chloride (as Ba)	**Formula:** $BaCl_2$	**CAS#:** 10361-37-2	**RTECS#:** CQ8750000	**IDLH:** 50 mg/m^3 (as Ba)
Conversion:	**DOT:** 1564 154 (barium compound, n.o.s.)			
Synonyms/Trade Names: Barium dichloride				
Exposure Limits: **NIOSH REL*:** TWA 0.5 mg/m^3 **OSHA PEL*:** TWA 0.5 mg/m^3 [***Note:** The REL and PEL also apply to other soluble barium compounds (as Ba) except Barium sulfate.]			**Measurement Methods (see Table 1):** **NIOSH** 7056, 7303 **OSHA** ID121	
Physical Description: White, odorless solid.				
Chemical & Physical Properties: **MW:** 208.2 **BP:** 2840°F **Sol:** 38% **FI.P:** NA **IP:** ? **Sp.Gr:** 3.86 **VP:** Low **MLT:** 1765°F **UEL:** NA **LEL:** NA Noncombustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **5 mg/m^3:** 95XQ/Sa **12.5 mg/m^3:** Sa:Cf/PaprHie **25 mg/m^3:** 100F/SaT:Cf/PaprTHie/ ScbaF/SaF **50 mg/m^3:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE	
Incompatibilities and Reactivities: Acids, oxidizers				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, upper resp sys; skin burns; gastroenteritis; musc spasm; slow pulse, extrasystoles; hypokalemia **TO:** Eyes, skin, resp sys, heart, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed	

Beryllium & beryllium compounds (as Be)	**Formula:** Be (metal)	**CAS#:** 7440-41-7 (metal)	**RTECS#:** DS1750000 (metal)	**IDLH:** Ca [4 mg/m^3 (as Be)]
Conversion:	**DOT:** 1566 154 (compounds); 1567 134 (powder)			
Synonyms/Trade Names: **Beryllium metal:** Beryllium Other synonyms vary depending upon the specific beryllium compound.				
Exposure Limits: **NIOSH REL:** Ca Not to exceed 0.0005 mg/m^3 See Appendix A **OSHA PEL:** TWA 0.002 mg/m^3 C 0.005 mg/m^3 0.025 mg/m^3 [30-minute maximum peak]			**Measurement Methods (see Table 1):** **NIOSH** 7102, 7300, 7301, 7303, 9102 **OSHA** ID125G, ID206	
Physical Description: Metal: A hard, brittle, gray-white solid.				
Chemical & Physical Properties: **MW:** 9.0 **BP:** 4532°F **Sol:** Insoluble **FI.P:** NA **IP:** NA **Sp.Gr:** 1.85 (metal) **VP:** 0 mmHg (approx) **MLT:** 2349°F **UEL:** NA **LEL:** NA	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** Daily **Remove:** When wet or contam **Change:** Daily **Provide:** Eyewash		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE	
Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of a powder or dust.				
Incompatibilities and Reactivities: Acids, caustics, chlorinated hydrocarbons, oxidizers, molten lithium				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con **SY:** Berylliosis (chronic exposure): anor, low-wgt, lass, chest pain, cough, clubbing of fingers, cyan, pulm insufficiency; irrit eyes; derm; [carc] **TO:** Eyes, skin, resp sys [lung cancer]			**First Aid (see Table 6):** **Eye:** Irr immed **Breath:** Fresh air	

Cadmium dust (as Cd)	**Formula:** Cd (metal)	**CAS#:** 7440-43-9 (metal)	**RTECS#:** EU9800000 (metal)	**IDLH:** Ca [9 mg/m^3 (as Cd)]
Conversion:	**DOT:** 2570 154 (cadmium compound)			

Synonyms/Trade Names: **Cadmium metal:** Cadmium
Other synonyms vary depending upon the specific cadmium compound.

Exposure Limits:
NIOSH REL*: Ca
See Appendix A
OSHA PEL*: [1910.1027] TWA 0.005 mg/m^3
[***Note:** The REL and PEL apply to all Cadmium compounds (as Cd).]

Measurement Methods (see Table 1):
NIOSH 7048, 7300, 7301, 7303, 9102
OSHA ID121, ID125G, ID189, ID206

Physical Description: Metal: Silver-white, blue-tinged lustrous, odorless solid.

Chemical & Physical Properties:
MW: 112.4
BP: 1409°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 8.65 (metal)
VP: 0 mmHg (approx)
MLT: 610°F
UEL: NA
LEL: NA
Metal: Noncombustible Solid in bulk form, but will burn in powder form.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Strong oxidizers; elemental sulfur, selenium & tellurium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing
SY: Pulm edema, dysp, cough, chest tight, subs pain; head; chills, musc aches; nau, vomit, diarr; anos, emphy, prot, mild anemia; [carc]
TO: Resp sys, kidneys, prostate, blood [prostatic & lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Chromium metal	**Formula:** Cr	**CAS#:** 7440-47-3	**RTECS#:** GB4200000	**IDLH:** 250 mg/m^3 (as Cr)
Conversion:	**DOT:**			

Synonyms/Trade Names: Chrome, Chromium

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3
See Appendix C
OSHA PEL*: TWA 1 mg/m^3
See Appendix C
[***Note:** The PEL also applies to insoluble chromium salts.]

Measurement Methods (see Table 1):
NIOSH 7024, 7300, 7301, 7303, 9102
OSHA ID121, ID125G

Physical Description: Blue-white to steel-gray, lustrous, brittle, hard, odorless solid.

Chemical & Physical Properties:
MW: 52.0
BP: 4788°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 7.14
VP: 0 mmHg (approx)
MLT: 3452°F
UEL: NA
LEL: NA
Noncombustible Solid in bulk form, but finely divided dust burns rapidly if heated in a flame.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
2.5 mg/m^3: Qm*
5 mg/m^3: 95XQ*/Sa*
12.5 mg/m^3: Sa:Cf*/PaprHie*
25 mg/m^3: 100F/PaprTHie*/ ScbaF/SaF
250 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers (such as hydrogen peroxide), alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin; lung fib (histologic)
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Cobalt metal dust and fume (as Co)	Formula: Co	CAS#: 7440-48-4	RTECS#: GF8750000	IDLH: 20 mg/m^3 (as Co)
Conversion:	**DOT:**			
Synonyms/Trade Names: Cobalt metal dust, Cobalt metal fume				
Exposure Limits: **NIOSH REL:** TWA 0.05 mg/m^3 **OSHA PEL†:** TWA 0.1 mg/m^3			**Measurement Methods (see Table 1):** **NIOSH** 7027, 7300, 7301, 7303, 9102 **OSHA** ID121, ID125G, ID213	
Physical Description: Odorless, silver-gray to black solid.				
Chemical & Physical Properties: **MW:** 58.9 **BP:** 5612°F **Sol:** Insoluble **Fl.P:** NA **IP:** NA **Sp.Gr:** 8.92 **VP:** 0 mmHg (approx) **MLT:** 2719°F **UEL:** NA **LEL:** NA Noncombustible Solid in bulk form, but finely divided dust will burn at high temperatures.	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** N.R. **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **0.25 mg/m^3:** Qm **0.5 mg/m^3:** 95XQ*/Sa* **1.25 mg/m^3:** Sa:Cf*/PaprHie* **2.5 mg/m^3:** 100F/ScbaF/SaF **20 mg/m^3:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE	
Incompatibilities and Reactivities: Strong oxidizers, ammonium nitrate				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Cough, dysp, wheez, decr pulm func; low-wgt; derm; diffuse nodular fib; resp hypersensitivity, asthma **TO:** Skin, resp sys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash **Breath:** Resp support **Swallow:** Medical attention immed	

