DRAFT FINAL REMOVAL ACTION WORKPLAN

The Landing – Old Mill Section
Mount Shasta Boulevard and Loveta Lane
Mt. Shasta, Siskyou County, California

PREPARED FOR:

BROWNFIELDS AND ENVIRONMENTAL RESTORATION PROGRAM
DEPARTMENT OF TOXIC SUBSTANCES CONTROL
8800 CAL CENTER DRIVE
SACRAMENTO, CALIFORNIA 95826

PREPARED BY:

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

GEOCON PROJECT NO. S9850-03-13B **APRIL 2018**

Project No. S9850-03-13B
April 24, 2018

Duane White, PE
Project Manager
Brownfields and Environmental Restoration Program
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, California 95826

Subject: DRAFT FINAL REMOVAL ACTION WORKPLAN
THE LANDING – OLD MILL SECTION
MT. SHASTA BOULEVARD AND LOVETA LANE
MT. SHASTA, CALIFORNIA
CONTRACT NO. 17-T4360, WORK ORDER NO. 1-360-1.0-102246

Dear Mr. White:

In accordance with the above-referenced contract and work order, we have prepared this Final Removal Action Workplan (RAW) for The Landing – Old Mill Section (the Site) located Mount Shasta Boulevard and Loveta Lane in Mt. Shasta, California. The Site is identified by Siskiyou County assessor's parcel number 067-010-010.

This RAW was prepared for the City of Mt. Shasta (the City) under a Targeted Site Investigation grant from the United States Environmental Protection Agency with oversight by the California Department of Toxic Substances Control. It was prepared pursuant to California Health and Safety Code Chapter 6.8, Sections 25323.1 and 25356.1, California Senate Bill 1706, and the *National Oil and Hazardous Substances Pollution Contingency Plan*.

The RAW describes the nature, source, and extent of contaminant impacts, presents an abbreviated human health risk assessment and ecological scoping assessment, an engineering evaluation and cost analysis for four removal action alternatives, and describes the applicable or relevant and appropriate requirements for implementation of the selected alternative.

We appreciate the opportunity to work with the DTSC on this project. Please call if you have any questions or would like to discuss any aspect of the RAW.

Sincerely,

GEOCON CONSULTANTS, INC.

Nicole Hastings-Bethel
Project Environmental Scientist

Jim Brake, PG
Senior Geologist

REGISTERED GEOLOGIST • JAMES F. BRAKE NO. 5758 • STATE OF CALIFORNIA

DRAFT FINAL

IDENTIFICATION FORM

Document Title:	Draft Final Removal Action Workplan The Landing – Old Mill Section
Site Location:	Mt. Shasta Boulevard and Loveta Lane, Mt. Shasta, California
Contract No.:	17-T4360
Work Order No.:	1-360-1.0-102246
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Geocon Project Manager:

Approval: ______________________ Date: April 24, 2018
Nicole Hastings-Bethel

Geocon Program Manager:

Approval: ______________________ Date: April 24, 2018
Jim Brake, PG No. 5753

This document has been prepared for the California Environmental Protection Agency (CalEPA), Department of Toxic Substances Control (DTSC). The material herein is not to be disclosed to, discussed with, or made available to any person(s) for any reason without prior express approval of the appropriate responsible DTSC officer.

DRAFT FINAL

APPROVAL FORM

Document Title: Draft Final Removal Action Workplan
The Landing – Old Mill Section

Site Location: Mt. Shasta Boulevard and Loveta Lane, Mt. Shasta, California

Contract No.: 17-T4360

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Duane White, PE

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Nicole Hastings-Bethel and Jim Brake, Project/Technical Managers (project file)
Geocon Consultants, Inc.

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LIST OF ACRONYMS AND ABBREVIATIONS

ALM	Adult Lead Model
APN	assessor's parcel number
ARAR	applicable or relevant and appropriate requirement
BTV	background threshold value
CDMG	California Division of Mines and Geology
Cal-EPA	California Environmental Protection Agency
Cal-OSHA	California Occupational Safety and Health Administration
CEQA	California Environmental Quality Act
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CNDDB	California Natural Diversity Database
cm^2	square centimeter
COC	contaminant of concern
COPEC	chemical of potential ecological concern
CVRWQCB	Central Valley Regional Water Quality Control Board
DRO	diesel-range organics
DTSC	Department of Toxic Substances Control
DTSC-SL	DTSC Screening Level – HERO Note 3
ED	exposure duration
EE/CA	engineering evaluation/cost analysis
Ecorp	Ecorp Consulting, Inc.
ECO-SSL	ecological soil screening levels
EF	exposure frequency
EIR	Environmental Impact Report
EPC	exposure point concentration
ET	exposure time
HI	hazard index
H&K	Holdrege and Kull
HERO	Human and Ecological Risk Office
HHRA	human health risk assessment
HQ	hazard quotient
IUR	inhalation unit risk
kg	kilogram
KM	Kaplan Meier
LUC	land use covenant
µg/dl	micrograms per deciliter
µg/l	micrograms per liter
M&E	Metcalf and Eddy
mg/day	milligrams per day
mg/kg	milligrams per kilogram

LIST OF ACRONYMS (continued)

mg/l	milligrams per liter
mg/cm^2	milligrams per square centimeter
m^3/day	cubic meters per day
m^3/day	cubic meters per kilogram
MSL	mean sea level
ng/kg	nanograms per kilogram
OEHHA	Office of Environmental Health Hazard Assessment
O&M	operations and maintenance
OSHA	Federal Occupational Safety and Health Administration
ORO	oil-range organics
PAH	polyaromatic hydrocarbons
PAL	project action level
PCP	pentachlorophenol
PEF	particulate emission factor
PG	Professional Geologist
pg/l	picograms per liter
PQL	practical quantitation limit
RAO	removal action objective
RAW	Removal Action Workplan
RACR	Removal Action Completion Report
RfC	reference concentration
RfD_o	reference dose
RME	reasonable maximum exposure
RSL	Regional Screening Level
SCM	Site Conceptual Model
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SF_o	slope factor
SWPPP	stormwater pollution prevention program
START	Superfund Technical Assessment and Response Team
TEQ	total 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalency
TSA	targeted site assessment
TSI	targeted site investigation
TTLC	Total Threshold Limit Concentration
UCL	upper confidence limit
UPL	upper production limit
USEPA	United States Environmental Protection Agency
VCA	Voluntary Cleanup Agreement
VOC	volatile organic compound
WMW	Wilcoxon-Mann-Whitney

EXECUTIVE SUMMARY

Geocon Consultants, Inc. prepared this Draft Final Removal Action Workplan (RAW) to address soil impacted by contaminants of concern (COC) at The Landing – Old Mill Section (the Site) in Mt. Shasta, California (Figure 1). The RAW was performed for the City of Mt. Shasta (the City) under a Targeted Site Investigation (TSI) grant from the United States Environmental Protection Agency (USEPA) with oversight by the California Department of Toxic Substances Control (DTSC).

The purpose of the RAW was to assemble existing data from previous investigations to describe the extent of COC impacts from the historical use of the Site as a lumber mill, assess the risk posed by the COCs to human health and the environment, evaluate removal alternatives and select the most appropriate one to mitigate that risk and ready the Site for redevelopment, and comply with provision of the Health and Safety Code Sections 25323.1 and 25356.1. This Draft Final RAW presents an abbreviated human health risk assessment (HHRA) and ecological scoping assessment, an engineering evaluation and cost analysis (EE/CA) for four removal action alternatives, and applicable or relevant and appropriate requirements (ARAR) for the selected alternative. The mitigation measures set forth in this RAW will be implemented in general accordance with the California Health and Safety Code Chapter 6.8, Sections 25323.1 and 25356.1, the Code of Federal Regulations (CFR) Title 40 - Protection of the Environment Part 300 *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP), and the DTSC Memorandum: *Removal Action Workplans*, dated September 23, 1998, unless otherwise noted. This document is the equivalent to an EE/CA as required under section 300.415(b)(4)(i) of the NCP for all non-time critical removal actions.

The approximately 20-acre 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 was first developed by the Pioneer Box Company in 1900. Lumber mill operations were reportedly conducted at the Site by several parties, most recently Roseburg Forest Products from 1900 until the late 1960s when operations were moved south to the “New Mill” (URS, 2007). 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 lumber scrap debris. Remnants of former structures are present in the form of concrete pads and foundations, but much of the Site is covered in dense vegetation. The City is planning to use the Site for open space in the form of a park and light commercial use.

Historical mill operations at the Site included the use of a dip tank, where lumber was treated with pentachlorophenol (PCP) then placed into an adjacent transfer pit, a boiler room, refuse burner, and a log pond (Figure 2). These four operational areas constitute the four areas of concern with respect to contaminant impacts at the Site.

Soil and groundwater investigations were conducted at the Site between 1998 and 2016 and the data generated is the basis for this RAW. Additionally, in January 2018, we conducted a round of groundwater monitoring at the Site the data from which is also included.

Cleanup standards include applicable DTSC Human and Ecological Risk Office (HERO) note screening levels, the USEPA Regional Screening Levels (RSLs), and the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) Environmental Screening Levels (ESLs) as summarized on Tables 1 through 6. The following project action levels (PALs) were developed for the COCs at the Site based on these standards, the City's proposed future redevelopment plan for recreational and commercial/industrial use, and in consultation with the DTSC:

- dioxins/furans (as Toxic Equivalency (TEQ) values relative to total 2,3,7,8-tetrachlorodibenzo-*p*-dioxin [TCDD]) - 220 – 700 nanograms per kilogram (ng/kg), DTSC, HERO Note 2;
- PCP - 4 milligrams per kilogram (mg/kg) - USEPA RSL, commercial/industrial;
- DRO - 570 mg/kg - SFBRWQCB ESL, soil leaching to groundwater; and
- ORO - 5,100 mg/kg - SFBRWQCB ESL, gross contamination.

Investigation at the Site has identified COCs in soil resulting from former industrial (lumber mill) land use, including PCP from wood treatment, petroleum products (diesel fuel and motor oil) from onsite equipment operation, and dioxins from incineration of wood waste. PCP and petroleum hydrocarbons are present in soil on the Site at concentrations exceeding their respective PALs. Dioxins are present in soil on the Site at concentrations that exceed established health risk-based screening levels for residential use; however, the Site is not planned for residential use. Therefore, dioxins are only considered part of the apparent problem for unrestricted use of the Site.

We performed an HHRA in general accordance with guidelines in DTSC's HHRA guidance. Exposure pathways are incidental ingestion and dermal contact with the affected soil, inhalation of particulates and volatile compounds originating from the affected soil, ingestion and dermal contact with affected groundwater, and inhalation of volatile compounds originating from affected groundwater. For all assessment areas, the chronic health hazard index (hazard, or HI) exceeds one, and the lifetime excess cancer risk (risk) exceeds one per million. Therefore, the Site is not considered suitable for unrestricted land use in its present (baseline) condition.

All assessment areas except Area 2 (Dip Tank and Transfer Pit) generally appear to be acceptable for use under the other exposure scenarios evaluated, including industrial, indoor commercial, recreational and construction worker. Without hot spot removal, the DRO and PCP concentrations in soil at Area 2 are generally not suitable for use under the exposure scenarios evaluated in this assessment. The DRO and PCP concentrations in soil at Area 2 require specific handling protocol for construction worker protection, including dust control and hazard communication.

Groundwater exposure is not likely for onsite receptors because the Site is located in an area served by treated municipal drinking water. However, groundwater is considered a medium of concern because drinking water is a potential beneficial use of groundwater. Based on the assessment presented herein, the groundwater obtained from the monitoring wells at the Site is not suitable for residential use.

We performed an Ecological Scoping Assessment in general accordance with guidelines in DTSC's Ecological Scoping Assessment guidance. Potentially complete exposure pathways exist for terrestrial receptors for mercury and PCP hot spots in soil in Area 2. Therefore, it is appropriate to consider hot spot removal and off-site disposal to mitigate the potential ecological exposures. The potential for future ecological exposure to chemicals of potential ecological concern (COPECs) in Area 2 is dependent upon the nature of future site development. If the assessment area is to support commercial/industrial development, habitat may not be present to support complete ecological exposure pathways. If the site remains open space or is developed as recreational open space, then the potential for ecological exposure may exist.

The EE/CA evaluates removal actions for effectiveness, cost, and implementability. We evaluated four alternatives in the EE/CA section of the RAW. The alternatives were evaluated based on the proposed land use for the Site of recreational and commercial/industrial. The most effective alternative selected is Alternative No. 3 - excavation of PCP- and petroleum-impacted soil to levels acceptable for commercial/industrial land use and offsite disposal of the soil. This alternative would remove approximately 374 cubic yards of contaminated soil from approximately 3,810 square feet of the Site, to a maximum depth of 8 feet, providing protection of human health and the environment by eliminating the routes of exposure to future recreational and commercial/industrial site users and ecological recepotors. Dioxin-impacted soil would require no further action if the future land use remains recreational and/or commercial/industrial. Alternative No. 3 can be performed in compliance with State and Federal requirements. Short-term exposure to construction personnel and offsite neighbors can be minimized through the implementation of dust controls (e.g., water spray of disturbed areas). Administrative control of land use through a land use covenant (LUC). A Soil Management Plan for the Site would ensure reliable protection of human health on a long-term basis.

There will be a 30-day public comment period to allow the public to review the Draft Final RAW and provide comments. Fact sheets will be mailed to the community notifying them of the comment period and a display advertisement will appear in the local newspaper announcing the comment period. Following the public comment period, DTSC will respond to comments in a Responsiveness Summary. The DTSC will then either approve the RAW as final or modify it in response to comments.

DRAFT FINAL REMOVAL ACTION WORKPLAN

1.0 INTRODUCTION

Geocon Consultants, Inc. prepared this Draft Final Removal Action Workplan (RAW) to address soil impacted by contaminants of concern (COC) at The Landing – Old Mill Section (the Site) located at Mount Shasta Boulevard and Loveta Lane in Mt. Shasta, California (Figure 1). The RAW was performed for the City of Mt. Shasta (the City) under a Targeted Site Investigation (TSI) grant from the United States Environmental Protection Agency (USEPA) with oversight by the California Department of Toxic Substances Control (DTSC).