Copper (dusts and mists, as Cu)	Formula: Cu	CAS#: 7440-50-8	RTECS#: GL5325000	IDLH: 100 mg/m^3 (as Cu)
Conversion:	**DOT:**			
Synonyms/Trade Names: Copper metal dusts, Copper metal fumes				
Exposure Limits: **NIOSH REL*:** TWA 1 mg/m^3 **OSHA PEL*:** TWA 1 mg/m^3 [***Note:** The REL and PEL also apply to other copper compounds (as Cu) except copper fume.]			**Measurement Methods (see Table 1):** **NIOSH** 7029, 7300, 7301, 7303, 9102 **OSHA** ID121, ID125G	
Physical Description: Reddish, lustrous, malleable, odorless solid.				
Chemical & Physical Properties: **MW:** 63.5 **BP:** 4703°F **Sol:** Insoluble **Fl.P:** NA **IP:** NA **Sp.Gr:** 8.94 **VP:** 0 mmHg (approx) **MLT:** 1981°F **UEL:** NA **LEL:** NA Noncombustible Solid in bulk form, but powdered form may ignite.	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **5 mg/m^3:** Qm* **10 mg/m^3:** 95XQ*/Sa* **25 mg/m^3:** Sa:Cf*/PaprHie* **50 mg/m^3:** 100F/PaprTHie*/ScbaF/SaF **100 mg/m^3:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE	
Incompatibilities and Reactivities: Oxidizers, alkalis, sodium azide, acetylene				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, nose, pharynx; nasal septum perf; metallic taste; derm; in animals: lung, liver, kidney damage; anemia **TO:** Eyes, skin, resp sys, liver, kidneys (incr risk with Wilson's disease)			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed	

Chromic acid and chromates

Formula:	CAS#:	RTECS#:	IDLH:
CrO_3 (acid)	1333-82-0 (CrO_3)	GB6650000 (CrO_3)	Ca [15 mg/m^3 {as Cr(VI)}]

Conversion: **DOT:** 1755 154 (acid solution); 1463 141 (acid, solid)

Synonyms/Trade Names: **Chromic acid (CrO_3):** Chromic anhydride, Chromic oxide, Chromium(VI) oxide (1:3), Chromium trioxide. Synonyms of chromates (i.e., chromium(VI) compounds) such as zinc chromate vary depending upon the specific compound.

Exposure Limits:
NIOSH REL (as Cr): Ca
TWA 0.001 mg/m^3
See Appendix A
See Appendix C
OSHA PEL (as CrO_3): C 0.1 mg/m^3 See Appendix C

Measurement Methods (see Table 1):
NIOSH 7600, 7604, 7605
OSHA ID103, ID215, W4001

Physical Description: CrO_3: Dark-red, odorless flakes or powder.
[**Note:** Often used in an aqueous solution (H_2CrO_4).]

Chemical & Physical Properties:
MW: 100.0
BP: 482°F (Decomposes)
Sol: 63%
FI.P: NA
IP: NA
Sp.Gr: 2.70 (CrO_3)
VP: Very low
MLT: 387°F (Decomposes)
UEL: NA
LEL: NA
CrO_3: Noncombustible Solid, but will accelerate the burning of combustible materials.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Combustible, organic, or other readily oxidizable materials (paper, wood, sulfur, aluminum, plastics, etc.); corrosive to metals

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit resp sys; nasal septum perf; liver, kidney damage; leucyt, leupen, eosin; eye inj, conj; skin ulcer, sens derm; [carc]
TO: Blood, resp sys, liver, kidneys, eyes, skin [lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Mercury compounds [except (organo) alkyls] (as Hg)

Formula:	CAS#:	RTECS#:	IDLH:
Hg (metal)	7439-97-6 (metal)	OV4550000 (metal)	10 mg/m^3 (as Hg)

Conversion: **DOT:** 2809 172 (metal)

Synonyms/Trade Names: **Mercury metal:** Colloidal mercury, Metallic mercury, Quicksilver
Synonyms of "other" Hg compounds vary depending upon the specific compound.

Exposure Limits:
NIOSH REL: Hg Vapor: TWA 0.05 mg/m^3 [skin] **OSHA PEL†:** C 0.1 mg/m^3
Other: C 0.1 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 6009 **OSHA** ID140

Physical Description: Metal: Silver-white, heavy, odorless liquid.
[**Note:** "Other" Hg compounds include all inorganic & aryl Hg compounds except (organo) alkyls.]

Chemical & Physical Properties:
MW: 200.6
BP: 674°F
Sol: Insoluble
FI.P: NA
IP: ?
Sp.Gr: 13.6 (metal)
VP: 0.0012 mmHg
FRZ: -38°F
UEL: NA
LEL: NA
Metal: Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Mercury vapor:
NIOSH
0.5 mg/m^3: CcrS†/Sa
1.25 mg/m^3: Sa:Cf/PaprS†(canister)
2.5 mg/m^3: CcrFS†/GmFS†/SaT:Cf/PaprTS(canister)/ScbaF/SaF
10 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Other mercury compounds:
NIOSH/OSHA
1 mg/m^3: CcrS†/Sa
2.5 mg/m^3: Sa:Cf/PaprS†(canister)
5 mg/m^3: CcrFS†/GmFS†/SaT:Cf/PaprTS(canister)/ScbaF/SaF
10 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Acetylene, ammonia, chlorine dioxide, azides, calcium (amalgam formation), sodium carbide, lithium, rubidium, copper

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; cough, chest pain, dysp, bron, pneu; tremor, insom, irrity, indecision, head, lass; stomatitis, salv; GI dist, anor, low-wgt; prot
TO: Eyes, skin, resp sys, CNS, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Molybdenum (soluble compounds, as Mo)	Formula:	CAS#:	RTECS#:	IDLH: 1000 mg/m^3 (as Mo)
Conversion:	**DOT:**			

Synonyms/Trade Names: Synonyms vary depending upon the specific soluble molybdenum compound.

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL: TWA 5 mg/m^3

Physical Description: Appearance and odor vary depending upon the specific soluble molybdenum compound.

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 9102
OSHA ID121, ID125G

Chemical & Physical Properties:
Properties vary depending upon the specific soluble molybdenum compound.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
OSHA
25 mg/m^3: Qm*
50 mg/m^3: 95XQ*/Sa*
125 mg/m^3: Sa:Cf*/PaprHie*
250 mg/m^3: 100F/SaT:Cf*/PaprTHie*/ScbaF/SaF
1000 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Varies

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit eyes, nose, throat; anor; inco; dysp; anemia
TO: Eyes, resp sys, kidneys, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush
Breath: Resp support
Swallow: Medical attention immed

Nickel metal and other compounds (as Ni)	Formula: Ni (metal)	CAS#: 7440-02-0 (metal)	RTECS#: QR5950000 (metal)	IDLH: Ca [10 mg/m^3 (as Ni)]
Conversion:	**DOT:**			

Synonyms/Trade Names: **Nickel metal:** Elemental nickel, Nickel catalyst
Synonyms of other nickel compounds vary depending upon the specific compound.

Exposure Limits:
NIOSH REL*: Ca
TWA 0.015 mg/m^3
See Appendix A
OSHA PEL*†: TWA 1 mg/m^3
[***Note:** The REL and PEL do not apply to Nickel carbonyl.]

Physical Description: Metal: Lustrous, silvery, odorless solid.

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 9102
OSHA ID121, ID125G

Chemical & Physical Properties:
MW: 58.7
BP: 5139°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 8.90 (Metal)
VP: 0 mmHg (approx)
MLT: 2831°F
UEL: NA
LEL: NA
Metal: Combustible Solid; nickel sponge catalyst may ignite SPONTANEOUSLY in air.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong acids, sulfur, selenium, wood & other combustibles, nickel nitrate

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Sens derm, allergic asthma, pneu; [carc]
TO: Nasal cavities, lungs, skin [lung and nasal cancer]

First Aid (see Table 6):
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Selenium	Formula: Se	CAS#: 7782-49-2	RTECS#: VS7700000	IDLH: 1 mg/m^3 (as Se)
Conversion:	**DOT:** 2658 152 (powder)			
Synonyms/Trade Names: Elemental selenium, Selenium alloy				

Exposure Limits:
NIOSH REL*: TWA 0.2 mg/m^3
OSHA PEL*: TWA 0.2 mg/m^3
[***Note:** The REL and PEL also apply to other selenium compounds (as Se) except Selenium hexafluoride.]

Physical Description: Amorphous or crystalline, red to gray solid.
[**Note:** Occurs as an impurity in most sulfide ores.]