The purpose of the RAW was to assemble existing data from previous investigations to describe the extent of COC impacts at the Site related to the historical use of the Site as a lumber mill, assess the risk posed by the COCs to human health and the environment, and to evaluate removal alternatives and select the most appropriate one to mitigate that risk and ready the Site for redevelopment. We understand that the most likely future use of the portion of the Site where lumber mill features existed (Figure 2) is open space as a community park and commercial use.

This Draft Final RAW presents an abbreviated human health risk assessment (HHRA) and ecological scoping assessment, an engineering evaluation and cost analysis (EE/CA) for four removal action alternatives, and applicable or relevant and appropriate requirements (ARAR) for the selected alternative. The mitigation measures set forth in this RAW will be conducted in general accordance with the California Health and Safety Code Chapter 6.8, Sections 25323.1 and 25356.1, the Code of Federal Regulations (CFR) Title 40 - Protection of the Environment Part 300 *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP), and the DTSC Memorandum: *Removal Action Workplans*, dated September 23, 1998, unless otherwise noted. This document is the equivalent to an EE/CA as required under section 300.415(b)(4)(i) of the NCP for all non-time critical removal actions.

1.1 Site Description and Location

The Site (latitude 41.300902º, longitude -122.307331º) is part of 127 acres owned by the City of Mt. Shasta now known for the purposes of marketing it for future development as The Landing. The Landing has been divided into smaller sections based on historical use. The Site is approximately 20 acres and is the location of the original lumber mill (Old Mill) operated since 1900.

The Site and the rest of the surrounding City-owned property (adjacent to the south) is vacant. A Union Pacific Railroad Company mainline track is adjacent to the west of the Site, beyond which is residential use and vacant land. Residential and commercial uses are adjacent to the north of the Site. Mt. Shasta Boulevard is adjacent to the east of the Site beyond which are commercial uses.

Weather conditions in the area are generally warm in the summer season with high temperatures in the 80s, and cold and wet winter season with low temperatures in the 20s. Annual average precipitation as rain and snow is approximately 40 and 103 inches per year, respectively. The prevailing wind in Mt. Shasta varies by season and is summarized further in Section 2.6.

1.2 Project Description

The City intends to redevelop the Site and surrounding area with uses that promote the historical, recreational, and tourism aspects of the City and Mt. Shasta region. The Site is currently in a Planned Unit Development area. According to the *Land Use Plan for the Roseburg Commerce Park, City of Mount Shasta*, dated August 2016, open space in the form of a park is planned for the northern, approximately 13.5-acre portion of the Site, which includes former lumber mill features such as the log pond, former refuse burner, boiler room, and dip tank. The approximately 6.5-acre southern portion of the Site is planned for light commercial use. The source of potable water for the Site will be from the City of Mt. Shasta municipal water system and not from groundwater.

1.3 Removal Action Objectives

Removal Action Objectives (RAO) are developed to mitigate impacts to human health and the environment due to a planned disturbance. Removal actions are subject to a different set of regulatory requirements than “remedial” actions. Therefore the term “removal” is used throughout this RAW in reference to the measures taken to mitigate potential exposure to COCs at the Site.

The COCs include dioxin, pentachlorophenol (PCP), diesel-range organics (DRO), and oil-range organics (ORO) that are present at elevated concentrations in shallow soil on the Site. Therefore, the RAOs detailed in this RAW are to:

- minimize the potential for site user exposure to COCs in shallow soil;
- minimize the spread of impacted material to adjacent properties;
- facilitate site re-development for recreation and commercial/light industrial uses;
- maximize confidence in the success of the remedial action(s);
- minimize long-term liability resulting from the remedial action(s);
- maximize public acceptance of actions to be taken;
- minimize the cost of remedial actions; and
- protect the beneficial uses of the groundwater and mitigate existing groundwater impacts.

1.4 Cleanup Standards

Cleanup standards include applicable DTSC HHRA screening levels, the USEPA Regional Screening Levels (RSLs), and the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB)

Environmental Screening Levels (ESLs) as summarized on Tables 1 through 6. The following project action levels (PALs) were developed for the primary COCs at the Site based on these standards, the City's proposed future redevelopment plan as recreational and commercial/industrial use, and in consultation with the DTSC:

- dioxins/furans (as Toxic Equivalency (TEQ) value relative to total 2,3,7,8-tetrachlorodibenzo-*p*-dioxin - [TCDD]) 220 – 700 nanograms per kilogram (ng/kg) DTSC, HHRA Note 2;
- PCP - 4 milligrams per kilogram (mg/kg) USEPA RSL, commercial/industrial;
- DRO - 570 mg/kg SFBRWQCB ESL, soil leaching to groundwater; and
- ORO - 5,100 mg/kg SFBRWQCB ESL, gross contamination.

The primary routes of exposure to COCs in soil on the Site are through incidental inhalation, ingestion, and dermal contact. Further discussion of COCs, exposure routes, and risk-based PALs is provided in Section 5.0.

We evaluated four removal action alternatives with regards to the nine criteria defined in 40 CFR 300.430, as summarized in Section 7.2. The proposed remedy will remediate the Site to levels that are safe for commercial/industrial use and that will accommodate recreation/open space with an approved Soil Management Plan.

2.0 BACKGROUND

This section describes the site location and physical characteristics including geology and hydrogeology of the Site and summarizes the findings of previous investigations.

2.1 Location, Description, and Identification

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 is in the southern portion of the City within a commercially and residentially developed area.

The Site is approximately 1,800 feet long in the north-south direction and 500 to 750 feet wide in the east-west direction. 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 west through the former log pond, and exits through a culvert at the western edge of the pond (Figure 2).

Structures associated with historical mill operations have been removed, and the Site is currently vacant. Remnants of former structures are present in the form of concrete pads and foundations, but much of the Site is covered in dense vegetation (Figure 2).

2.1.1 Name and Address

Name: The Landing – Old Mill Section

Address: no physical address, South Mt. Shasta Boulevard, Mt. Shasta, California

2.1.2 Owner's Contact Person, Mailing Address and Telephone Number

Contact Person: Bruce Pope, City Manager

Mailing Address: City of Mt. Shasta
305 North Mt. Shasta Boulevard
Mt. Shasta, CA 96067

Telephone Number: 530.926.7510

2.1.3 Environmental Consultant's Contact Information

The environmental consultant's contact person, mailing address and telephone number are as follows:

Contact Person: Jim Brake, PG
Mailing Address: Geocon Consultants, Inc.
3160 Gold Valley Drive, Suite 800
Rancho Cordova, California 95742

Telephone Number: 916.852.9118

2.1.4 CalSites Database Number

Envirostor ID: 60002107

Site Code: 102246

2.1.5 Assessor's Parcel Number(s) and Zoning

APN: 067-010-010

Acreage: 20.81 acres

Land Use and Zoning: Planned Development (PUD)

2.1.6 Ownership

The current Site owner is City of Mt. Shasta.

2.1.7 Township, Range, Section and Meridian

The Site is located in the northeastern quarter of Section 21, Township 40 North, Range 4 West of the Mount Diablo Base and Meridian.

2.2 Operational History and Status

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

According to the former City Manager, 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 lumber scrap debris. During future inspections and assessment, the debris was referred to locally as the "wood pile" (Marconi, 2013).

2.3 Topography

The Site lies at an elevation of approximately 3,500 feet above mean sea level (MSL - USGS, 2012) and was graded (filled) to be predominantly flat-lying with a gentle slope to the west. 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.

2.4 Geology and Hydrogeology

2.4.1 Geology and Soil Types

The Site is within the Cascade Range geomorphic province of Northern California, and is located approximately 10 miles southwest of the summit of Mount Shasta, a composite volcano in the southern Cascade Range. The southern Cascade Range is flanked by the Modoc Plateau to the east, the Sierra Nevada and Great Valley to the south, and the Klamath Mountains to the West. Regional geologic conditions consist of volcanic layers, colluvial, alluvial, and talus deposits, and lesser glacially-derived materials. The Geologic Map of Weed Quadrangle (California Division of Mines and Geology [CDMG], 1987) indicates that the Site is underlain by volcanic rocks and glacial deposits.

During our previous field investigations at the Site, we encountered moist, silty sand fill with occasional charcoal and wood fragments from 0 to 3.5 feet, decomposing wood debris with occasional charcoal, gravel, and brick fragments to depths of up to 6 feet. Native soil consisting of weathered volcanic deposits of silty sand and medium-grained sand with occasional lenses of coarse sand and gravel underlies the fill material to the maximum depth explored of 16 feet.

2.4.2 Hydrogeologic Setting

The Site is located in the Upper Sacramento River Watershed. Surface water on the Site consists of Mill Creek that flows through, and seasonal standing water in, the former log pond in the northern portion of the Site. During site visits in May and September 2013, March 2015, and January 2018, we observed water flowing in this stream and shallow standing water (marsh-like conditions) in the central portion of the former log pond. The topographic map depicts an unnamed, east-west-oriented, perennial drainage course across the central portion of the Site that drains into Cold Creek approximately one mile southwest of the Site. Cold Creek flows into Lake Siskiyou, which is a reservoir on the Sacramento River.

In 2015 we installed five groundwater monitoring wells (OM-1 through OM-5) at the Site (Figure 2). These wells were monitored most recently in January 2018. Depth to groundwater ranged from 6.24 feet in OM-4 to 20.31 feet in OM-5, and groundwater flow was estimated to be to the southwest at an average gradient of 0.04 ft/ft, consistent with previous year monitoring events (Figure 3). Well construction details and groundwater elevation data from January 2018 is presented in Table 7.

The Central Valley Regional Water Quality Control Board (CVRWQCB) Water Quality Control Plan for the Sacramento River and San Joaquin River Basins indicates that groundwater in the site vicinity has existing beneficial uses for municipal and domestic supply (CVRWQCB, 2011). However, the source of potable water for future site use will be from the City of Mt. Shasta municipal water system and not from groundwater beneath the Site.

2.5 Surrounding Land Use and Sensitive Ecosystems

Land surrounding the Site is used for commercial/light industrial purposes and residential use. Single-family residential properties are adjacent to the north of the Site. Commercial uses are present along the eastern side of Mt. Shasta Boulevard, east of the Site, beyond which are primarily single-family residences. Single-family residences are also present beyond the railroad tracks west of the Site. The nearest daycare/school is “I AM” School, Inc. located at 118 Siskiyou Ave, approximately 1,300 feet northwest of the Site.

Sensitive ecosystems on and around the Site were identified in a biological survey performed by North State Resources in 1998. The survey was included as part of Pacific Municipal Consultants’ *Draft Environmental Impact Report* (EIR) for the Roseburg Commerce Park, which included the Site. A complex of fresh emergent wetland/montane riparian vegetation was identified in the Log Pond Area, which includes a perennial stream and several springs and seeps. Vegetation was described as a moderate to dense network of emergent wetland and riparian species. Otherwise, the central and southern portions of the Site are dominated by disturbed areas resulting from former mill operations. Vegetation within these areas is described as a combination of trees, shrubs, and grasses and forbs.

2.6 Meteorology

Mt. Shasta climate is categorized as California Energy Commission climate zone 16 and is within the area known as the Northeast Plateau Air Basin. Weather conditions in the area are generally warm in the summer season with high temperatures in the 80s, and cold and wet winter season with temperatures in low 20s. An annual average of precipitation and snow is approximately 40 and 103 inches per year, respectively.

The prevailing wind in Mt. Shasta varies. Based on data collected between January 1979 and June 2017, prevailing wind is generally from the northwest or southeast at an average speed of 3.8 miles per hour (mph). In January, February, and March, the prevailing wind is generally from the southeast at an average speed of 3.9 mph. In April, May, and June, the prevailing wind is generally from the northwest at an average speed of 4.3 mph. In August and September, the prevailing wind is generally from the northeast at an average speed of 3.1 mph. In July, October, November, and December the prevailing wind varied from northwest, northeast, to southeast (Iowa State University, 2018).

2.7 Previous Investigations/Regulatory Involvement

Previous environmental investigations conducted at the Site involving regulatory oversight are summarized in the following subsections. GPS coordinates of sample locations and wells, as provided from these previous investigations, is compiled and summarized in Table 8. Laboratory analysis results for COCs in soil, groundwater, and surface water are summarized in Tables 1 through 6. Analysis results for soil only are presented for the northern area on Figures 4-1 and 4-2 and the southern area on Figures 5-1 and 5-2.

2.7.1 Regulatory Inspections and Wood Pile Cleanup

Reports of previous investigations at the Site indicate that 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, 2007). 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, 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 referenced in Section 2.2 occupied the pond.

In 1988, at the direction of the CVRWQCB, Steffen, Robertson and Kirsten installed three groundwater monitoring wells in the vicinity of the wood pile. One well was installed upgradient (east) of the pile, and two downgradient (west). 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 and detected metals appeared to be consistent with local background concentrations.

In 1991, the City retained Metcalf and Eddy (M&E) to develop a 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, total xylenes (BTEX), oil and grease, and phenols (including PCP). GRO was detected in the samples at concentrations up to 57 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 daily cover material at a local landfill.

The CVRWQCB issued a letter in October 1995 indicating that the wood pile removal was nearly complete and that further mitigation regarding the wood pile was not required. According to former City Manager Mr. Marconi, the three monitoring wells installed in 1988 were subsequently destroyed (Marconi, 2013).