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 9102, S190 (II-7)
OSHA ID121

Chemical & Physical Properties:
MW: 79.0
BP: 1265°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 4.28
VP: 0 mmHg (approx)
MLT: 392°F
UEL: NA
LEL: NA
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 mg/m^3: Qm*/95XQ*/100F/PaprHie*/PaprHie*/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Acids, strong oxidizers, chromium trioxide, potassium bromate, cadmium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; vis dist; head; chills, fever; dysp, bron; metallic taste, garlic breath, GI dist; derm; eye, skin burns; in animals: anemia; liver nec, cirr; kidney, spleen damage
TO: Eyes, skin, resp sys, liver, kidneys, blood, spleen

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Silver (metal dust and soluble compounds, as Ag)	Formula: Ag (metal)	CAS#: 7440-22-4 (metal)	RTECS#: VW3500000 (metal)	IDLH: 10 mg/m^3 (as Ag)
Conversion:	**DOT:**			

Synonyms/Trade Names: **Silver metal:** Argentum
Synonyms of soluble silver compounds such as Silver nitrate ($AgNO_3$) vary depending upon the specific compound.

Exposure Limits:
NIOSH REL: TWA 0.01 mg/m^3
OSHA PEL: TWA 0.01 mg/m^3

Physical Description: Metal: White, lustrous solid.

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 9102
OSHA ID121

Chemical & Physical Properties:
MW: 107.9
BP: 3632°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 10.49 (metal)
VP: 0 mmHg (approx)
MLT: 1761°F
UEL: NA
LEL: NA
Metal: Noncombustible Solid, but flammable in form of dust or powder.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam ($AgNO_3$)
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.25 mg/m^3: Sa:Cf£/PaprHie£
0.5 mg/m^3: 100F/ScbaF/SaF
10 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Acetylene, ammonia, hydrogen peroxide, bromoazide, chlorine trifluoride, ethyleneimine, oxalic acid, tartaric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Blue-gray eyes, nasal septum, throat, skin; irrit, ulceration skin; GI dist
TO: Nasal septum, skin, eyes

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush
Breath: Resp support
Swallow: Medical attention immed

Vanadium dust	Formula: V_2O_5	CAS#: 1314-62-1	RTECS#: YW2450000	IDLH: 35 mg/m^3 (as V)
Conversion:	**DOT:** 2862 151			

Synonyms/Trade Names: Divanadium pentoxide dust, Vanadic anhydride dust, Vanadium oxide dust, Vanadium pentaoxide dust. Other synonyms vary depending upon the specific vanadium compound.

Exposure Limits:
NIOSH REL*: C 0.05 mg V/m^3 [15-minute]
[***Note:** The REL applies to all vanadium compounds except Vanadium metal and Vanadium carbide (see Ferrovanadium dust).]
OSHA PEL†: C 0.5 mg V_2O_5/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 7504, 9102
OSHA ID185

Physical Description: Yellow-orange powder or dark-gray, odorless flakes dispersed in air.

Chemical & Physical Properties:
MW: 181.9
BP: 3182°F (Decomposes)
Sol: 0.8%
FI.P: NA
IP: NA
Sp.Gr: 3.36
VP: 0 mmHg (approx)
MLT: 1274°F
UEL: NA
LEL: NA
Noncombustible Solid, but may increase intensity of fire when in contact with combustible materials.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH (as V)
0.5 mg/m^3: 100XQ*/Sa*
1.25 mg/m^3: Sa:Cf*/PaprHie*
2.5 mg/m^3: 100F/PaprTHie*/ScbaF/SaF
35 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Lithium, chlorine trifluoride

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, throat; green tongue, metallic taste, eczema; cough; fine rales, wheez, bron, dysp
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Zinc oxide	Formula: ZnO	CAS#: 1314-13-2	RTECS#: ZH4810000	IDLH: 500 mg/m^3
Conversion:	**DOT:** 1516 143			

Synonyms/Trade Names: Zinc peroxide

Exposure Limits:
NIOSH REL: Dust: TWA 5 mg/m^3
C 15 mg/m^3
Fume: TWA 5 mg/m^3
ST 10 mg/m^3
OSHA PEL†: TWA 5 mg/m^3 (fume)
TWA 15 mg/m^3 (total dust)
TWA 5 mg/m^3 (resp dust)

Measurement Methods (see Table 1):
NIOSH 7303, 7502
OSHA ID121, ID143

Physical Description: White, odorless solid.

Chemical & Physical Properties:
MW: 81.4
BP: ?
Sol(64°F): 0.0004%
FI.P: NA
IP: NA
Sp.Gr: 5.61
VP: 0 mmHg (approx)
MLT: 3587°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 mg/m^3: 95XQ/Sa
125 mg/m^3: Sa:Cf/PaprHie
250 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
500 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Chlorinated rubber (at 419°F), water
[**Note:** Slowly decomposed by water.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Metal fume fever: chills, musc ache, nau, fever, dry throat, cough; lass; metallic taste; head; blurred vision; low back pain; vomit; mal; chest tight; dysp, rales, decr pulm func
TO: Resp sys

First Aid (see Table 6):
Breath: Resp support

I. SUBSTANCE IDENTIFICATION

A. Substance. Inorganic Arsenic.

B. Definition. Copper acetoarsenite, arsenic and all inorganic compounds containing arsenic except arsine, measured as arsenic (As).

C. Permissible Exposure Limit. 0.01 milligrams per cubic meter of air (same as 10 micrograms per cubic meter of air) as determined as an average over an 8-hour period. No employee may be exposed to any skin or eye contact with arsenic trichloride or to skin or eye contact likely to cause skin or eye irritation.

D. Action Level. 0.005 milligrams per cubic meter of air (same as 5 micrograms per cubic meter of air) determined as an average over an 8-hour period.

E. Regulated Areas. Only employees authorized by your employer should enter a regulated area.

II. HEALTH HAZARD DATA

A. Comments. The health hazard of inorganic arsenic is high.

B. Ways In Which Inorganic Arsenic Affects Your Body. Exposure to airborne inorganic arsenic may cause lung cancer, and it can be a skin irritant. Inorganic arsenic may also affect your body if swallowed. One compound in particular, arsenic trichloride, is especially dangerous because it is highly corrosive and it can be absorbed readily through the skin. Because inorganic arsenic is a poison, you should wash your hands thoroughly prior to eating or smoking.

III. PROTECTIVE CLOTHING AND EQUIPMENT

A. Respirators. Respirators will be provided by your employer at no cost to you for routine use if your employer is in the process of implementing engineering and work practice controls or where engineering and work practice controls are not feasible or insufficient. You must wear respirators for non-routine activities or in emergency situations where you are likely to be exposed to levels of inorganic arsenic in excess of the permissible exposure limit. Since how well your respirator fits your face is very important, your employer is required to conduct fit tests to make sure the respirator seals properly when you wear it. These tests are simple and rapid and will be explained to you during training sessions.

B. Protective clothing. If you work in a regulated area, your employer is required to provide at no cost to you, and you must wear, appropriate, clean, protective clothing and equipment. The purpose of this equipment is to prevent you from bringing to your home arsenic-contaminated dust and to protect your body from repeated skin contact with inorganic arsenic likely to cause skin irritation. This clothing should include such items as coveralls or similar full-body clothing, gloves, shoes or coverlets, and aprons. Protective equipment should include face shields or vented goggles where eye injury may occur.

IV. HYGIENE FACILITIES AND PRACTICES

You must not eat, drink, smoke, chew gum or tobacco, or apply cosmetics in the regulated area, except that drinking water is permitted. If you work in a regulated area your employer is required to provide lunch rooms and other areas for these purposes.

If you work in a regulated area, your employer is required to provide showers, washing facilities, and change rooms. You must wash your face and hands before eating and must shower at the end of the work shift. Do not take used protective clothing out of change rooms without your employer's permission. Your employer is required to provide for laundering or cleaning of your protective clothing.

V. SIGNS AND LABELS

Your employer is required to post warning signs and labels for your protection. Signs must be posted in regulated areas. The signs must warn that a cancer hazard is present, that only authorized employees may enter the area, and that no smoking or eating is allowed, and that respirators must be worn.