2.7.2 1998 Targeted Site Assessment

The USEPA conducted a Targeted Site Assessment (TSA) at the Site in 1998 under their Regional Brownfields Program (E&E, 1998). The assessment was conducted by E&E's Superfund Technical Assessment and Response Team (START) on behalf of the USEPA. The assessment focused on areas of historical lumber mill operations and included soil, sediment, surface water, and groundwater sampling and laboratory analysis. Samples were analyzed for petroleum hydrocarbons, volatile organic compounds (VOC), polynuclear aromatic hydrocarbons (PAHs) including PCP, dioxins/furans, and metals. VOCs were not detected in any of the samples analyzed. Laboratory analysis results showed the following areas of the Site had been impacted by historical operations:

- the footprint of the former dip tank and transfer pit where DRO was detected in shallow soil at concentrations up to 47,000 mg/kg (Figure 4-1) and GRO was detected in a groundwater sample at 734 μg/l;
- the footprint of the former dip tank where PCP was detected in soil (Figure 4-2) and groundwater at concentrations up to 32 mg/kg and 12 micrograms per liter (μg/l), respectively;
- the area of the former boiler room where DRO was detected in a shallow soil sample at a concentration of 784 mg/kg (Figure 5-1);
- the northeastern portion of the former log pond where DRO was detected in a shallow soil sample at a concentration of 594 mg/kg (Figure 5-1);
- the former refuse burner where dioxins (reported as TEQ) were detected in a five-point composite sample (OMRB-1) collected from shallow soil at a concentration of 30 ng/kg (Figure 5-2); and
- 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.

2.7.3 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 samples showed the following:

- PCP was detected in soil samples collected north and west of the former dip tank and transfer pit at concentrations up to 150 mg/kg (Figure 4-2) and in groundwater samples collected west of the former dip tank at concentrations up to 110 μg/l.
- Lead was detected in a surface water sample collected at the same general location as the sample collected in 1998 at concentrations less than drinking water standards. However, the 2005 sample contained beryllium and nickel at elevated concentrations. As with the 1998 sample, the 2005 sample was collected during a period of high rainfall.

2.7.4 2007 Targeted Site Investigation

In 2007, URS conducted a TSI to further assess the extent of PCP and DRO in soil and groundwater west of the former dip tank and transfer pit (URS, 2007). Analysis of samples showed the following:

- PCP was detected in a shallow soil sample collected from boring ODT-3 at the western edge of the former dip tank at a concentrations of 130 mg/kg (Figure 4-2).
- PCP and DRO were also detected in a groundwater sample collected from ODT-3 at respective concentrations of 4.5 and 93 μg/l, respectively.

Due to the presence of dense vegetation adjacent to the west of the former dip tank, URS collected their additional groundwater samples (ODT-4 and ODT-5) approximately 130 feet from the western edge of the former tank. PCP and DRO were not detected in either sample.

2.7.5 2014 Phase II ESA

In late 2013, Geocon conducted a Phase II ESA under a USEPA Brownfields assessment grant to further assess the extent of hazardous substance and petroleum impacts at the Site that were identified during previous investigations and to determine if additional assessment and/or cleanup might be necessary prior to the redevelopment of the Site. The results of this investigation were presented in our Phase II ESA report, dated June 5, 2014, and are summarized as follows:

- DRO and ORO concentrations in soil samples collected from the former dip tank/transfer pit area (Figure 4-1) did not exceed their respective PALs.
- PCP in soil at concentrations exceeding the PAL was generally limited to the footprint and area southwest of the former dip tank (Figure 4-2). PCP in soil appeared to extend to a maximum depth of 8 feet and the lateral extent was defined with the exception of the area south and west of the dip tank. PCP in groundwater at concentrations exceeding the PAL also appeared to be limited to the footprint and area southwest of the former dip tank; however, the downgradient (western) extent remained undefined.
- DRO in soil at concentrations exceeding the PAL were generally limited to the footprint and the area southwest of the former boiler room in the upper 5 feet of soil (Figure 5-1). The lateral extent of impacts was not defined. DRO and ORO were detected in the grab-groundwater sample collected southwest of the former boiler room at concentrations exceeding their respective PALs. The downgradient extent of impacted groundwater was not defined during this investigation.
- DRO and ORO were not detected in soil in the area of the former log pond (Figure 4-1) at concentrations exceeding their respective PALs. DRO and ORO were detected in grab-groundwater samples collected on either side of the intermittent stream that flows through the former pond at concentrations exceeding their PALs.
- DRO was detected in soil samples collected north and east of the former refuse burner in soil at concentrations exceeding the PAL (Figure 5-1). The vertical extent of DRO impacts on the eastern side was limited to a depth of 2 feet, but the vertical extent on the northern end of the refuse burner was not defined. Groundwater was not characterized in this area during this investigation.
- Dioxin was detected in soil to depths of at least 5 feet in the area surrounding the former refuse burner (Figure 5-2) at TEQ values ranging from 0.59 to 190 ng/kg. The vertical and lateral extent of impacts were not defined.

2.7.6 2014 Analysis of Brownfields Cleanup Alternatives

In 2014, following the Phase II ESA, Geocon prepared an Analysis of Brownfields Cleanup Alternatives (ABCA) for the Site. The ABCA provided a preliminary evaluation for three potential cleanup alternatives for the Site. The former dip tank area, boiler room and refuse burner were identified as areas for targeted cleanup. The ABCA recommended a cleanup alternative consisting of targeted excavation/disposal and capping of impacted soil.

2.7.7 2015 Targeted Site Investigation

In March 2015, Geocon conducted a TSI to further assess the extent of hazardous substance and petroleum impacts at the Site, which also included the installation and monitoring of five groundwater monitoring wells (OM-1 through OM-5) at the Site (Figure 2). The results of this investigation were presented in our TSI report, dated April 22, 2015, and are summarized as follows:

- PCP was not detected in soil samples collected downgradient of the former dip tank and transfer pit (Figure 4-2) at concentrations exceeding its PAL. PCP, DRO, and ORO were detected in grab-groundwater sample ODT-24 at concentrations exceeding their respective PALs (Table 2).
- DRO was detected in two soil samples collected southwest of the former boiler room (Figure 5-1) at concentrations exceeding the PAL. DRO and ORO were also detected in three grab-groundwater samples from this area at concentrations exceeding their PAL (Table 2).
- DRO and ORO were detected in grab-groundwater samples collected from the former log pond at concentrations exceeding their respective PAL (Table 2).
- Dioxin TEQ values for soil samples collected from the former refuse burner area (Figure 5-2) ranged from 0.49 to 310.59 ng/kg, the maximum of which exceeds the lower end of the PAL range for dioxin TEQ.
- Dioxin was detected in all of the grab-groundwater samples at concentrations exceeding its PAL (Table 4).
- DRO was detected in soil samples from the former refuse burner area at concentrations exceeding its PAL (Figure 5-1). DRO and ORO were detected in a grab groundwater sample from this area at concentrations exceeding their PALs (Table 2).
- DRO was detected in a groundwater grab sample from OM-3 at a concentration of 170 µg/l, which exceeds its PAL (Table 2).
- Dioxin was detected in groundwater samples from OM-1 and OM-5 at TEQ values of 102 and 130 picograms per liter (pg/l), which exceed the PAL (Table 4).
- A variety of metals were detected in groundwater samples from all of the wells at concentrations exceeding their respective PALs (Table 6).

DRO and ORO concentrations were highest in soil and groundwater samples collected from borings that encountered decomposed woody debris and analysis was conducted without using silica gel cleanup. To further assess the type of hydrocarbons present in the samples, we had Cascadia Forensics perform hydrocarbon fingerprinting of the grab-groundwater samples from BR-20 and LP-14 to further evaluate the source of petroleum hydrocarbons. Hydrocarbon figure printing indicated that a majority of the material reported as petroleum hydrocarbons was due to false positive interference from wood or wood waste.

The detections of dioxins in groundwater samples are considered to be anomalous, as dioxins will preferentially partition into soils with high organic content and generally will not desorb into water. The detections of dioxin may be due to the presence of organic material in the groundwater samples.

2.7.8 2016 Groundwater Monitoring

In late March 2016, Geocon conducted groundwater monitoring using monitoring wells OM-1 through OM-5. The results of this monitoring event were presented in our TSI report for The Landing – New Mill Section, dated April 29, 2016, and are summarized as follows:

- PAHs, including PCP, were not detected.
- DRO and ORO were detected in groundwater samples from two wells at maximum concentrations of 170 µg/l, which exceeds the PAL for DRO.
- Lead and chromium were the only metals detected in groundwater samples at concentrations exceeding their respective PALs, with maximum concentrations of 0.058 and 0.022 milligrams per liter (mg/l), respectively.
- TEQ values were detected two groundwater samples at concentrations of 50.4 and 348 pg/l which exceed the PAL.

2.7.9 2016 Targeted Brownfields Assessment - Phase I/II ESA

In late June 2016, Weston Solutions, Inc. (Weston) conducted a Targeted Brownfields Assessment consisting of a combination Phase I/II ESA to further assess the extent of hazardous substance and petroleum impacts at the Site. The results of this investigation were presented in a *Phase I/II Investigation, Targeted Brownfields Assessment Report*, dated October 2016, and are summarized as follows:

- DRO was detected in soil samples collected from within the footprint of the former refuse burner at concentrations exceeding the PAL.
- Dioxins were detected in all of the soil samples collected from 0 to 2 feet and 4 to 5 feet at concentrations ranging from 1.63 to 450 ng/kg.

2.7.10 2016 Analysis of Brownfields Cleanup Alternatives

In 2016, following their Targeted Brownfields Assessment - Phase I/II ESA, Weston prepared an ABCA for the Site. The ABCA provided a preliminary evaluation for five potential cleanup alternatives for the Site. The former dip tank area, boiler room and refuse burner were identified as areas for targeted cleanup. The area of dioxin-impacted soil was significantly expanded from that presented in the 2014 ABCA because of additional data from Weston's 2016 investigation. The conclusions in Weston's ABCA were based on more conservative PALs for DRO and dioxins than we have established for the Site, which are based on the DTSC Human and Ecological Risk Office's (HERO) Note 2 guidance. Weston's ABCA recommended consolidating and capping PCP-, petroleum-, and dioxin-impacted soil on the southern portion of the Site.

2.7.11 January 2018 Groundwater Monitoring

In January 2018, Geocon conducted another round of groundwater monitoring at the Site. Groundwater samples collected from wells OM-1 though OM-5 were analyzed for DRO, ORO, metals, and dioxins. Per DTSC guidance, none of the groundwater samples were filtered prior to analysis. Laboratory analysis for groundwater samples are summarized as follows:

- DRO and ORO were detected in the groundwater sample from OM-4 at concentrations of 70 and 80 µg/l, respectively - both less than their respective PALs (Table 2).
- Dioxin was detected in each groundwater sample at concentrations (TEQ values) ranging from 0.168 to 5.61 pg/l all of which are less than the PAL (Table 4).
- Lead was detected in all of the groundwater samples at concentrations ranging from 0.015 to 0.03 – all of which equal or exceed the PAL. Arsenic, beryllium, cadmium, and thallium were also detected in the groundwater sample from OM-2 at concentrations that exceed the PAL (Table 6).

The laboratory report is in Appendix A and the monitoring well sampling data sheets are in Appendix B.

2.8 Apparent Problem

Investigation at the Site has identified contaminants in soil resulting from former industrial (lumber mill) land use, including PCP associated with wood treatment processes, petroleum products (diesel fuel and motor oil), and dioxins associated with the incineration of wood waste. PCP and petroleum hydrocarbons are present in soil on the Site at concentrations exceeding established health risk-based screening levels for future recreational and commercial/industrial users of the Site. Dioxins are present in soil on the Site at concentrations that exceed established health risk-based screening levels for residential use; however, the Site is not planned for residential use. Therefore, dioxins are only considered part of the apparent problem for unrestricted use of the Site.

COCs detected in soil have also been detected in water at the Site. Groundwater was reportedly encountered at depths ranging from 8 to 10 feet near the western end of the former dip tank and groundwater is monitored using monitoring wells OM-1 through OM-5 at the Site.

Surface water at the Site includes a stream and shallow standing water in the former log pond. Surface water samples were previously obtained downstream (southwest) of the log pond. Lead (18.5 ug/L), beryllium and nickel were detected in surface water samples collected during periods of high rainfall. The detections are believed to be the result of the analysis of suspended sediment in the surface water sample and are therefore not considered representative of surface water conditions. Metal concentrations in a sediment sample collected from this location were within the range of published background concentrations and additional surface water characterization was not recommended.

3.0 SITE CONCEPTUAL MODEL

Figure 6 is a site conceptual model (SCM) diagram. The SCM depicts:

- Primary source media and release mechanisms;
- Secondary source media and transport mechanisms;
- Potential points of exposure (exposure media) and exposure routes; and
- Potential receptors.

The model components are described below.

3.1 Primary Source Media

Primary source media include:

- Organic constituents (petroleum products, biocides, and combustion byproducts) released to the ground surface as a result of past industrial land use.
- Inorganic constituents (metals) that are naturally-occurring or released to the ground surface as a result of past industrial land use.

3.2 Primary Release Mechanisms

The following primary release mechanisms correspond with the source media listed above:

- Organic constituents may have been released to the ground surface as a result of incidental spillage:
  - Petroleum products related to spillage or leakage of fuels (e.g., diesel) and motor oil, gear oil, or waste oil.
  - Biocides (e.g., pentachlorophenol, or PCP) from dip tanks or storage areas associated with preservation of wood products.
  - Combustion byproducts (e.g., dioxins and furans) associated with partial combustion of wood products at and near incinerator locations.
- Inorganic constituents (metals such as arsenic, cadmium, chromium, mercury, nickel, lead, and zinc) may be derived from industrial processes and degradation of waste products, or may occur naturally in native soil and rock.

3.3 Secondary Source Media

The secondary source media are contaminated surface soil, shallow subsurface soil, and groundwater. Surface water is not considered a medium of concern as described above in Section 2.5.

3.4 Transport Mechanisms

Transport mechanisms are depicted on Figure 6 and are described below.

Surface Water Erosion: Seasonal overland surface water flow during storm events may transport contaminated soil via sediment in suspended form.

Leaching: Precipitation and percolation may leach heavy metals from contaminated soil and transport them in dissolved form.

Erosion: Erosion of contaminated soil by wind or mechanical disturbance may transport suspended particulates.

Volatilization: The HHRA (Section 5.0) considers volatilization for air exposure pathways for both organic and inorganic (e.g., mercury) COCs.

Biological Uptake: Contaminants may be incorporated in plant tissue as a result of biological uptake for plants growing in contaminated soil. These contaminants may be incorporated in animal tissue through the food chain or as a result of direct contact (ingestion, dermal contact, inhalation of soil dust) with contaminated soil. Considering the proposed land uses (commercial/industrial and recreational), biological uptake resulting from vegetable or animal consumption is not considered a complete exposure pathway for human exposure.

3.5 Exposure Media and Exposure Routes

Exposure media for the Site are soil, air, and water. Air may contain both suspended particulates (dust) and vapor (volatile constituents). Exposure routes are incidental ingestion and dermal contact with contaminated soil and water, and inhalation of particulates or vapors originating from the contaminated soil and water. The HHRA considers volatilization for air exposure pathways for both organic and inorganic (e.g., mercury) COCs.

Groundwater exposure is not likely for onsite receptors because groundwater is not a source of drinking water at the Site, and the Site is located in an area served by treated municipal drinking water. However, groundwater is considered a medium of concern because drinking water is a potential beneficial use of groundwater. Surface water is not considered a medium of concern as described above in Section 2.5.

Ingestion of plant and animal tissue is a potential exposure pathway in the case of future vegetable garden cultivation, hunting, or fishing. Food chain exposure pathways are not evaluated in the human health assessment based on the proposed site use (commercial/industrial and recreational).

3.6 Potential Receptors

The Site is currently open space. The City plans to construct a community park and light commercial infrastructure on the Site. Potential receptors include offsite residents, commercial workers, construction workers, trespassers, and recreational visitors. Ecological receptors are described in the Ecological Scoping Assessment in Section 6.0.

3.7 Areas of Concern

The Site includes the former locations of several industrial unit processes associated with past lumber milling activity including:

- Log pond;
- Dip tank and transfer pit;
- Boiler room; and
- Refuse burner.

4.0 BACKGROUND EVALUATION

4.1 Metals in Soil

For the purposes of the HHRA, it is useful to distinguish between background metals concentrations occurring naturally in soil and elevated concentrations resulting from past waste disposal or releases of hazardous substances to the environment. According to the DTSC's HERO Note No. 3 (DTSC, 2018), "HERO strongly recommends consideration of site-specific background concentrations of inorganic constituents."

DTSC (1997) provides a framework in which risk assessors may identify background metals concentrations. Pursuant to DTSC guidance (http://www.dtsc.ca.gov/AssessingRisk/backgrnd.cfm), "risk assessments should eliminate from consideration those whose range of concentrations falls within the range of local ambient conditions." To do this, the local ambient data set may be defined by pooling all site data and determining ambient conditions in the presence of possible contamination. DTSC (1997) describes two methods of comparison:

1. Comparison of all detected COC concentrations on a site for a given metal to a single concentration representative of the upper range of local ambient conditions; and
2. Comparison of mean COC concentrations on a site for a given metal to mean ambient concentrations using the Wilcoxon Rank Sum test, a simple non-parametric statistical technique.

The two methods may be used to compare both high-end concentrations and mean concentrations to determine whether impacts exist.

Site metals data are presented in Tables 5 and 6. ProUCL Version 5.1 (USEPA, 2015) was used to perform outlier tests and to prepare box plots and normality plots (Q-Q Plots), which are in Appendix C.

Based on the outlier test results and visual interpretation of the plots, the datasets were culled so that only a single population nearest the origin is used to represent background conditions. ProUCL was then used to perform background threshold value (BTV) statistics on the culled datasets.

Statistical evaluation of site soil metals data is summarized below. ProUCL 5.1 (USEPA, 2015) worksheets, statistical tests, plots and BTV statistics are in Appendix C. Statistical evaluation is summarized in Table 1a and 1b in Appendix D, respectively, for the entire Site and the background population.

4.1.1 Antimony

Antimony was detected in 6 of 61 soil samples at concentrations up to 4.8 mg/kg. The practical quantitation limit (PQL) ranges from 2 to 9.9 mg/kg. The data appear to be normally distributed with no outliers. The BTV for antimony is based on the upper range of detected values (4.8 mg/kg). The detected values are less than the RSL for antimony in residential soil (31 mg/kg) and commercial/industrial soil (580 mg/kg).

4.1.2 Arsenic

Arsenic was detected in 37 of 61 soil samples at concentrations ranging from 0.97 to 8.0 mg/kg. The PQL ranges from 0.6 to 2.9 mg/kg. Summary statistics for the soil arsenic data set for the entire Site are presented in Appendix D, Table 1a.

Inspection of the quantile-quantile (Q-Q) plot (Appendix C) indicates an inflection point at a soil arsenic value of approximately 4.5 mg/kg. The Q-Q plot for soil arsenic values below the inflection point is linear, indicating a single population nearest the origin. Excluding three potential outliers (5.7, 7.3 and 8.0 mg/kg) above this inflection point, Rosner's Outlier Test identified no potential outliers at 5% significance level for the culled population. Pursuant to DTSC (1997, 2009) guidance, this population is considered to be representative of background soil arsenic conditions for the Site.

The data are approximately normal at 5% significance level based on normal goodness-of-fit tests. Assuming a normal distribution, the 95% Kaplan Meier (KM) Chebyshev Upper Prediction Limit (UPL) is 6.61 mg/kg. Only two arsenic concentrations (7.3 and 8.0 mg/kg) exceed this UPL: sample OMDT-10-5 (7.3 mg/kg) was obtained in 1998 from the southwestern end of the former dip tank at a depth of 5 feet, and sample OMLP-2-1 (8.0 mg/kg) was obtained from near the center of the former log pond at a depth of 1 foot.

4.1.2.1 Statistical Comparison of Background Data to Site Data

ProUCL 5.0 (USEPA, 2015) was used to perform the Wilcoxon-Mann-Whitney (WMW) test (Bain and Engelhardt, 1992), which is also known as the Wilcoxon Rank Sum test. WMW is a non-parametric test used for determining whether a difference exists between site and background population distributions. The WMW test statistic tests whether or not central tendency measurements from one population tend to be larger than those from another population based upon the assumption that the population distributions are comparable.

Site soil arsenic populations (including the three potential outliers) were compared to the background soil arsenic data set (excluding the three potential outliers) using the WMW Background Test Form 1, for which the null hypothesis is that the constituent concentrations in potentially impacted areas are not statistically greater than the background concentrations.

For comparison of the complete Site data set to background, the null hypothesis is not rejected, indicating that the mean soil arsenic value for the Site is not significantly larger than the mean of the background population, despite the three potential outliers (5.7, 7.3 and 8.0 mg/kg).

4.1.3 Barium

Barium was detected in 60 of 61 soil samples at concentrations ranging from 5.5 to 610 mg/kg. The mean value is 166 mg/kg. Rosner's test detects one outlier (610 mg/kg) at the 1% significance level. The BTV for barium is based on the upper range of background values (429 mg/kg) based on the Q-Q plot. The data do not follow a discernable distribution, and ProUCL suggest the 95% KM (Chebyshev) upper confidence limit (UCL) (231 mg/kg) as a central tendency value. The maximum detected value is less than the RSL for barium in residential soil (15,000 mg/kg) and commercial/industrial soil (220,000 mg/kg).

The single outlying value (RB-3-5; 610 mg/kg) was obtained from the refuse burner area at a depth of 5 feet. The shallower samples at this location (RB-3-1 and RB-3-2) obtained from depths of 1 and 2 feet had barium concentrations of 30 and 5.5 mg/kg, respectively. The other barium concentrations detected in this area are within the background range. Therefore, the single outlying value is considered anomalous.

4.1.4 Beryllium

Beryllium was detected in 24 of 61 soil samples at concentrations ranging from 0.38 to 1.5 mg/kg. The mean value is 1.1 mg/kg. The data follow a normal distribution at the 5% significance level based on the Shapiro-Wilk normality test. The BTV for beryllium is based on the upper range of background values (1.5 mg/kg). The beryllium values detected in site soil are less than the DTSC HERO Note 3 screening level (DTSC-SL) for beryllium in residential soil of 3 mg/kg and commercial/industrial soil of 210 mg/kg.

4.1.5 Cadmium

Cadmium was detected in 38 of the 55 soil samples at concentrations ranging from 0.15 to 0.93 mg/kg. Rosner's test detects no outliers at the 1% significance level. The BTV for cadmium is based on the upper range of background values (0.93 mg/kg). This maximum concentration is less than the DTSC-SL for cadmium in residential soil of 5.2 mg/kg and commercial/industrial soil of 7.3 mg/kg.

4.1.6 Chromium

Chromium (total) was detected in 60 of 61 soil samples at concentrations ranging from 3.3 to 80.5 mg/kg. The mean value is 29.2 mg/kg. Rosner's test detects no outliers at the 1% significance level. The BTV for chromium is based on the upper range of background values (80.5 mg/kg). This maximum concentration is less than the DTSC-SL for chromium in residential soil of 36,000 mg/kg and commercial/industrial soil of 170,000 mg/kg.

4.1.7 Cobalt

Cobalt was detected in 58 of 61 soil samples analyzed for cobalt at concentrations ranging from 1.4 to 17.3 mg/kg. The mean value is 6.2 mg/kg. Rosner's test detects no outliers at the 5% significance level. The BTV for cadmium is based on the upper range of background values (17.3 mg/kg). This maximum concentration is less than the RSL for cobalt in residential soil of 23 mg/kg and commercial/industrial soil of 350 mg/kg.

4.1.8 Copper

Copper was detected in 60 of 61 soil samples at concentrations ranging from 4.2 to 82.6 mg/kg. The mean value is 28.9 mg/kg. Rosner's test detects one outlier (82.6 mg/kg) at the 5% significance level. The data do not follow a discernable distribution, and ProUCL suggests the use of the 95% KM (Chebyshev) UCL (35.38 mg/kg) as a conservative central tendency value. All site soil copper concentrations are less than the RSL for copper in residential soil of 3,100 mg/kg and commercial/industrial soil of 47,000 mg/kg.

A single outlying concentration of 82.6 mg/kg was detected in sample OM-3-2, which was obtained from the transfer pit area at a depth of 2 feet and was qualified with a "J" flag indicating that the value is estimated. The shallow sample at this location (OM-3-0.5) had a copper concentration of 16.5 mg/kg, and the other copper concentrations detected in soil samples from this area are within the background range. Therefore, the single outlying value is considered anomalous.

4.1.9 Lead

Lead was detected in 60 of 61 soil samples analyzed for lead at concentrations ranging from 1.2 to 70.3 mg/kg. The data do not follow a discernable distribution, and ProUCL suggests the use of the 95% KM (Chebyshev) UCL (17.4 mg/kg) as a central tendency value. All site lead concentrations are less than the DTSC-SL for lead in residential soil of 80 mg/kg and commercial/industrial soil of 320 mg/kg.

Rosner's test detects outlying data (70.3, 34.4, 33.1 mg/kg) at the 5% significance level. Two of these values (OM-10-0.5, 70.3 mg/kg and OM-2-0.5, 34.4 mg/kg) were obtained near the former dip tank, and one (OMWA-1-1, 33.1 mg/kg) was obtained near the former refuse burner. Therefore, lead is considered a COC for the former dip tank and refuse burner areas. An inflection point is observed in the Q-Q plot (Appendix C) at approximately 12 mg/kg, which is lower than the lead values detected in background samples BG-1 (27.5 mg/kg) and BG-3 (23.0 mg/kg).

4.1.10 Mercury

Mercury was detected in 18 of 61 soil samples at concentrations ranging from 0.04 to 8.0 mg/kg. The mean value is 0.86 mg/kg. The data do not follow a discernable distribution, and ProUCL suggests the use of the 95% KM (Chebyshev) UCL (0.915 mg/kg) as a central tendency value. The DTSC-SLs for mercury in residential and commercial/industrial soil are 1.0 mg/kg and 4.5 mg/kg, respectively.

The Q-Q plot of the non-transformed data suggests an inflection point at 0.14 mg/kg. Mercury concentrations exceeding 0.14 mg/kg were detected in two soil samples collected within the former dip tank area: OM10-0.5 (2.3 mg/kg), OM-10-2 (8.0 mg/kg) and OM-10-7.5 (1.2 mg/kg), and OM-4-0.5 (2.4 mg/kg) and OM-4-2 (0.17 mg/kg). Therefore, mercury is considered a COC for the former dip tank area.

4.1.11 Molybdenum

Molybdenum was detected in one of 15 soil samples at 1.2 mg/kg. The PQL is 1.0 mg/kg. This concentration is less than the RSL for molybdenum in residential soil of 390 mg/kg and the RSL for commercial/industrial soil of 5,800 mg/kg.

4.1.12 Nickel

Nickel was detected in 60 of 61 soil samples at concentrations ranging from 3.1 to 89.8 mg/kg. The mean value is 30.8 mg/kg. Rosner’s Outlier Test detected no potential outliers at the 5% significance level. The Q-Q plot of log-transformed data suggests a single population. The BTV for nickel is based on the upper range of background values (89.8 mg/kg). The site nickel concentrations are less than the DTSC-SL for nickel in residential soil of 490 mg/kg and commercial/industrial soil of 3,100 mg/kg.

4.1.13 Selenium

Selenium was detected in one of 55 soil samples at 2.3 mg/kg. This value is less than the RSL for selenium in residential soil of 390 mg/kg and commercial/industrial soil of 5,800 mg/kg.

4.1.14 Silver

Silver was detected in one of 61 soil samples at 0.62 mg/kg. This value is less than the RSL for silver in residential soil of 390 mg/kg and commercial/industrial soil of 1,500 mg/kg.

4.1.15 Thallium

Thallium was not detected in any of 55 soil samples analyzed for thallium. The PQL ranged from 1.0 to 4.1 mg/kg. The RSL for thallium in residential soil is 0.78 mg/kg.

4.1.16 Vanadium

Vanadium was detected in 60 of 61 soil samples at concentrations ranging from 8.4 to 134 mg/kg. The mean value is 59.5 mg/kg. Rosner's Outlier Test detected no outliers at the 5% significance level. The linear Q-Q plot suggests a single population of data. The BTV for vanadium is based on the upper range of background values (134 mg/kg). The vanadium concentrations detected in site soil ssamples are less than the DTSC-SL for vanadium in residential soil of 390 mg/kg and commercial/industrial soil of 1,000 mg/kg.