VI. MEDICAL EXAMINATIONS

If your exposure to arsenic is over the action level at least 30 days per year, or your have been exposed to arsenic for more than 10 years over the action level, your employer is required to provide you with a medical examination. The examination shall be every 6 months for employees over 45 years old or with more than 10 years exposure over the action level and annually for other covered employees. The initial medical examination must include a medical history; a chest X-ray; skin examination; nasal examination and sputum cytology examination for the early detection of lung cancer. In subsequent medical examinations, the chest X-ray is not required unless recommended by the physician. The cytology exams are only included in the initial examination and examinations given after you are either 45 years or older or have 10 or more years employment over the action level. The examining physician will provide a written opinion to your employer interpreting the results of the medical exams. You should also receive a copy of this opinion. The physician must not tell your employer any conditions he or she detects unrelated to occupational exposure to arsenic but must tell you those conditions.

VII.OBSERVATION OF MONITORING

Your employer is required to monitor your exposure to arsenic and you or your representatives are entitled to observe the monitoring procedure. You are entitled to receive an explanation of the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, you must also be provided with and must wear the protective clothing and equipment.

VIII. ACCESS TO RECORDS

You or your representative are entitled to records of your exposure to inorganic arsenic upon request to your employer. Your medical examination records can be furnished to you, your physician, or any other individual or organization that you designate if you request your employer to provide them.

IX. TRAINING AND NOTIFICATION

Additional information on all of these items plus training as to hazards of exposure to inorganic arsenic and the engineering and work practice controls associated with your job will also be provided by your employer. If you are exposed over the permissible exposure limit, your employer must inform you of that fact and the actions he or she is taking to reduce your exposures.

Substance Safety Data Sheet

I. Substance Identification

A. Substance: Cadmium.

B. 8-Hour, Time-weighted-average, Permissible Exposure Limit (TWA PEL):

1. TWA PEL: Five micrograms of cadmium per cubic meter of air 5 $\mu g/m^3$, time-weighted average (TWA) for an 8-hour workday.

C. Appearance: Cadmium metal - soft, blue-white, malleable, lustrous metal or grayish-white powder. Some cadmium compounds may also appear as a brown, yellow, or red powdery substance.

II. Health Hazard Data

A. Routes of Exposure.

Cadmium can cause local skin or eye irritation. Cadmium can affect your health if you inhale it or if you swallow it.

B. Effects of overexposure.

1. Short-term (acute) exposure: Cadmium is much more dangerous by inhalation than by ingestion. High exposures to cadmium that may be immediately dangerous to life or health occur in jobs where workers handle large quantities of cadmium dust or fume; heat cadmium-containing compounds or cadmium-coated surfaces; weld with cadmium solders or cut cadmium-containing materials such as bolts.

2. Severe exposure may occur before symptoms appear. Early symptoms may include mild irritation of the upper respiratory tract, a sensation of constriction of the throat, a metallic taste and/or a cough. A period of 1 - 10 hours may precede the onset of rapidly progressing shortness of breath, chest pain, and flu-like symptoms with weakness, fever, headache, chills, sweating and muscular pain. Acute pulmonary edema usually develops within 24 hours and reaches a maximum by three days. If death from asphyxia does not occur, symptoms may resolve within a week.

3. Long-term (chronic) exposure. Repeated or long-term exposure to cadmium, even at relatively low concentrations, may result in kidney damage and an increased risk of cancer of the lung and of the prostate.

C. Emergency First Aid Procedures

1. Eye exposure: Direct contact may cause redness or pain. Wash eyes immediately with large amounts of water, lifting the upper and lower eyelids. Get medical attention immediately.

2. Skin exposure: Direct contact may result in irritation. Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water. Get medical attention immediately.

3. Ingestion: Ingestion may result in vomiting, abdominal pain, nausea, diarrhea, headache and sore throat. Treatment for symptoms must be administered by medical personnel. Under no circumstances should the employer allow any person whom he retains, employs, supervises or controls to engage in therapeutic chelation. Such treatment is likely to translocate cadmium from pulmonary or other tissue to renal tissue. Get medical attention immediately.

4. Inhalation: If large amounts of cadmium are inhaled, the exposed person must be moved to fresh air at once. If breathing has stopped, perform cardiopulmonary resuscitation. Administer oxygen if available. Keep the affected person warm and at rest. Get medical attention immediately.

5. Rescue: Move the affected person from the hazardous exposure. If the exposed person has been overcome, attempt rescue only after notifying at least one other person of the emergency and

putting into effect established emergency procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the location of the emergency equipment before the need arises.

III. Employee Information

A. Protective Clothing and Equipment

1. Respirators: You may be required to wear a respirator for non-routine activities; in emergencies; while your employer is in the process of reducing cadmium exposures through engineering controls; and where engineering controls are not feasible. If respirators are worn in the future, they must have a joint Mine Safety and Health Administration (MSHA) and National Institute for Occupational Safety and Health (NIOSH) label of approval. Cadmium does not have a detectable odor except at levels well above the permissible exposure limits. If you can smell cadmium while wearing a respirator, proceed immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

2. Protective Clothing: You may be required to wear impermeable clothing, gloves, foot gear, a face shield, or other appropriate protective clothing to prevent skin contact with cadmium. Where protective clothing is required, your employer must provide clean garments to you as necessary to assure that the clothing protects you adequately. The employer must replace or repair protective clothing that has become torn or otherwise damaged.

3. Eye Protection: You may be required to wear splash-proof or dust resistant goggles to prevent eye contact with cadmium.

B. Employer Requirements

1. Medical: If you are exposed to cadmium at or above the action level, your employer is required to provide a medical examination, laboratory tests and a medical history according to the medical surveillance provisions under paragraph (l) of this standard. (See summary chart and tables in this Appendix A.) These tests shall be provided without cost to you. In addition, if you are accidentally exposed to cadmium under conditions known or suspected to constitute toxic exposure to cadmium, your employer is required to make special tests available to you.

2. Access to Records: All medical records are kept strictly confidential. You or your representative are entitled to see the records of measurements of your exposure to cadmium. Your medical examination records can be furnished to your personal physician or designated representative upon request by you to your employer.

3. Observation of Monitoring: Your employer is required to perform measurements that are representative of your exposure to cadmium and you or your designated representative are entitled to observe the monitoring procedure. You are entitled to observe the steps taken in the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, you or your representative must also be provided with, and must wear the protective clothing and equipment.

C. Employee Requirements

You will not be able to smoke, eat, drink, chew gum or tobacco, or apply cosmetics while working with cadmium in regulated areas. You will also not be able to carry or store tobacco products, gum, food, drinks or cosmetics in regulated areas because these products easily become contaminated with cadmium from the workplace and can therefore create another source unnecessary of cadmium exposure.

Some workers will have to change out of work clothes and shower at the end of the day, as part of their workday, in order to wash cadmium from skin and hair. Handwashing and cadmium-free eating

facilities shall be provided by the employer and proper hygiene should always be performed before eating. It is also recommended that you do not smoke or use tobacco products, because among other things, they naturally contain cadmium. For further information, read the labeling on such products.

IV. Physician Information

A. Introduction

The medical surveillance provisions of paragraph (l) generally are aimed at accomplishing three main interrelated purposes: first, identifying employees at higher risk of adverse health effects from excess, chronic exposure to cadmium; second, preventing cadmium-induced disease; and third, detecting and minimizing existing cadmium-induced disease. The core of medical surveillance in this standard is the early and periodic monitoring of the employee's biological indicators of: a) recent exposure to cadmium; b) cadmium body burden; and c) potential and actual kidney damage associated with exposure to cadmium.

The main adverse health effects associated with cadmium overexposure are lung cancer and kidney dysfunction. It is not yet known how to adequately biologically monitor human beings to specifically prevent cadmium-induced lung cancer. By contrast, the kidney can be monitored to provide prevention and early detection of cadmium-induced kidney damage. Since, for non-carcinogenic effects, the kidney is considered the primary target organ of chronic exposure to cadmium, the medical surveillance provisions of this standard effectively focus on cadmium-induced kidney disease. Within that focus, the aim, where possible, is to prevent the onset of such disease and, where necessary, to minimize such disease as may already exist. The by-products of successful prevention of kidney disease are anticipated to be the reduction and prevention of other cadmium-induced diseases.

B. Health Effects

The major health effects associated with cadmium overexposure are described below.

1. Kidney

The most prevalent non-malignant disease observed among workers chronically exposed to cadmium is kidney dysfunction. Initially, such dysfunction is manifested as proteinuria. The proteinuria associated with cadmium exposure is most commonly characterized by excretion of low-molecular weight proteins (15,000 to 40,000 MW) accompanied by loss of electrolytes, uric acid, calcium, amino acids, and phosphate. The compounds commonly excreted include: beta-2-microglobulin ($ß_2$-M), retinol binding protein (RBP), immunoglobulin light chains, and lysozyme. Excretion of low molecular weight proteins are characteristic of damage to the proximal tubules of the kidney (Iwao et al., 1980).