4.1.17 Zinc

Zinc was detected in all of the 61 soil samples at concentrations ranging from 4.3 to 109 mg/kg. The mean value is 38.5 mg/kg. Rosner's Outlier Test detected no outliers at the 5% significance level. The Q-Q plot of log-transformed nickel data suggests a single population. The BTV for zinc is based on the upper range of background values (109 mg/kg). All site soil zinc values are less than the RSL for zinc in residential soil of 23,000 mg/kg and commercial/industrial soil of 350,000 mg/kg.

4.1.18 Hexavalent Chromium

Hexavalent chromium was detected in one of 40 soil samples at a trace concentration of 0.2 mg/kg, which is less than the RSL for residential of 0.3 mg/kg and commercial/industrial soil of 6.34 mg/kg.

4.2 Organics and Inorganics in Groundwater

Groundwater samples were not filtered and contain suspended solids. Laboratory analysis data for groundwater samples from monitoring wells OM-1 through OM-5 are considered to be more representative of actual groundwater quality than the data associated with grab-groundwater samples. Groundwater monitoring well construction and development tends to limit suspended particulates in unfiltered groundwater samples, while unfiltered grab groundwater samples tend to have a wide range of suspended particulate content.

The following evaluation considers recent (2015, 2016 and 2018) analysis data for groundwater samples obtained from developed groundwater monitoring wells, and does not include data for grab groundwater samples.

Despite well construction and development, the contaminant concentrations in the unfiltered groundwater samples obtained from the monitoring wells appear to be directly related to the suspended solids content of the groundwater samples. For example, groundwater constituent concentrations are generally higher in the upgradient monitoring well (OM-1) than in the site monitoring wells (OM-2, OM-3, OM-4 and OM-5) for most constituents except for a single sample obtained from OM-5 in March 2015, which had a suspended solids content of 1.03%, a dioxin TEQ value of 130 pg/L, and the only mercury detection (0.42 ug/L). A duplicate sample was obtained from OM-5 in March 2015 which had a suspended solids content of 0.12% and a dioxin TEQ value of 3.9 pg/L. Suspended solids contents in other samples ranged from 0.06% to 0.43%, and the mean value is 0.16%. The highest dioxin TEQ value for all monitoring well groundwater samples was obtained from upgradient well OM-1 (348 pg/L; 0.18% suspended solids).

The statistical evaluation summarized in Table 1e in Appendix D considers organic constituents detected in site soil (DRO, ORO, PCP, dioxin) as well as inorganic constituents (lead, mercury) occurring in site soil at concentrations exceeding their respective background ranges. Table 1f in Appendix D summarizes groundwater data for these constituents in upgradient well OM-1.

5.0 HUMAN HEALTH RISK ASSESSMENT

We performed an HHRA in general accordance with guidelines set forth in DTSC's HHRA guidance (available online at http://www.dtsc.ca.gov/assessingrisk/humanrisk2.cfm). HHRA methodology and results are summarized below.

5.1 Exposure Pathways and Media of Concern

A SCM is presented in Section 3.0 and on Figure 6. Exposure media for the Site are soil, air, and water. Exposure pathways are incidental ingestion and dermal contact with the affected soil, inhalation of particulates and volatile compounds originating from the affected soil, ingestion and dermal contact with affected groundwater, and inhalation of volatile compounds originating from affected groundwater. Surface water pathways are not considered in the risk assessment, as discussed in Section 2.5.

5.2 Exposure Point Concentrations and Chemical Groups

Statistical analysis of laboratory analysis data for site soil identifies organic and inorganic COCs. The statistical evaluation is summarized in Table 2, Appendix D. Exposure Point Concentrations (EPCs) are generally represented by a reasonable maximum exposure (RME) concentration, using the 95% upper confidence limit (95% UCL) on the arithmetic mean constituent concentration, as determined using the latest version of ProUCL (Version 5.0; USEPA, 2015). Statistical calculations are summarized in Appendix C. When UCL calculations are not possible based on a limited number of detections, the maximum detected concentration is typically used as the EPC.

Summary statistics for all site data are presented in Tables 1a and 1b, Appendix D by constituent. EPCs presented in Tables 1a and 1b are considered when quantifying hazard and risk for the Site as a whole. Summary data for COCs for each area of concern are presented in Tables 1c and 1d. As expected based on the conceptual model, the EPCs developed for shallow soil (upper 2 feet, Table 1d) are generally higher than the EPCs developed for all soil depths (Table 1c). Therefore, EPCs for shallow soil (Table 1d) are used for hazard and risk quantification for specific assessment areas (Appendix D).

Because an authoritative rather than random soil sampling approach was employed for the site investigation, there are inherent limitations to the data usability for statistical analysis.

5.3 Constituents of Concern

Site investigation and statistical analysis have identified the following COCs in soil and groundwater:

- DRO;
- ORO;
- PCP;

- Dioxin as TEQ values; and
- Metals (lead and mercury).

Inorganic COC selection is summarized in Table 2 (Appendix D). In general, metals are considered COCs if the EPC exceeds the BTV. As discussed above in Section 4, metals with isolated outlying values (e.g., arsenic, barium, copper) are not considered COCs.

5.4 Exposure Parameters

Soil and air exposure resulting from residential (unrestricted) land use is considered, as are other potential exposure scenarios including industrial, commercial and recreational land use, routine visitation from neighboring residences, and construction worker exposure. Residential use of groundwater is also considered.

5.4.1 Residential Land Use

Exposure parameters for residential land use are adopted from the PEA Guidance Manual (DTSC, 2015) as updated by HERO HHRA Note No. 1 (DTSC, 2014), pursuant to guidance presented in *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual* (RAGS Part E, Supplemental Guidance for Dermal Risk Assessment; US EPA, OSWER 9285.7-02EP; July 2004) and *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (US EPA, OSWER 9355.4-24; December 2002).

- Child exposure is considered for hazard assessment.
- Exposure frequency is 350 days per year.
- Body weight is 15 kilograms (kg) for child and 80 kg for adult.
- The incidental soil ingestion rate is 200 milligrams per day (mg/day) for child and 100 mg/day for adult. Pica is not considered.
- The inhalation rate is 10 cubic meters per day (m^3/day) for child and 20 m^3/day for adult.
- Averaging time is 70 years for carcinogenic effects.
- Exposure duration for adults is 20 years. Averaging time for non-carcinogenic effects is equal to the exposure duration.
- Exposed skin surface area is 2,900 square centimeters (cm^2) for children and 6,032 cm^2 for adults.
- Dermal adherence factor is 0.2 milligrams per square centimeter (mg/cm^2) for children and 0.07 mg/cm^2 for adults.
- Particulate emission factor (PEF) is 1.36 x 10^9 cubic meters per kilogram (m^3/kg).

5.4.2 Industrial Land Use

Exposure parameters for industrial land use are adopted from HERO HHRA Note No. 1 (DTSC, 2014):

- Adult exposure is considered.
- Exposure frequency is 250 days per year.
- Body weight is 80 kg.
- The incidental soil ingestion rate is 100 mg/day.
- The inhalation rate is 14 m^3/day.
- Averaging time is 70 years for carcinogenic effects.
- Exposure duration is 25 years.
- Averaging time for non-carcinogenic effects is equal to the exposure duration.
- Exposed skin surface area is 6,032 cm^2.
- Dermal adherence factor is 0.2 mg/cm^2.
- PEF is 1.36×10^9 m^3/kg.

5.4.3 Commercial Indoor Worker

Exposure parameters for the commercial indoor worker are adopted from RAGS (USEPA, 2004) and Supplemental Guidance (USEPA, 2002), and are identical to the parameters set forth above for industrial land use, with the following exceptions:

- Incidental soil ingestion rate is 50 mg/day instead of 100 mg/day.
- Exposed skin surface area is 3,300 cm^2 instead of 6,032 cm^2.

5.4.4 Child and Adult Recreational Land Use

Exposure parameters for recreational land use are based on the residential (unrestricted) land use exposure scenario with the following modifications:

- Exposure frequency for child and adult ingestion and inhalation is 150 days per year rather than 350 days per year.
- Exposure frequency for child dermal contact is 150 days per year, rather than 350 days per year. Exposure frequency for adult dermal contact is 100 days per year as set forth for the residential (unrestricted) land use scenario.
- Exposure time is 8 hours per day rather than 24 hours per day.

5.4.5 Construction Worker

Exposure parameters for the construction worker are adopted from HERO HHRA Note No. 1 (DTSC, 2014). Considering the expected duration of the cleanup (approximately one month), the default exposure duration (one year) used in this scenario is conservative.

- Adult exposure is considered.
- Exposure duration is one year.
- Exposure frequency is 250 days per year.
- Body weight is 80 kg.
- Incidental soil ingestion rate is 330 mg/day.
- Inhalation rate is 20 m^3/day for the eight-hour workday.
- Averaging time is 70 years for carcinogenic effects.
- Averaging time for non-carcinogenic effects is equal to the exposure duration.
- Exposed skin surface area is 6,032 cm^2.
- Dermal adherence factor is 0.08 mg/cm^2.
- PEF is 1.0×10^6 m^3/kg.

5.5 Toxicity Values

Toxicity values and references are listed in Table 3 (Appendix D). Toxicity value selection was performed pursuant to HERO HHRA Note No. 3 (DTSC, 2018). Dioxin TEQ values are derived for dioxins and furans relative to 2,3,7,8-TCDD pursuant to HHRA Note 2 (DTSC, 2017), following the 2005 World Health Organization reevaluation of TEQ factors (Van den Berg, 2006).

5.6 Risk Characterization

5.6.1 Soil and Air

We performed risk and hazard calculations using the following equations for non-volatile constituents in soil. For residential land use, hazard is evaluated for child exposure. Calculations are summarized in Appendix D Tables 4 through 8, and results are summarized in Table 9.

$$Risk_{soil} = SF_o \text{ x } C_s \text{ x } [((IR_{s,child} \text{ x } EF \text{ x } ED_{child} \text{ x } 10^{-6} \text{ kg/mg}) / (BW_{child} \text{ x } AT \text{ x } 365 \text{ days/yr})) + ((SA_{child} \text{ x } AF \text{ x } ABS \text{ x } EF_{child} \text{ x } ED_{child} \text{ x } 10^{-6} \text{ kg/mg}) / (BW_{child} \text{ x } AT \text{ x } 365 \text{ days/yr})) + ((IR_{s,adult} \text{ x } EF \text{ x } ED_{adult} \text{ x } 10^{-6} \text{ kg/mg}) / (BW_{adult} \text{ x } AT \text{ x } 365 \text{ days/yr})) + ((SA_{adult} \text{ x } AF \text{ x } ABS \text{ x } EF_{adult} \text{ x } ED_{adult} \text{ x } 10^{-6} \text{ kg/mg}) / (BW_{adult} \text{ x } AT \text{ x } 365 \text{ days/yr}))]$$

$$Hazard_{soil} = (C_s / RfD_o) \text{ x } [((IR_s \text{ x } EF \text{ x } ED \text{ x } 10^{-6} \text{ kg/mg}) / (BW \text{ x } AT \text{ x } 356 \text{ days/yr})) + ((SA \text{ x } AF \text{ x } ABS \text{ x } EF \text{ x } ED \text{ x } 10^{-6} \text{ kg/mg}) / (BW \text{ x } AT \text{ x } 365 \text{ days/yr}))]$$

$Risk_{air} = SF_i \times C_a \times [((IR_{child} \times EF \times ED_{child}) / (BW_{child} \times AT \times 365 \text{ days/yr})) + ((IR_{adult} \times EF \times ED_{adult}) / (BW_{adult} \times AT \times 365 \text{ days/yr}))]$

$Hazard_{air} = (C_a / RfD_i) \times (IR \times EF \times ED) / (BW \times AT \times 365 \text{ days/yr})$

Where:

ABS = absorption fraction of chemical from soil

AT = averaging time, years

AF = soil to skin adherence factor, mg/cm^2

BW = body weight, kg

C_a = concentration in air, mg/m^3 ($C_a = C_s / PEF$)

C_s = concentration in soil, mg/kg

ED = exposure duration, years

EF = exposure frequency

PEF = particulate emission factor, m^3/kg

$Hazard_{air}$ = non-cancer chronic health hazard for air pathways

$Hazard_{soil}$ = non-cancer chronic health hazard for soil pathways

IR_a = inhalation rate, m^3/day

IR_s = incidental soil ingestion rate, mg/day

SA = exposed skin surface area, cm^2

SF_i = inhalation cancer slope factor, $(mg/kg\text{-}day)^{-1}$

SF_o = oral cancer slope factor, $(mg/kg\text{-}day)^{-1}$

RfD_i = inhalation reference dose, mg/kg-day

RfD_o = oral reference dose, mg/kg-day

$Risk_{air}$ = lifetime excess cancer risk for air pathways

$Risk_{soil}$ = lifetime excess cancer risk for soil pathways

For volatile constituents (i.e., mercury) in soil, the following methodology is used to assess chronic health hazard related to air pathways pursuant to HERO HHRA Note No. 3 (DTSC, 2016).

$Hazard_{air} = (C_a / RfC_i) \times (EF_i \times ED \times ET) / (AT_{nc} \times 24 \text{ hr/day} \times 365 \text{ day/yr})$

Where:

RfC_i = reference concentration for inhalation exposure, mg/m^3 (mercury RfCi = 3.0E-05 mg/m^3 as established by OEHHA and as listed in Table 3)

AT_{nc} = averaging time for non-carcinogenic effects, years

C_a = concentration in air, mg/m^3 ($C_a = C_s$ / VF)

VF = volatilization factor for soil, m^3/kg, as established by DTSC (2016) Table A-5 ($VF_{resident}$ = 3.52E+04 m^3/kg; VF_{worker} = 3.52E+04 m^3/kg)

C_s = concentration in soil, mg/kg

EF_i = exposure frequency for inhalation pathway, days/yr

ED = exposure duration, years

ET = exposure time, hr/day (24 hr/day for resident and 8 hr/day for worker)

5.6.2 Water

Risk and hazard calculations are performed using the following equations for non-volatile constituents in water. Calculations are summarized in the Tables 11 and 12 (Appendix D).

$Risk_{water}$ = SFo x Cw x [(IRw_{child} x EF x ED_{child}) / (BW_{child} x ATc) + (IRw_{adult} x EF x ED_{adult}) / (BW_{adult} x ATc) + (SA_{child} x Kp x ET x EF x ED_{child} x (1 L / 1,000 cm^3)) / (BW_{child} x ATc) + (SA_{adult} x Kp x ET x EF x ED_{adult} x (1 L / 1,000 cm^3)) / (BW_{adult} x ATc)

$Hazard_{water}$ = (Cw/RfDo) x [(IRw_{child} x EF x ED_{child}) / (BW_{child} x ATnc) + (SA_{child} x Kp x ET_{child} x EF x ED_{child} x (1 L / 1,000 cm^3)) / (BW_{child} x ATnc)]

Where:

SFo = Slope factor ([mg/kg-day]-1)

RfDo = oral reference dose (mg/kg-day)

BW_{adult} = body weight, adult (80 kg)

BW_{child} = body weight, child (15 kg)

ATc = averaging time, carcinogen (70 years x 365 days/year; 25,550 days)

ATnc = averaging time, non-carcinogen (AT = ED x 365 days/year; 2190 days)

EF = exposure frequency (350 days/year)

ED_{child} = exposure duration, child (6 years)

ED_{adult} = exposure duration, adult (20 years)

IRw_{child} = ingestion rate, child (0.78 L/day)

IRw_{adult} = ingestion rate, adult (2.5 L/day)

ET_{child} = exposure time during bathing, child (0.54 hr/day)

ET_{adult} = exposure time during bathing, adult (0.71 hr/day)

SA_{child} = skin surface area available for contact, child (6,378 cm^2)

SA_{adult} = skin surface area available for contact, adult (20,900 cm^2)

Kp = chemical-specific dermal permeability coefficient from water (cm/hour)

Cw = concentration of chemical in water (mg/L)

Risk and hazard calculations are performed using the following equations for volatile constituents in water. Calculations are summarized in the Tables 11 and 12 (Appendix D).

$Risk_{water}$ = SFo x Cw x [(IRw_{child} x EF x ED_{child}) / (BW_{child} x ATc) + (IRw_{adult} x EF x ED_{adult}) / (BW_{adult} x ATc) + (SA_{child} x Kp x ET x EF x ED_{child} x (1 L / 1,000 cm^3)) / (BW_{child} x ATc) + (SA_{adult} x Kp x ET x EF x ED_{adult} x (1 L / 1,000 cm^3)) / (BW_{adult} x ATc) +IUR x 1,000 ug/mg x Cw x K x ET x EF X ED

$Hazard_{water}$ = (Cw/RfDo) x [(IRw_{child} x EF x ED_{child}) / (BW_{child} x ATnc) + (SA_{child} x Kp x ET_{child} x EF x ED_{child} x (1 L / 1,000 cm^3)) / (BW_{child} x ATnc) + K x ET x EF x ED_{child} / AT]

Where:

IUR = inhalation unit risk $(ug/m^3)^{-1}$

K = Andelman volatilization factor (0.5 L/m^3)

5.7 Summary of Results

Risk assessment results for soil are summarized in Appendix D Table 9. The table lists hazard and risk for each area of concern and exposure scenario paring, considering all COCs as well as providing specific results for hazard and risk related to dioxins/furans.

HHRA Note No. 2 (DTSC, 2017), provides recommended health-protective remedial goals for soil contaminated by dioxins and dioxin-like compounds expressed as dioxin TEQ concentrations. DTSC (2017) recommends a remedial goal ranging from 220 to 700 ng/kg for commercial/industrial sites based on a central tendency value (95% UCL). The TEQ concentration of 220 ng/kg corresponds to a risk of one-per-ten-thousand (1.E-05), and the TEQ concentration of 700 ng/kg corresponds to a hazard quotient of unity (1). DTSC (2017) states that the selection of a remedial goal between 200 and 700 ng/kg should be performed in consultation with DTSC HERO.

As described in Section 5.2, the EPCs developed for shallow soil (upper 2 feet, Table 1d) are generally higher than the EPCs developed for all soil depths (Table 1c). Therefore, EPCs for shallow soil (Table 1d) are used for hazard and risk quantification for specific assessment areas.

5.7.1 Residential Land Use

5.7.1.1 All Detected Chemicals, Including Ambient Range Constituents of Concern

Table 4a (Appendix D) summarizes hazard and risk for all site data considering all detected constituents. EPCs for the entire Site are presented in Tables 1a and 1b (Appendix D). Pursuant to guidelines set forth in HERO HHRA Note No. 4 (DTSC, 2014), it is appropriate to evaluate hazard and risk associated with exposure to all detected chemicals, including those that are determined to be consistent with site-specific background or ambient concentrations. This information is intended to be useful for risk management decisions and to foster public transparency.

As summarized in Table 4a, background arsenic concentrations in soil (EPC 2.5 mg/kg based on 95% UCL) results in a hazard quotient (HQ; 6.3) greater than unity and a lifetime excess cancer risk (risk; 2.E-05) greater than one-per-million under the residential exposure scenario. The COCs mercury and dioxin TEQ contribute significantly to the hazard index (HI), and the COCs PCP and dioxin TEQ contribute significantly to the cumulative risk.

5.7.1.2 Constituents of Concern

Human health risk and hazard under a residential exposure scenario are characterized in Tables 4b through 4e (Appendix D). For all assessment areas, the chronic health hazard index (hazard, or HI) exceeds unity, and the lifetime excess cancer risk (risk) exceeds one-per million. Therefore, the Site is not considered suitable for unrestricted land use in its present condition.

5.7.2 Industrial Land Use

Human health hazard and risk are characterized under an industrial land use scenario in Tables 5a through 5d (Appendix D). Results are presented in Table 9 (Appendix D) and summarized below.

Assessment Area	Result
Log Pond	HI<1, Risk<10-6 excluding dioxin TEQ. Dioxin TEQ Risk<10-5
Dip Tank and Transfer Pit	HI>1, (driven by DRO), Risk>10-6 (driven by PCP)
Boiler Room	HI<1, Risk<10-6 excluding dioxin TEQ. Dioxin TEQ Risk<10-5
Refuse Burner	HI<1, Risk<10-6 excluding dioxin TEQ. Dioxin TEQ Risk<10-5

Therefore, all assessment areas except Area 2 appear to be suitable for industrial use. DRO and PCP concentrations in soil at Area 2 are not suitable for industrial land use based on this exposure scenario.

5.7.3 Commercial Indoor Worker

Human health hazard and risk are characterized under a commercial indoor worker scenario in Tables 6a through 6d (Appendix D). Results are presented in Table 9 (Appendix D) and summarized below.

Assessment Area	Result
Log Pond	HI<1, Risk<10-6 excluding dioxin TEQ. Dioxin TEQ Risk<10-5
Dip Tank and Transfer Pit	HI>1, (driven by DRO), Risk>10-6 (driven by PCP)
Boiler Room	HI<1, Risk<10-6 excluding dioxin TEQ. Dioxin TEQ Risk<10-5
Refuse Burner	HI<1, Risk<10-6 excluding dioxin TEQ. Dioxin TEQ Risk<10-5

Therefore, all assessment areas except Area 2 appear to be suitable for commercial use. DRO and PCP concentrations in soil at Area 2 are not suitable for commercial land use based on this exposure scenario.

5.7.4 Child and Adult Recreational Use

Human health hazard and risk are characterized under child and adult recreational use scenarios in Tables 7a through 7d (Appendix D). Results are presented in Table 9 (Appendix D) and summarized below.

Assessment Area	Result
Log Pond	HI<1, Risk<10-6 excluding dioxin TEQ. Dioxin TEQ HQ=1.2, Risk<10-5
Dip Tank and Transfer Pit	HI>1, (driven by DRO), Risk>10-6 (driven by PCP)
Boiler Room	HI<1, Risk<10-6 excluding dioxin TEQ. Dioxin TEQ Risk<10-5
Refuse Burner	HI<1, Risk<10-6 excluding dioxin TEQ. Dioxin TEQ Risk<10-5

Therefore, all assessment areas except Area 2 appear to be suitable for recreational use. DRO and PCP concentrations in soil at Area 2 are not suitable for recreational land use based on this exposure scenario.

5.7.5 Construction Worker

Human health hazard and risk are characterized under a construction worker scenario in Tables 8a through 8d (Appendix D). Results are presented in Table 9 (Appendix D) and summarized below.

Assessment Area	Result
Log Pond	HI<1, Risk<10-6 excluding dioxin TEQ. dioxin TEQ Risk<10-5
Dip Tank and Transfer Pit	HI>1, (driven by DRO), Risk>10-6 (driven by PCP)
Boiler Room	HI<1, Risk<10-6 excluding dioxin TEQ. Dioxin TEQ Risk<10-5
Refuse Burner	HI<1, Risk<10-6 excluding dioxin TEQ. Dioxin TEQ Risk<10-5

Therefore, all assessment areas except Area 2 do not appear to require specific controls for construction. DRO and PCP concentrations in soil at Area 2 require specific handling protocols for worker protection.

5.7.6 Residential Groundwater Use

Human health hazard and risk are characterized under a residential groundwater use scenario in Tables 11 and 12 (Appendix D). The statistical evaluation summarized in Table 1e (Appendix D) considers organic constituents detected in site soil (DRO, ORO, PCP, dioxin TEQ) as well as inorganic constituents (lead, mercury) in site soil at concentrations exceeding the background range. Table 1f (Appendix D) summarizes groundwater data for these constituents in upgradient well OM-1. The EPCs for unfiltered groundwater presented in Tables 11 and 12 show that groundwater is not suitable for residential use.

As described in Section 4.2, contaminant concentrations in the unfiltered groundwater samples obtained from the monitoring wells appear to be related to the suspended solids content of the groundwater samples. For example, groundwater constituent concentrations are generally greater in the upgradient monitoring well (OM-1) than in the downgradient wells (OM-2, OM-3, OM-4 and OM-5) for most constituents except for a single sample obtained from OM-5 in March 2015, which had a suspended solids content of 1.03%, a dioxin TEQ value of 130 pg/L, and the only mercury detection of 0.42 ug/L. A duplicate sample was obtained from OM-5 in March 2015 with a suspended solids content of 0.12% and a dioxin TEQ value of 3.9 pg/L. Other suspended solids contents range from 0.06% to 0.43%, and the mean value is 0.16%. The highest dioxin TEQ value for all monitoring well samples of 348 pg/l was obtained from upgradient well OM-1 with 0.18% suspended solids.

5.8 Lead Hazard Assessment

Lead hazards were assessed using the Lead Risk Assessment Spreadsheet Version 8 (LeadSpread 8; DTSC, 2011) for child exposure, and the Modified USEPA Adult Lead Model (Modified ALM; DTSC, 2011) for adult exposure. LeadSpread and the Modified ALM worksheets are in Appendix E. Calculations were performed using standard exposure parameters and the EPC values (95% UCL values) listed in Tables 1a and 1b (Appendix D). Results are summarized in Table 10 (Appendix D).

The California Environmental Protection Agency (CalEPA) Office of Environmental Health Hazard Assessment (OEHHA) modified the toxicity evaluation of lead in 2007, replacing the 10 micrograms per deciliter (µg/dl) threshold blood concentration with a source-specific "benchmark change" of 1.0 µg/dl. This change is addressed in the OEHHA publication Child-Specific Benchmark Change in Blood Lead Concentration for School Site Risk Assessment (OEHHA, April 2007; http://oehha.ca.gov/risk-assessment/crnr/final-report-chrc-lead).

As summarized in Table 10, the Site maximum soil lead value of 70.3 mg/kg and the RME soil lead value of 17.4 mg/kg yield blood lead levels less than 1.0 µg/dl considering the standard exposure parameters in the child and adult exposure models (Appendix D).

5.9 Uncertainty Analysis

Per OEHHA (2004), "systematic, logical and informed approaches to decision making about carcinogens in the environment call for quantitative assessments, because the absence of clearly definable thresholds does not permit identification of 'safe' levels of exposure. Unfortunately, due to the frequent lack of sufficient data, assumptions have to be made in order to complete quantitative assessments of cancer risk."

There are uncertainties associated with contaminant concentrations in site media; the amount of exposure to site media; and the toxicological effects of contaminants. Such uncertainty must be discussed so that the assessment does not result in a "higher degree of implied certainty in the overall assessment than is warranted" (OEHHA, 2004).

As a result of the uncertainties described below, confidence in the exposure assessment is considered low to moderate. Confidence in toxicity values range from low to high based on the data available for specific contaminants.

5.9.1 Sampling Uncertainty

Sampling uncertainty related to contaminant concentrations in soil, as well as sampling uncertainty related to the literature-derived exposure and toxicity parameters, contribute to the overall uncertainty of the assessment. Statistical analysis is performed as part of the assessment to develop an RME. Confidence in a population mean and variance increases as the number of samples collected and analyzed increases. Based on the moderate sample population and the authoritative sampling approach, confidence in sampling is considered moderate to low.

5.9.2 Model Uncertainty

The literature-derived exposure factors and toxicity factors used in the assessment were obtained with the goal of reducing uncertainty; however, limitations of existing data pertaining to activity patterns for future site occupants, as well as health effects from exposure to contaminants, result in model uncertainty.

5.9.3 Laboratory Methods and Detection Limits

Contaminant concentrations in soil generally exceed the corresponding laboratory detection limits. Therefore, detection limits are not expected to be a significant source of uncertainty.

5.9.4 Toxicity Values

The slope factors used for risk characterization imply a linear (no threshold) dose-response relationship. If the dose-response relationship is non-linear, the assumption of linearity would tend to overestimate risks. In general, the literature-derived toxicity values are based on conservative estimates that tend to overestimate health risk.

5.10 Conclusions

5.10.1 Unrestricted Land Use

Baseline conditions at all assessment areas are not suitable for residential land use. For all assessment areas, the chronic health hazard index (hazard, or HI) exceeds unity, and the lifetime excess cancer risk (risk) exceeds one-per million. Therefore, the Site is not considered suitable for unrestricted land use in its present condition.