It has also been observed that exposure to cadmium may lead to urinary excretion of high-molecular weight proteins such as albumin, immunoglobulin G, and glycoproteins (Ex. 29). Excretion of high-molecular weight proteins is typically indicative of damage to the glomeruli of the kidney. Bernard et al., (1979) suggest that damage to the glomeruli and damage to the proximal tubules of the kidney may both be linked to cadmium exposure but they may occur independently of each other.

Several studies indicate that the onset of low-molecular weight proteinuria is a sign of irreversible kidney damage (Friberg et al., 1974; Roels et al., 1982; Piscator 1984; Elinder et al., 1985; Smith et al., 1986). Above specific levels of $ß_2$-M associated with cadmium exposure it is unlikely that $ß_2$-M levels return to normal even when cadmium exposure is eliminated by removal of the individual from the cadmium work environment (Friberg, Ex. 29, 1990).

Some studies indicate that such proteinuria may be progressive; levels of $ß_2$-M observed in the urine increase with time even after cadmium exposure has ceased. See, for example, Elinder et al., 1985. Such observations, however, are not universal, and it has been suggested that studies in

which proteinuria has not been observed to progress may not have tracked patients for a sufficiently long time interval (Jarup, Ex. 8-661).

When cadmium exposure continues after the onset of proteinuria, chronic nephrotoxicity may occur (Friberg, Ex. 29). Uremia results from the inability of the glomerulus to adequately filter blood. This leads to severe disturbance of electrolyte concentrations and may lead to various clinical complications including kidney stones (L-140-50).

After prolonged exposure to cadmium, glomerular proteinuria, glucosuria, aminoaciduria, phosphaturia, and hypercalciuria may develop (Exs. 8-86, 4-28, 14-18). Phosphate, calcium, glucose, and amino acids are essential to life, and under normal conditions, their excretion should be regulated by the kidney. Once low molecular weight proteinuria has developed, these elements dissipate from the human body. Loss of glomerular function may also occur, manifested by decreased glomerular filtration rate and increased serum creatinine. Severe cadmium- induced renal damage may eventually develop into chronic renal failure and uremia (Ex. 55).

Studies in which animals are chronically exposed to cadmium confirm the renal effects observed in humans (Friberg et al., 1986). Animal studies also confirm problems with calcium metabolism and related skeletal effects which have been observed among humans exposed to cadmium in addition to the renal effects. Other effects commonly reported in chronic animal studies include anemia, changes in liver morphology, immunosuppression and hypertension. Some of these effects may be associated with co- factors. Hypertension, for example, appears to be associated with diet as well as cadmium exposure. Animals injected with cadmium have also shown testicular necrosis (Ex. 8-86B).

2. Biological Markers

It is universally recognized that the best measures of cadmium exposures and its effects are measurements of cadmium in biological fluids, especially urine and blood. Of the two, CdU is conventionally used to determine body burden of cadmium in workers without kidney disease. CdB is conventionally used to monitor for recent exposure to cadmium. In addition, levels of CdU and CdB historically have been used to predict the percent of the population likely to develop kidney disease (Thun et al., Ex. L-140-50; WHO, Ex. 8-674; ACGIH, Exs. 8-667, 140-50).

The third biological parameter upon which OSHA relies for medical surveillance is Beta-2-microglobulin in urine ($ß_2$-M), a low molecular weight protein. Excess $ß_2$-M has been widely accepted by physicians and scientists as a reliable indicator of functional damage to the proximal tubule of the kidney (Exs. 8- 447, 144-3-C, 4-47, L-140-45, 19-43-A).

Excess $ß_2$-M is found when the proximal tubules can no longer reabsorb this protein in a normal manner. This failure of the proximal tubules is an early stage of a kind of kidney disease that commonly occurs among workers with excessive cadmium exposure. Used in conjunction with biological test results indicating abnormal levels of CdU and CdB, the finding of excess $ß_2$-M can establish for an examining physician that any existing kidney disease is probably cadmium-related (Trs. 6/6/90, pp. 82- 86, 122, 134). The upper limits of normal levels for cadmium in urine and cadmium in blood are 3 µg Cd/gram creatinine in urine and 5 µg Cd/liter whole blood, respectively. These levels were derived from broad-based population studies.

Three issues confront the physicians in the use of $ß_2$-M as a marker of kidney dysfunction and material impairment. First, there are a few other causes of elevated levels of $ß_2$-M not related to cadmium exposures, some of which may be rather common diseases and some of which are serious diseases (e.g., myeloma or transient flu, Exs. 29 and 8-086). These can be medically evaluated as alternative causes (Friberg, Ex. 29). Also, there are other factors that can cause $ß_2$-M to degrade so that low levels would result in workers with tubular dysfunction. For example, regarding the degradation of $ß_2$-M, workers with acidic urine (pH < 6) might have $ß_2$-M levels that are within the "normal" range when in fact kidney dysfunction has occurred (Ex. L-140-1) and the

low molecular weight proteins are degraded in acid urine. Thus, it is very important that the pH of urine be measured, that urine samples be buffered as necessary (See Appendix F.), and that urine samples be handled correctly, i.e., measure the pH of freshly voided urine samples, then if necessary, buffer to pH > 6 (or above for shipping purposes), measure pH again and then, perhaps, freeze the sample for storage and shipping. (See also Appendix F.) Second, there is debate over the pathological significance of proteinuria, however, most world experts believe that $ß_2$-M levels greater than 300 µg/g Cr are abnormal (Elinder, Ex. 55, Friberg, Ex. 29). Such levels signify kidney dysfunction that constitutes material impairment of health. Finally, detection of $ß_2$-M at low levels has often been considered difficult, however, many laboratories have the capability of detecting excess $ß_2$-M using simple kits, such as the Phadebas Delphia test, that are accurate to levels of 100 µg $ß_2$-M/g Cr U (Ex. L-140-1).

Specific recommendations for ways to measure $ß_2$-M and proper handling of urine samples to prevent degradation of $ß_2$-M have been addressed by OSHA in Appendix F, in the section on laboratory standardization. All biological samples must be analyzed in a laboratory that is proficient in the analysis of that particular analyte, under paragraph (l)(1)(iv). [See Appendix F]. Specifically, under paragraph (l)(1)(iv), the employer is to assure that the collecting and handling of biological samples of cadmium in urine (CdU), cadmium in blood (CdB), and beta-2 microglobulin in urine ($ß_2$-M) taken from employees is collected in a manner that assures reliability. The employer must also assure that analysis of biological samples of cadmium in urine (CdU), cadmium in blood (CdB), and beta-2 microglobulin in urine ($ß_2$-M) taken from employees is performed in laboratories with demonstrated proficiency for that particular analyte. (See Appendix F.)

3. Lung and Prostrate Cancer

   The primary sites for cadmium-associated cancer appear to be the lung and the prostate (L-140-50). Evidence for an association between cancer and cadmium exposure derives from both epidemiological studies and animal experiments. Mortality from prostrate cancer associated with cadmium is slightly elevated in several industrial cohorts, but the number of cases is small and there is not clear dose-response relationship. More substantive evidence exists for lung cancer.

   The major epidemiological study of lung cancer was conducted by Thun et al., (Ex. 4-68). Adequate data on cadmium exposures were available to allow evaluation of dose-response relationships between cadmium exposure and lung cancer. A statistically significant excess of lung cancer attributed to cadmium exposure was observed in this study even when confounding variables such as co-exposure to arsenic and smoking habits were taken into consideration (Ex. L-140-50).

   The primary evidence for quantifying a link between lung cancer and cadmium exposure from animal studies derives from two rat bioassay studies; one by Takenaka et al., (1983), which is a study of cadmium chloride and a second study by Oldiges and Glaser (1990) of four cadmium compounds.

   Based on the above cited studies, the U.S. Environmental Protection Agency (EPA) classified cadmium as "B1", a probable human carcinogen, in 1985 (Ex. 4-4). The International Agency for Research on Cancer (IARC) in 1987 also recommended that cadmium be listed as "2A", a probable human carcinogen (Ex. 4- 15). The American Conference of Governmental Industrial Hygienists (ACGIH) has recently recommended that cadmium be labeled as a carcinogen. Since 1984, NIOSH has concluded that cadmium is possibly a human carcinogen and has recommended that exposures be controlled to the lowest level feasible.

4. Non-carcinogenic Effects

   Acute pneumonitis occurs 10 to 24 hours after initial acute inhalation of high levels of cadmium fumes with symptoms such as fever and chest pain (Exs. 30, 8-86B). In extreme exposure cases

pulmonary edema may develop and cause death several days after exposure. Little actual exposure measurement data is available on the level of airborne cadmium exposure that causes such immediate adverse lung effects, nonetheless, it is reasonable to believe a cadmium concentration of approximately 1 mg/m3 over an eight hour period is "immediately dangerous" (55 FR 4052, ANSI; Ex. 8-86B).

In addition to acute lung effects and chronic renal effects, long term exposure to cadmium may cause other severe effects on the respiratory system. Reduced pulmonary function and chronic lung disease indicative of emphysema have been observed in workers who have had prolonged exposure to cadmium dust or fumes (Exs. 4-29, 4-22, 4-42, 4-50, 4-63). In a study of workers conducted by Kazantzis et al., a statistically significant excess of worker deaths due to chronic bronchitis was found, which in his opinion was directly related to high cadmium exposures of 1 mg/m3 or more (Tr. 6/8/90, pp. 156-157).

Cadmium need not be respirable to constitute a hazard. Inspirable cadmium particles that are too large to be respirable but small enough to enter the tracheobronchial region of the lung can lead to bronchoconstriction, chronic pulmonary disease, and cancer of that portion of the lung. All of these diseases have been associated with occupational exposure to cadmium (Ex. 8- 86B). Particles that are constrained by their size to the extra-thoracic regions of the respiratory system such as the nose and maxillary sinuses can be swallowed through mucocillary clearance and be absorbed into the body (ACGIH, Ex. 8-692). The impaction of these particles in the upper airways can lead to anosmia, or loss of sense of smell, which is an early indication of overexposure among workers exposed to heavy metals. This condition is commonly reported among cadmium-exposed workers (Ex. 8-86-B).

I. SUBSTANCE IDENTIFICATION INORGANIC LEAD

A Substance: Pure lead (Pb) is a heavy metal at room temperature and pressure and is a basic chemical element. It can combine with various other substances to form numerous lead compounds.

B Compounds covered by the standard: The word "lead" when used in this standard means elemental lead, all inorganic lead compounds and a class of organic lead compounds called lead soaps. This standard does not apply to other organic lead compounds.

C Uses: Exposure to lead occurs in several different occupations in the construction industry, including demolition or salvage of structures where lead or lead-containing materials are present; removal or encapsulation of lead-containing materials, new construction, alteration, repair, or renovation of structures that contain lead or materials containing lead; installation of products containing lead. In addition, there are construction related activities where exposure to lead may occur, including transportation, disposal, storage, or containment of lead or materials containing lead on construction sites, and maintenance operations associated with construction activities.

D Permissible exposure: The permissible exposure limit (PEL) set by the standard is 50 micrograms of lead per cubic meter of air (50 µg/m3) averaged over an 8-hour workday.

E Action level: The standard establishes an action level of 30 micrograms of lead per cubic meter of air (30 µg/m3) averaged over an 8-hour workday. The action level triggers several ancillary provisions of the standard such as exposure monitoring, medical surveillance, and training.

II. HEALTH HAZARD DATA

A Ways in which lead enters your body. When absorbed into your body in certain doses, lead is a toxic substance. The object of the lead standard is to prevent absorption of harmful quantities of lead. The standard is intended to protect you not only from the immediate toxic effects of lead, but also from the serious toxic effects that may not become apparent until years of exposure have passed. Lead can be absorbed into your body by inhalation (breathing) and ingestion (eating). Lead (except for certain organic lead compounds not covered by the standard, such as tetraethyl lead) is not absorbed through your skin. When lead is scattered in the air as a dust, fume or mist it can be inhaled and absorbed through your lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. You can also absorb lead through your digestive system if lead gets into your mouth and is swallowed. If you handle food, cigarettes, chewing tobacco, or make-up which have lead on them or handle them with hands contaminated with lead, this will contribute to ingestion. A significant portion of the lead that you inhale or ingest gets into your blood stream. Once in your blood stream, lead is circulated throughout your body and stored in various organs and body tissues. Some of this lead is quickly filtered out of your body and excreted, but some remains in the blood and other tissues. As exposure to lead continues, the amount stored in your body will increase if you are absorbing more lead than your body is excreting. Even though you may not be aware of any immediate symptoms of disease, this lead stored in your tissues can be slowly causing irreversible damage, first to individual cells, then to your organs and whole body systems.

B Effects of overexposure to lead.

1. Short term (acute) overexposure. Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise which develops quickly to seizures, coma, and death from cardiorespiratory arrest. A short term dose of lead can lead to acute encephalopathy. Short term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however, arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects which take longer to acquire. Lead adversely affects numerous body systems, and causes forms of health impairment and disease which arise after periods of exposure as short as days or as long as several years.

2. Long-term (chronic) overexposure. Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic there may be severe abdominal pain. Damage to the central nervous system in general and the brain (encephalopathy) in particular is one of the most severe forms of lead poisoning. The most severe, often fatal, form of encephalopathy may be preceded by vomiting, a feeling of dullness progressing to drowsiness and stupor, poor memory, restlessness, irritability, tremor, and convulsions. It may arise suddenly with the onset of seizures, followed by coma, and death. There is a tendency for muscular weakness to develop at the same time. This weakness may progress to paralysis often observed as a characteristic "wrist drop" or "foot drop" and is a manifestation of a disease to the nervous system called peripheral neuropathy. Chronic overexposure to lead also results in kidney disease with few, if any, symptoms appearing until extensive and most likely permanent kidney damage has occurred. Routine laboratory tests reveal the presence of this kidney disease only after about two-thirds of kidney function is lost. When overt symptoms of urinary dysfunction arise, it is often too late to correct or prevent worsening conditions, and progression to kidney dialysis or death is possible. Chronic overexposure to lead impairs the reproductive systems of both men and women. Overexposure to lead may result in decreased sex drive, impotence and sterility in men. Lead can alter the structure of sperm cells raising the risk of birth defects. There is evidence of miscarriage and stillbirth in women whose husbands were exposed to lead or who were exposed to lead themselves. Lead exposure also may result in decreased fertility, and abnormal menstrual cycles in women. The course of pregnancy may be adversely affected by exposure to lead since lead crosses the placental barrier and poses risks to developing fetuses. Children born of parents either one of whom were exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral disorders or die during the first year of childhood. Overexposure to lead also disrupts the blood-forming system resulting in decreased hemoglobin (the substance in the blood that carries oxygen to the cells) and ultimately anemia. Anemia is characterized by weakness, pallor and fatigability as a result of decreased oxygen carrying capacity in the blood.

3. Exposure to lead throughout a working lifetime requires that a worker's blood lead level (BLL, also expressed as PbB) be maintained at or below forty micrograms per deciliter of whole blood (40 µg/dl). The blood lead levels of workers (both male and female workers) who intend to have children should be maintained below 30 µg/dl to minimize adverse reproductive health effects to the parents and to the developing fetus. The measurement of your blood lead level (BLL) is the most useful indicator of the amount of lead being absorbed by your body. Blood lead levels are most often reported in units of milligrams (mg) or micrograms (ug) of lead (1 mg=1000 mg) per 100 grams (100g), 100 milliliters (100 ml) or deciliter (dl) of blood. These three units are essentially the same. Sometime BLLs are expressed in the form of mg% or mg%. This is a shorthand notation for 100g, 100 ml, or dl. (Reference to BLL measurements in this standard are expressed in the form of µg/dl.)

   BLL measurements show the amount of lead circulating in your blood stream, but do not give any information about the amount of lead stored in your various tissues. BLL measurements merely show current absorption of lead, not the effect that lead is having on your body or the effects that past lead exposure may have already caused. Past research into lead-related diseases, however, has focused heavily on associations between BLLs and various diseases. As a result, your BLL is an important indicator of the likelihood that you will gradually acquire a lead-related health impairment or disease.