5.10.2 Proposed Future Commercial/Industrial and Recreational Land Use

All assessment areas except Area 2 (Dip Tank and Transfer Pit) generally appear to be acceptable for use under the other exposure scenarios evaluated, including industrial, indoor commercial, recreational and construction worker.

Without hot spot removal, the DRO and PCP concentrations in soil at Area 2 (Dip Tank and Transfer Pit) are generally not suitable for use under the exposure scenarios evaluated in this assessment. The DRO and PCP concentrations in soil at Area 2 require specific handling protocol for construction worker protection, including dust control and hazard communication.

5.10.3 Potential Hot Spots

The assessment identified the following potential hot spots.

5.10.3.1 PCP and Mercury

PCP is considered a COC for two locations within the Dip Tank and Transfer Pit Area, and mercury is considered a chemical of potential ecological concern (COPEC) at these locations:

- Location OM-10 based on laboratory analysis results for samples OM-10-0.5 (150 mg/kg PCP, 2.3 mg/kg mercury), OM-10-2 (150 mg/kg PCP, 8.0 mg/kg mercury), and OM-10-7.5 (15 mg/kg PCP, 1.2 mg/kg mercury).
- Location OM- 4 based on laboratory analysis results for samples OM-4-0.5 (11 mg/kg PCP, 2.4 mg/kg mercury) and OM-4-2 (12 mg/kg; 0.17 mg/kg mercury)

5.10.3.2 DRO

DRO is considered a COC for the Dip Tank and Transfer Pit Area, particularly at OMTP-2 based on laboratory analysis results for sample OMTP-2-1 (47,000 mg/kg). However, DRO in this area appears to be limited to this location.

5.10.3.3 Other Potential Hot Spots

Other PCP-impacted soil with concentrations exceeding screening levels is present in the Dip Tank and Transfer Pit Area and other DRO-impacted soil with concentrations exceeding screening levels is present at the down slope side of the Boiler Room Area and at the Refuse Burner Area. Although these elevated soil PCP and DRO concentrations did not result in unacceptable central tendency values, these areas should be considered when determining the extent of hot spot removal.

5.10.4 Residential Groundwater Use

Groundwater exposure is not likely for onsite receptors because the Site is located in an area served by treated municipal drinking water. However, groundwater is considered a medium of concern because drinking water is a potential beneficial use of groundwater.

Based on the assessment presented herein, the groundwater obtained from the monitoring wells at the Site is not suitable for residential use.

As described in Section 4.2, contaminant concentrations in the unfiltered groundwater samples obtained from the monitoring wells appear to be related to the suspended solids content of the groundwater samples. Groundwater constituent concentrations are generally higher in samples from the upgradient monitoring well (OM-1) than in those from the downgradient wells (OM-2, OM-3, OM-4 and OM-5) for most constituents except for a single sample obtained from OM-5 in March 2015, which had a suspended solids content of 1.03%, a dioxin TEQ value of 130 pg/l, and the only mercury detection of 0.42 ug/l. A duplicate sample was obtained from OM-5 in March 2015 with a suspended solids content of 0.12% and a dioxin TEQ value of 3.9 pg/l, and mercury was not detected. Other suspended solids contents range from 0.06% to 0.43%, and the mean value is 0.16%. The highest dioxin TEQ value for all monitoring well samples was obtained from upgradient well OM-1 at 348 pg/l with 0.18% suspended solids.

6.0 ECOLOGICAL RISK ASSESSMENT

We performed an Ecological Scoping Assessment in general accordance with guidelines set forth in DTSC's Ecological Scoping Assessment guidance (http://www.dtsc.ca.gov/assessingrisk/eco2.cfm).

6.1 Ecological Scoping Assessment

Scoping-level assessment is described in *Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities,* Part A: Overview (DTSC, 1996). An Ecological Scoping Assessment is the first phase of assessment, and is intended to develop a conceptual site model, identify contaminants and receptors of concern and potential exposure pathways.

A scoping-level assessment consists of characterization of the chemical, physical, and biological nature of the Site, and an evaluation of the potential for complete exposure pathways. The results of this qualitative assessment may be used to determine the need for, and the extent of, further assessment. Components of the Ecological Scoping Assessment include:

- Site characterization;
- Biological characterization; and
- Pathway assessment.

6.1.1 Site Characterization

Site characterization findings are summarized in Section 2 of this report, and an SCM is developed in Section 3.

6.1.1.1 Conceptual Model

Figure 6 is an SCM diagram for the Site depicting source media, release mechanisms, and transport mechanisms. Figure 7 is a conceptual model diagram for ecological receptors.

6.1.1.2 Areas of Concern

The Site is divided into four assessment areas as listed below.

Assessment Area	Description	Size (acres)
1	Log Pond	3.5
2	Dip Tank and Transfer Pit	0.5
3	Boiler Room	0.2
4	Refuse Burner	0.2

The assessment areas are currently vegetated open space. Future land use includes commercial, industrial and/or recreational use.

6.1.1.3 Constituents of Potential Ecological Concern

COPECs are identified based on comparison to ecological screening levels and background concentrations. The comparison addresses the following questions:

- Does the EPC exceed ecological soil screening levels (Eco-SSLs)?
- Does the EPC exceed the upper-end background concentration?

Constituents that meet both criteria are considered COPECs.

As described in Section 4.1, lead and mercury are present in site soil at the Dip Tank/Transfer Pit Area at concentrations exceeding site background concentrations, and lead is present in site soil at the Refuse Burner Area at concentrations exceeding site background concentrations. In addition, organic constituents DRO, ORO, PCP, and TEQ are present in site soil in multiple assessment areas.

COPEC selection is summarized in Tables 13 through 16 in Appendix D. Ecological EPCs are represented by 95% UCL values, or for small data sets, by maximum detected concentrations. As described in Section 5.2, EPCs developed for shallow soil (upper 2 feet) are generally higher than the EPCs developed for all soil depths. Therefore, EPCs for shallow soil (Table 1d) are used for this scoping assessment. COPECs are listed by assessment area below.

Assessment Area	COPEC	95 % UCL (mg/kg)	Maximum Detected Concentration (mg/kg)
1 Log Pond	none	NA	NA
2 Dip Tank and Transfer Pit	mercury	2.32	8.0
	PCP	24.4	150
3 Boiler Room	none	NA	NA
4 Refuse Burner	none	NA	NA

Notes:
COPEC = constituent of potential ecological concern
NA = not applicable (no UCL calculated)
PCP = pentachlorophenol
UCL = upper confidence limit on mean detected concentration

6.1.2 Biological Characterization

Biological characterization of the Site and adjacent property has previously been performed by others as part of the *Roseburg Commerce Park Draft Environmental Impact Report*, SCH No. 98032006 (Draft EIR; Pacific Municipal Consultants, May 1998). Section 4.7 of the Draft EIR describes the Site's biological resources, regulatory framework, potential impacts and mitigation measures related to a previously proposed development project (Appendix F).

The biological resources study was conducted by North State Resources using the following methods:

- Lists of special status plant and wildlife species were reviewed, including lists from the California Department of Fish and Game and the United States Fish and Wildlife Service.
- Searches and queries of the California Department of Fish and Game Natural Diversity Database (CNDDB), California Native Plant Society Electronic Inventory (Skinner and Pavlik, 1994) and the CDFG Wildlife Habitat Relationships System (Airola, 1988) were conducted to search for potential special status floral or fauna.
- The Site was transected on foot to characterize vegetation habitats and to document features that may be considered potential habitat for special status flora and fauna. Vegetation was classified using the WHR system (Mayer and Laudenslayer 1988). Wildlife species were identified by direct observation, by identification of vocalizations, or by observation of various animal signs.

6.1.2.1 Habitats

The following habitats were identified:

- The northeastern end of the Site (former log pond area, including the adjacent boiler room area and refuse burner area) and the eastern edge of the Site were mapped as fresh emergent wetland/montane riparian complex.
- The remainder of the Site (including the dip tank and transfer pit area) was mapped as barren and/or disturbed areas

Vegetation Community	**Area** (acres)	**Portion of Site** (%)
Fresh Emergent Wetland / Montane Riparian Complex	8.5	43
Barren and/or Disturbed Areas	11.5	57

6.1.2.2 Species and Communities

A complex of fresh emergent wetland/montane riparian vegetation was identified at the log pond area, which includes a perennial stream and several springs and seeps. Vegetation was described as moderate to dense network of emergent wetland and riparian species. Dominant species within this area include sedges (*Carer*: spp.), rushes (*Jimcus* spp.), broad-leaf cattail (*Typha latifolia*), bracken fern (*Pteridium aquilinum*), doc (*Rumex* sp.) and horsetail fern (*Equisetum arvense*). Riparian vegetation is moderate to dense and includes an overstory of white alder (*Alnus rhombifolia*), willow (*Salix* spp.), and black cottonwood (*Populus trichocarpa*). Shrubs include Himalayan blackberry (*Rubus discolor*), spirea (*Spirea douglasii*), wood rose (*Rosa woodsi*), snowberry (*Symphoricarpo*s sp.), and thimbleberry (*Rubus parviflorus*). The southern portion of the western half of this area is occupied by a dense stand of montane chaparral dominated by green leaf manzanita, mountain whitethorn, bitter cherry and chinquapin with occasional black oaks.

The central and southern portions of the Site are dominated by disturbed areas resulting from former mill operations. Vegetation within these areas is described as a combination of trees, shrubs, and grasses and forbs. Dominant tree species include ponderosa pine (*Pinus ponderosa*), incense cedar (*Calocedrus decurrens*), Douglas fir (*Pseudotsuga menziesii*) and black oak (*Quercus kelloggii*). Shrubs are found growing in dense to sparse motts and include green leaf manzanita (*Arctostaphylos patula*), mountain whitethorn (*Ceanothus cordulatus*), tobacco brush (*C. velutinus*), rabbitbrush (*Chrysothamnus nauseosus*), bitter cherry (*Pnmus emarginata*), scotch broom (*Cytisus scoparius*), and chinquapin (*Castanopsis sempervirens*). Other herbaceous growth occurs throughout the disturbed areas and includes everlasting peavine (*Lathyrus latifolius*), common mullein (*Verbascum* sp.), willow-herb (*Epilobium* sp.), bull thistle (*Cirsium* sp.) plantain (*Plantago* sp.), and various other grasses and forbs.

6.1.2.3 Special Status Species

Five special status plant species were found to exist in similar habitats within the general vicinity of the Site. These species include Shasta chaenactis (*Chaenactis sziffrutescens*), pallid bird's beak (*Cordylanthus tenuis ssp.pallencens*), Oregon fireweed (*Epilobium oreganum*), Aleppo avens (*Geum aleppicum*), and northern adder's-tongue (*Ophioglossum pusillum*). No record of these species being within the Site was identified. Shasta chaenactis occurs in coniferous forests on sandy or serpentine soils. Oregon fireweed and Aleppo avens occur in meadow or bog/fen habitats. Although historical records exist of its occurrence in the Mt. Shasta area, northern adder's-tongue is considered extirpated in California. Pallid bird's-beak is known from the lower montane conifer forests in the vicinity of Black Butte and areas southwest. Potential habitat may occur within the Site for pallid-bird's beak, particularly in forested areas in the eastern portion of the Site. Potential habitat for the four other special status species mentioned was not identified within the Site.

Potential habitat for two amphibian wildlife species (northern red-legged frog - *R. aurora auro*ra) and Cascades frog (*R. cascadae*) was identified within wetland areas, which are primarily associated with the log pond area. Potential habitat for three avian special status wildlife species (northern goshawk - *Accipiter gentilis*), Cooper's hawk (*A. cooperii*) and sharp-shinned hawk (*A. striatus*) was identified in the forested area to the east of the Site, across Mt. Shasta Boulevard.

6.1.3 Pathway Assessment

Terrestrial receptors are potentially exposed to elevated metals concentrations in contaminated soil. Site conceptual model diagrams are presented as Figures 7 and 8. The conceptual model is described in Section 3, and assessment areas are described in Section 6.1.1.

The contaminated medium at the Site is soil. The potential for significant surface water impact is expected to be low. Potentially complete exposure pathways include:

- Direct exposure to contaminated soil for producers and invertebrates;
- Indirect exposure for consumers via food-web transfer (ingestion of affected biota); and
- Secondary direct exposure for consumers (incidental soil ingestion, inhalation of airborne particulate sand dermal contact).

Terrestrial plants may be exposed via root contact, and herbivorous consumers may consume the contaminants with the affected plants. Terrestrial invertebrates may incorporate contaminants by contact with contaminated soil. Wildlife exposure may occur via food-web transfer or directly via inhalation of airborne particulates or incidental ingestion during activities such as foraging, grooming or burrowing. Mercury is the only potentially volatile constituent.

Wildlife exposures to chemicals in soil via inhalation of volatile constituents or dust and dermal contact are not evaluated quantitatively in this Ecological Scoping Assessment, pursuant to the Eco-SSL guidance (USEPA, 2005).

6.1.4 Findings of Ecological Scoping Assessment

The scoping assessment identified COPECs (mercury and PCP) in soil at the dip tank and transfer pit area. The elevated concentrations of these COPECs occur in isolated hot spots within the assessment area. COPECs are selected based on their occurrence at concentrations higher than local background concentrations and above one or more Eco-SSLs. The potential for future ecological exposure to COPECs in the dip tank and transfer pit area is dependent upon the nature of site development. If the assessment area is to support commercial/industrial development, habitat may not be present to support complete ecological exposure pathways. If the site remains open space or is developed as recreational open space, then the potential for ecological exposure may exist. Assessment areas, EPCs and likely remedial actions are summarized below.

Assessment Area	COPEC	EPC (mg/kg)		Proposed Remedial Action
		Value	Source	
1 Log Pond	None	NA	NA	None
2 Dip Tank and Transfer Pit	Mercury	2.32	95% UCL	Hot spot removal and offsite disposal of impacted soil
	PCP	24.4	95% UCL	None
3 Boiler Room	None	NA	NA	None
4 Refuse Burner	None	NA	NA	None

Notes:
EPC = exposure point concentrations
COPEC = constituent of potential ecological concern
na = not applicable (no UCL calculated)
PCP = pentachlorophenol
UCL = upper confidence limit on mean detected concentration

Potentially complete exposure pathways exist for terrestrial receptors for soil in the hot spots in the former dip tank and transfer pit assessment area. Therefore, it is appropriate to consider hot spot removal and off-site disposal to mitigate the potential ecological exposures.