   Once your blood lead level climbs about 40 µg/dl, your risk of disease increases. There is a wide variability of individual response to lead, thus it is difficult to say that a particular BLL in a given

person will cause a particular effect. Studies have associated fatal encephalopathy with BLLs as low as 150 µg/dl. Other studies have shown other forms of diseases in some workers with BLLs well below 80 µg/dl. Your BLL is a crucial indicator of the risks to your health, but one other factor is also extremely important. This factor is the length of time you have had elevated BLLs. The longer you have an elevated BLL, the greater the risk that large quantities of lead are being gradually stored in your organs and tissues (body burden). The greater your overall body burden, the greater the chances of substantial permanent damage. The best way to prevent all forms of lead-related impairments and diseases -- both short term and long term -- is to maintain your BLL below 40 µg/dl. The provisions of the standard are designed with this end in mind.

Your employer has prime responsibility to assure that the provisions of the standard are complied with both by the company and by individual workers. You, as a worker, however, also have a responsibility to assist your employer in complying with the standard. You can play a key role in protecting your own health by learning about the lead hazards and their control, learning what the standard requires, following the standard where it governs your own actions, and seeing that your employer complies with provisions governing his or her actions.

4. Reporting signs and symptoms of health problems. You should immediately notify your employer if you develop signs or symptoms associated with lead poisoning or if you desire medical advice concerning the effects of current or past exposure to lead or your ability to have a healthy child. You should also notify your employer if you have difficulty breathing during a respirator fit test or while wearing a respirator. In each of these cases, your employer must make available to you appropriate medical examinations or consultations. These must be provided at no cost to you and at a reasonable time and place. The standard contains a procedure whereby you can obtain a second opinion by a physician of your choice if your employer selected the initial physician.

Pentachlorophenol	Formula: C_6Cl_5OH	CAS#: 87-86-5	RTECS#: SM6300000	IDLH: 2.5 mg/m^3
Conversion:	**DOT:** 3155 154			

Synonyms/Trade Names: PCP; Penta; 2,3,4,5,6-Pentachlorophenol

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3 [skin]
OSHA PEL: TWA 0.5 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 5512

Physical Description: Colorless to white, crystalline solid with a benzene-like odor. [fungicide]

Chemical & Physical Properties:
MW: 266.4
BP: 588°F (Decomposes)
Sol: 0.001%
FI.P: NA
IP: NA
Sp.Gr: 1.98
VP(77°F): 0.0001 mmHg
MLT: 374°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2.5 mg/m^3: CcrOv95*/PaprOvHie*/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids, alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose, throat; sneez, cough; lass, anor, low-wgt; sweat; head, dizz; nau, vomit; dysp, chest pain; high fever; derm
TO: Eyes, skin, resp sys, CVS, liver, kidneys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

2,3,7,8-Tetrachloro-dibenzo-p-dioxin	Formula: $C_{12}H_4Cl_4O_2$	CAS#: 1746-01-6	RTECS#: HP3500000	IDLH: Ca [N.D.]
Conversion:	**DOT:**			

Synonyms/Trade Names: Dioxin; Dioxine; TCDBD; TCDD; 2,3,7,8-TCDD
[**Note:** Formed during past production of 2,4,5-trichlorophenol, 2,4,5-T & 2(2,4,5-trichlorophenoxy)propionic acid.]

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless to white, crystalline solid.
[**Note:** Exposure may occur through contact at previously contaminated worksites.]

Chemical & Physical Properties:
MW: 322.0
BP: Decomposes
Sol: 0.00000002%
FI.P: ?
IP: ?
Sp.Gr: ?
VP(77°F): 0.000002 mmHg
MLT: 581°F
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: UV light (decomposes)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes; allergic derm, chloracne; porphyria; GI dist; possible repro, terato effects; in animals: liver, kidney damage; hemorr; [carc]
TO: Eyes, skin, liver, kidneys, repro sys [in animals: tumors at many sites]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Benzene	**Formula:** C_6H_5	**CAS#:** 71-43-2	**RTECS#:** CY1400000	**IDLH:** Ca [500 ppm]
Conversion: 1 ppm = 3.19 mg/m^3	**DOT:** 1114 130			
Synonyms/Trade Names: Benzol, Phenyl hydride				
Exposure Limits: **NIOSH REL:** Ca TWA 0.1 ppm ST 1 ppm See Appendix A **OSHA PEL:** [1910.1028] TWA 1 ppm ST 5 ppm See Appendix F			**Measurement Methods (see Table 1):** **NIOSH** 1500, 1501, 3700, 3800 **OSHA** 12, 1005	
Physical Description: Colorless to light-yellow liquid with an aromatic odor. [**Note:** A solid below 42°F.]				
Chemical & Physical Properties: **MW:** 78.1 **BP:** 176°F **Sol:** 0.07% **FI.P:** 12°F **IP:** 9.24 eV **Sp.Gr:** 0.88 **VP:** 75 mmHg **FRZ:** 42°F **UEL:** 7.8% **LEL:** 1.2% Class IB Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Eyewash Quick drench		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE **See Appendix E** (page 351)	
Incompatibilities and Reactivities: Strong oxidizers, many fluorides & perchlorates, nitric acid				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, nose, resp sys; dizz; head, nau, staggered gait; anor, lass; derm; bone marrow depres; [carc] **TO:** Eyes, skin, resp sys, blood, CNS, bone marrow [leukemia]			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed	

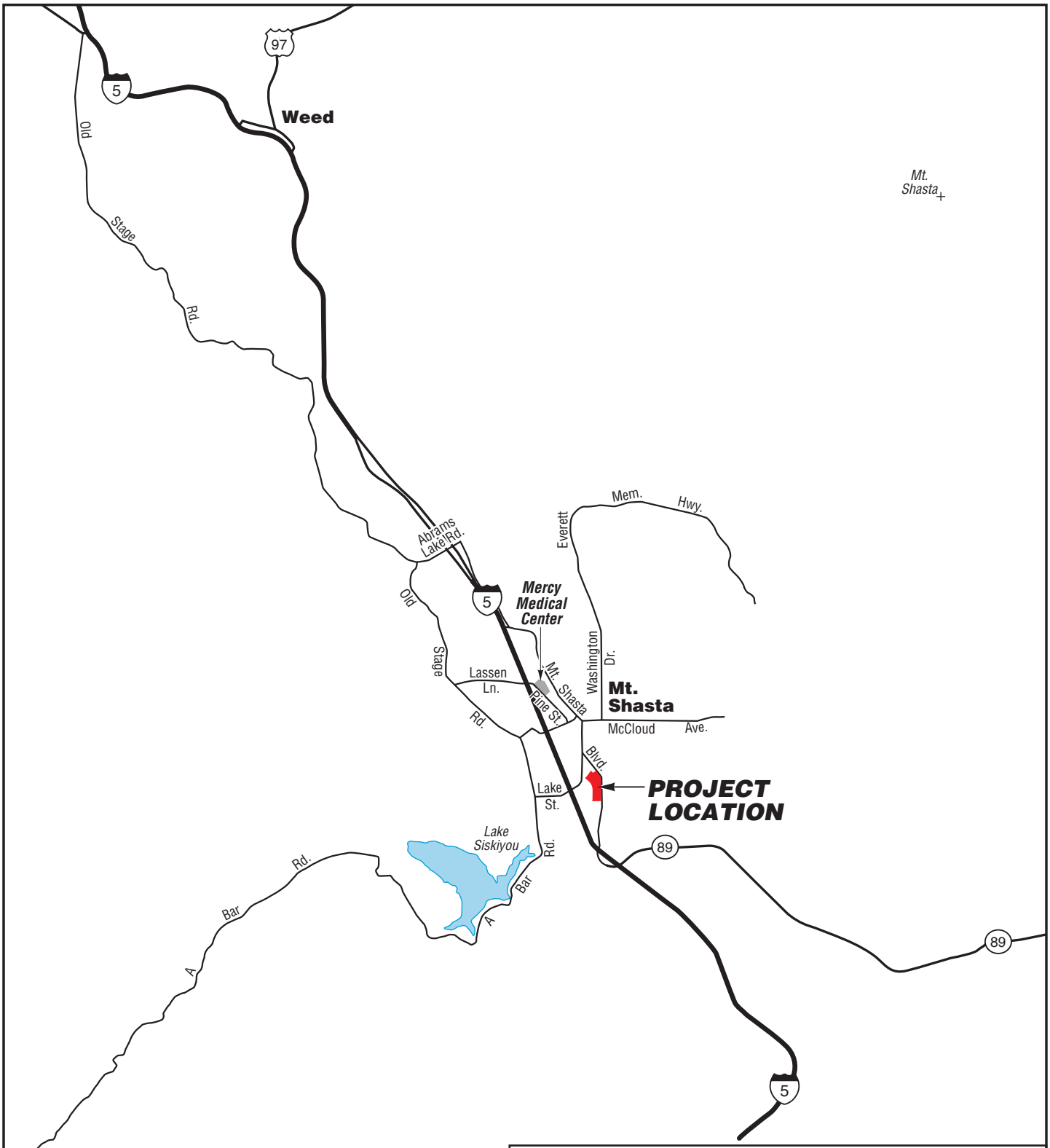
Ethyl benzene	**Formula:** $CH_3CH_2C_6H_5$	**CAS#:** 100-41-4	**RTECS#:** DA0700000	**IDLH:** 800 ppm [10%LEL]
Conversion: 1 ppm = 4.34 mg/m^3	**DOT:** 1175 130			
Synonyms/Trade Names: Ethylbenzol, Phenylethane				
Exposure Limits: **NIOSH REL:** TWA 100 ppm (435 mg/m^3) ST 125 ppm (545 mg/m^3) **OSHA PEL†:** TWA 100 ppm (435 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1501 **OSHA** 7, 1002	
Physical Description: Colorless liquid with an aromatic odor.				
Chemical & Physical Properties: **MW:** 106.2 **BP:** 277°F **Sol:** 0.01% **FI.P:** 55°F **IP:** 8.76 eV **Sp.Gr:** 0.87 **VP:** 7 mmHg **FRZ:** -139°F **UEL:** 6.7% **LEL:** 0.8% Class IB Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **800 ppm:** CcrOv*/GmFOv/PaprOv*/ Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Strong oxidizers				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, muc memb; head; derm; narco, coma **TO:** Eyes, skin, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush prompt **Breath:** Resp support **Swallow:** Medical attention immed	

Stoddard solvent	**Formula:**	**CAS#:** 8052-41-3	**RTECS#:** WJ8925000	**IDLH:** 20,000 mg/m^3
Conversion:	**DOT:** 1268 128 (petroleum distillates, n.o.s.)			
Synonyms/Trade Names: Dry cleaning safety solvent, Mineral spirits, Petroleum solvent, Spotting naphtha [**Note:** A refined petroleum solvent with a flash point of 102-110°F, boiling point of 309-396°F, and containing >65% C_{10} or higher hydrocarbons.]				
Exposure Limits: **NIOSH REL:** TWA 350 mg/m^3 C 1800 mg/m^3 [15-minute] **OSHA PEL†:** TWA 500 ppm (2900 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1550	
Physical Description: Colorless liquid with a kerosene-like odor.				
Chemical & Physical Properties: **MW:** Varies **BP:** 309-396°F **Sol:** Insoluble **FI.P:** 102-110°F **IP:** ? **Sp.Gr:** 0.78 **VP:** ? **FRZ:** ? **UEL:** ? **LEL:** ? Class II Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **3500 mg/m^3:** CcrOv*/Sa* **8750 mg/m^3:** Sa:Cf*/PaprOv* **17,500 mg/m^3:** CcrFOv/GmFOv/PaprTOv*/ ScbaF/SaF **20,000 mg/m^3:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Strong oxidizers				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, nose, throat; dizz; derm; chemical pneu (aspir liquid); in animals: kidney damage **TO:** Eyes, skin, resp sys, CNS, kidneys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed	

Toluene	**Formula:** $C_6H_5CH_3$	**CAS#:** 108-88-3	**RTECS#:** XS5250000	**IDLH:** 500 ppm
Conversion: 1 ppm = 3.77 mg/m^3	**DOT:** 1294 130			
Synonyms/Trade Names: Methyl benzene, Methyl benzol, Phenyl methane, Toluol				
Exposure Limits: **NIOSH REL:** TWA 100 ppm (375 mg/m^3) ST 150 ppm (560 mg/m^3) **OSHA PEL†:** TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)			**Measurement Methods (see Table 1):** **NIOSH** 1500, 1501, 3800, 4000 **OSHA** 111	
Physical Description: Colorless liquid with a sweet, pungent, benzene-like odor.				
Chemical & Physical Properties: **MW:** 92.1 **BP:** 232°F **Sol(74°F):** 0.07% **FI.P:** 40°F **IP:** 8.82 eV **Sp.Gr:** 0.87 **VP:** 21 mmHg **FRZ:** -139°F **UEL:** 7.1% **LEL:** 1.1% Class IB Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **500 ppm:** CcrOv*/PaprOv*/ GmFOv/Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Strong oxidizers				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, nose; lass, conf, euph, dizz, head; dilated pupils, lac; anxi, musc ftg, insom; pares; derm; liver, kidney damage **TO:** Eyes, skin, resp sys, CNS, liver, kidneys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed	

VM & P Naphtha	**Formula:**	**CAS#:** 8032-32-4	**RTECS#:** OI6180000	**IDLH:** N.D.
Conversion:	**DOT:** 1268 128 (petroleum distillates, n.o.s.)			
Synonyms/Trade Names: Ligroin, Painters naphtha, Petroleum ether, Petroleum spirit, Refined solvent naphtha, Varnish makers' & painters' naphtha				
Exposure Limits: **NIOSH REL:** TWA 350 mg/m^3 C 1800 mg/m^3 [15-minute] **OSHA PEL†:** none			**Measurement Methods (see Table 1):** **NIOSH** 1550 **OSHA** 48	
Physical Description: Clear to yellowish liquid with a pleasant, aromatic odor.				
Chemical & Physical Properties: **MW:** 87-114 (approx) **BP:** 203-320°F **Sol:** Insoluble **Fl.P:** 20-55°F **IP:** ? **Sp.Gr(60°F):** 0.73-0.76 **VP:** 2-20 mmHg **FRZ:** ? **UEL:** 6.0% **LEL:** 1.2% Class IB Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **3500 mg/m^3:** CcrOv/Sa **8750 mg/m^3:** Sa:Cf/PaprOv **17,500 mg/m^3:** CcrFOv/GmFOv/PaprTOv/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: None reported [**Note:** VM&P Naphtha is a refined petroleum solvent predominantly C_7-C_{11} which is typically 55% paraffins, 30% monocycloparaffins, 2% dicycloparaffins & 12% alklybenzenes.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, upper resp sys; derm; CNS depres; chemical pneu (aspir liquid) **TO:** Eyes, skin, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed	

m-Xylene	**Formula:** $C_6H_4(CH_3)_2$	**CAS#:** 108-38-3	**RTECS#:** ZE2275000	**IDLH:** 900 ppm
Conversion: 1 ppm = 4.34 mg/m^3	**DOT:** 1307 130			
Synonyms/Trade Names: 1,3-Dimethylbenzene; meta-Xylene; m-Xylol				
Exposure Limits: **NIOSH REL:** TWA 100 ppm (435 mg/m^3) ST 150 ppm (655 mg/m^3) **OSHA PEL†:** TWA 100 ppm (435 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1501, 3800 **OSHA** 1002	
Physical Description: Colorless liquid with an aromatic odor.				
Chemical & Physical Properties: **MW:** 106.2 **BP:** 282°F **Sol:** Slight **Fl.P:** 82°F **IP:** 8.56 eV **Sp.Gr:** 0.86 **VP:** 9 mmHg **FRZ:** -54°F **UEL:** 7.0% **LEL:** 1.1% Class IC Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **900 ppm:** CcrOv*/PaprOv*/Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Strong oxidizers, strong acids				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, nose, throat; dizz, excitement, drow, inco, staggering gait; corn vacuolization; anor, nau, vomit, abdom pain; derm **TO:** Eyes, skin, resp sys, CNS, GI tract, blood, liver, kidneys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed	



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Old Mill

Mt. Shasta,
California

VICINITY MAP

S9717-06-01	October 2013	Figure 1