6.2 Conclusions

Potentially complete exposure pathways exist for terrestrial receptors for soil in the mercury and PCP hot spots in the former dip tank and transfer pit assessment area. Therefore, it is appropriate to consider hot spot removal and off-site disposal to mitigate the potential ecological exposures.

The potential for future ecological exposure to COPECs in the dip tank and transfer pit area is dependent upon the nature of site development. If the assessment area is to support commercial/industrial development, habitat may not be present to support complete ecological exposure pathways. If the site remains open space or is developed as recreational open space, then the potential for ecological exposure may exist.

7.0 ENGINEERING EVALUATION/COST ANALYSIS

An EE/CA is used to evaluate removal actions for effectiveness, cost, and implementability. An EE/CA requires evaluation of at least three alternatives. As PCP, petroleum hydrocarbons, and dioxin are the primary COCs that pose the greatest risk to future site receptors, removal actions were chosen to specifically mitigate exposure to these COCs.

7.1 Removal Action Alternatives

We evaluated four alternatives for this RAW. The alternatives were evaluated based on the proposed land use of Site for recreational and commercial/industrial. Currently, the Site is undeveloped. The Site is fenced and No Trespassing signs are posted along the northern and eastern sides of the Site adjacent to a residential neighborhood and Mt. Shasta Boulevard, respectively. The four alternatives include:

1. No Action.
2. Excavation and offsite disposal for unrestricted use – PCP-impacted soil from the former dip tank, petroleum-impacted soil from the former boiler room and former refuse burner, and dioxin-impacted soil from the eastern and western portions of the Site would be excavated and replaced (as needed for redevelopment) with clean, imported soil.
3. Excavation and offsite disposal for recreational and commercial/industrial use – PCP-impacted soil from the former dip tank, petroleum-impacted soil from the former boiler room and former refuse burner would be excavated and replaced (as needed for redevelopment) with clean, imported soil. A land use covenant (LUC) restricting use of the Site would be required to ensure that the land use of the Site remains recreational and/or commercial/industrial use. A LUC is described further in Section 8.8.
4. Consolidation and containment by capping – petroleum-impacted soil would be consolidated with PCP-impacted soil on the eastern portion of the Site and capped with clean fill material, and/or site structures, pavement, and hardscapes to minimize the potential for future site users to be exposed to COCs in soil. An LUC would be required to ensure that the land use of the Site remains commercial. An operations and maintenance (O&M) agreement (OMA) with DTSC, and 5-year reviews (site inspections) performed by a qualified consultant to ensure the cap on impacted soil remains viable.

These removal action alternatives are evaluated in the following sections.

7.2 Evaluation of Removal Action Alternatives

We evaluated the four removal action alternatives with regards to the following nine criteria, as defined in 40 CFR 300.430:

- Overall protection of human health and the environment;
- Compliance with State and Federal requirements;
- Long-term effectiveness and performance;
- Reduction of toxicity, mobility, and volume;

- Short-term effectiveness;
- Implementability;
- Cost;
- Regulatory acceptance; and
- Community acceptance.

Through this process, we determined the overall effectiveness of each alternative.

7.2.1 Overall Protection of Human Health and the Environment

This criterion evaluates the ability of each of the alternatives to protect human health and the environment. The evaluation primarily focuses on post-implementation conditions, except where onsite construction has a potential to significantly impact areas offsite.

Alternative No. 1 - No Action

This alternative would not be sufficiently protective of human health under the current or future land use because no measures would be taken specifically to mitigate exposure to COCs at concentrations exceeding local background levels or applicable health risk-based screening levels. Under this alternative, trespassers could be exposed to COCs at elevated concentrations in soil at the Site through direct contact, ingestion, and inhalation of dust. This alternative may be suitable under the current inactive use if the Site is fenced and warning signage is posted regarding chemical hazards.

Alternative No. 2 - Excavation and Offsite Disposal – Unrestricted Use

Excavation and offsite disposal of PCP-, petroleum-, and dioxi-impacted soil and replacement with clean imported soil, if necessary, would provide the greatest overall protection of human health and the environment. Transportation of the impacted soil would potentially increase the risk of short-term exposure to receptors along the transportation route from airborne dust generation and spillage, but this threat could be minimized through the use of appropriate controls such as tarping of loads and route planning through less populated areas.

Alternative No. 3 - Excavation and Offsite Disposal – Recreational and Commercial/Industrial Use

Excavation and offsite disposal of PCP- and petroleum-impacted soil and replacement with clean imported soil, if necessary, would provide good overall protection of human health and the environment for the proposed recreational and commercial/industrial use of the Site. As with Alternative No. 2, transportation of PCP- and petroleum-impacted soil would potentially increase the risk of short-term exposure to receptors along the transportation route from airborne dust generation and spillage. Dioxin-impacted soil is present at the Site at concentrations that are less than DTSC screening levels for commercial/industrial use, but exceed residential screening levels, and will remain in place under this alternative. However, this alternative would also require administrative controls of the land use on the Site through an LUC in the form of a deed restriction on the title.

Alternative No. 4 – Consolidation and Containment by Capping

This alternative will provide good overall protection of human health and the environment for recreational or commercial/industrial uses in all site portions (including the capped portion) through elimination of the exposure routes to PCP and petroleum at elevated concentrations on the accessible portions of Site. However, this alternative would also require administrative controls of the land use on the capped portion through an LUC on the title and maintenance of the cap in accordance with an OMA.

7.2.2 Compliance with State and Federal Requirements

This criterion is used to evaluate whether each of the four alternatives will comply with applicable State, and/or Federal regulations. ARARs are summarized in Appendix G.

Alternative No. 1 - No action

This alternative may comply with State and/or Federal regulations under the Site's current inactive use as long as the Site is fenced and posted regarding the chemical hazard. This alternative would not comply with State and/or Federal regulations for the proposed recreational and commercial development, as users could be exposed to COCs in soil at concentrations that pose an unacceptable health risk.

Alternative No. 2 - Excavation and Offsite Disposal – Unrestricted Use

This alternative would comply with State and Federal regulations as the exposure to COC would be mitigated.

Alternative No. 3 - Excavation and Offsite Disposal – Recreational and Commercial/Industrial Use

This alternative would comply with State and Federal regulations as the exposure to COC would be mitigated; however, use of the Site would be limited on the title to recreational and commercial/industrial.

Alternative No. 4 – Consolidation and Containment by Capping

This alternative would comply with State and Federal regulations as consolidating and capping PCP- and petroleum-impacted soil with clean fill and/or future structures, pavements, or hardscapes would reduce the risk of exposure to COCs at elevated concentrations in soil for future recreational and commercial/industrial use.

7.2.3 Long-term Effectiveness and Performance

This criterion is used to assess whether the alternative will provide long-term protection of human health and the environment from exposure to COCs at elevated concentrations in site soil.

Alternative No. 1 - No action

This alternative would not be effective in the long-term because site users could be exposed to COCs at elevated concentrations in the soil on the Site. This alternative could be effective in the long-term for the current inactive use, as long as fencing and signage is maintained.

Alternative No. 2 - Excavation and Offsite Disposal – Unrestricted Use

This alternative would be effective in the long-term, because removal of the impacted soil on Site to meet unrestricted use criteria would mitigate future site users' exposure to COCs at elevated concentrations in the soil.

Alternative No. 3 - Excavation and Offsite Disposal – Recreational and Commercial/Industrial Use

This alternative would be effective in the long-term if the future land use remains recreational and/or commercial/industrial. Removal of PCP- and petroleum-impacted soil from portions of the Site will meet recreational and commercial/industrial use criteria and would decrease the potential for future site users' exposure to COCs in the soil. Dioxin-impacted soil would require no further action if the future land use remains recreational and/or commercial/industrial.

Alternative No. 4 – Consolidation and Containment by Capping

This alternative would be effective in the long-term if the future land use remains recreational or commercial/industrial and the cover over the impacted soil is maintained.

7.2.4 Reduction of Toxicity, Mobility, and Volume

This criterion is used to assess the potential for each alternative to reduce the toxicity, mobility, or volume of COCs on the Site.

Alternative No. 1 - No action

This alternative would not reduce the toxicity, mobility, and/or volume of impacted soil on the Site.

Alternative No. 2 - Excavation and Offsite Disposal – Unrestricted Use

This alternative would be effective in reducing the toxicity, mobility, and volume of COCs on the Site because soil with PCP, petroleum hydrocarbons, and dioxin concentrations exceeding their respective residential screening level would be removed.

Alternative No. 3 - Excavation and Offsite Disposal – Recreational and Commercial/Industrial Use

This alternative would be effective in reducing the toxicity, mobility, and volume of COCs by removing PCP- and petroleum-impacted soil from the Site. The toxicity, mobility, and volume of soil in dioxin-impacted areas would not change.

Alternative No. 4 – Consolidation and Containment by Capping

This alternative will not reduce the volume or toxicity of COCs on the Site. However, by consolidating petroleum-impacted soil with PCP-impacted soil and capping the consolidated impacted soil on the eastern portion of the Site, the routes of exposure to PCP and petroleum hydrocarbons in that soil would be eliminated. The toxicity, mobility, and volume of dioxin-impacted soil would not change.

7.2.5 Short-term Effectiveness

This criterion evaluates the impacts of each alternative in the short term – i.e., during future redevelopment for recreational and commercial/industrial site use.

Alternative No. 1 – No action

This alternative would not be effective in the short-term if the Site is developed. This alternative would be effective in the short-term; however, if access is restricted through site fencing and the fencing and signage regarding site hazards are maintained.

Alternative No. 2 – Excavation and Offsite Disposal – Unrestricted Use

This alternative should not lead to a significantly increased short-term risk of exposure to COCs onsite for construction personnel or offsite neighboring receptors if dust control is implemented during removal. Covering the excavated soil prior to transporting it would minimize the short-term risk to offsite receptors along the transportation route.

Alternative No. 3 – Excavation and Offsite Disposal – Recreational and Commercial/Industrial Use

This alternative should not lead to a significantly increased short-term risk of exposure to COCs onsite for construction personnel or offsite neighboring receptors if dust control is implemented during removal. Covering the excavated soil prior to transporting it would minimize the short-term risk to offsite receptors along the transportation route. Additionally, as the volume of soil proposed to be excavated is less for this alternative, the potential exposure to offsite receptors should be lower than that for Alternative No. 2. The short-term effectiveness is judged to be good.

Alternative No. 4 – Consolidation and Containment by Capping

With use of proper dust control during construction of the future structures, this alternative should not lead to a short-term increase in risk for construction personnel or offsite neighboring receptors. Covering the excavated soil prior to transporting it would minimize the short-term risk to offsite receptors along the transportation route. Additionally, as the volume of soil proposed to be excavated is less for this alternative, the potential exposure to offsite receptors should be lower than that for Alternative No. 2. The short-term effectiveness is judged to be good.

7.2.6 Implementability

This criterion evaluates the ability of the future stakeholder(s) and contractors to implement the alternative.

Alternative No. 1 – No action

The implementability of this alternative is good from the standpoint that it requires no labor, materials or equipment.

Alternative No. 2 – Excavation and Offsite Disposal – Unrestricted Use

This alternative is technically implementable; however, the cost for excavation, transportation, and offsite disposal of the impacted soil would be economically infeasible.

Alternative No. 3 – Excavation and Offsite Disposal – Recreational and Commercial/Industrial Use

This alternative is technically implementable for the future stakeholder(s).

Alternative No. 4 – Consolidation and Containment by Capping

This alternative is technically implementable for the future stakeholder(s). However, opposed to Alternative 3, this alternative requires maintenance and inspection of the cap in accordance with an OMA, which is not necessary for Alternative 3 and accomplishes the same land use goal.

7.2.7 Cost

Alternative No. 1 – No action

There are no costs associated with implementing this alternative. If additional fencing and warning signage were added at the Site there would be some cost associated with installation and maintenance of those items; however, that cost would be significantly lower than the costs for Alternative Nos. 2, 3, and 4.

Alternative No. 2 – Excavation and Offsite Disposal – Unrestricted Use

This is the most costly of the four alternatives at an estimated cost of $2,017,911. The majority of the costs for this alternative are associated with transportation and disposal of the dioxin-impacted soil. A breakdown of this estimate is included in Table 9.

Alternative No. 3 – Excavation and Offsite Disposal – Recreational and Commercial/Industrial Use

The estimated cost to implement this alternative is approximately $167,954. The majority of the cost of this alternative is for the excavation and offsite transport of the PCP- and petroleum-impacted soil. A breakdown of this estimate is included in Table 10.

Alternative No. 4 – Consolidation and Containment by Capping

The estimated cost to implement this alternative is approximately $71,025. The majority of the initial cost of this alternative is excavation and placement of the cap; however, an additional $51,000 over an assumed 30-year period is associated with the long-term O&M required by this alternative. A breakdown of this estimate is included in Table 11.

7.2.8 Regulatory Acceptance

Each of the four alternatives is evaluated to determine whether it meets legal and technical standards for regulatory acceptance.

Alternative No. 1 – No Action

No action may be acceptable for continued inactive land use if the Site were secured using adequate fencing and warning signage posted regarding the chemical hazard.

Alternative No. 2 – Excavation and Offsite Disposal – Unrestricted Use

This alternative would meet legal and technical standards because it would reduce the health risk associated with exposure to COCs in site soil to acceptable levels for unrestricted land use by removing impacted soil.

Alternative No. 3 – Excavation and Offsite Disposal – Recreational and Commercial/Industrial Use

This alternative would meet legal and technical standards because it would reduce the health risk associated with exposure to COCs in site soil to acceptable levels for recreational and commercial/industrial land use by removing impacted soil exceeding these levels. Regulatory acceptance of this alternative would require an LUC in the form of a deed restriction for the area of the Site with dioxin-impacted soil.

Alternative No. 4 – Consolidation and Containment by Capping

This alternative would meet legal and technical standards and should receive regulatory acceptance by eliminating the exposure pathways and reducing the mobility of COCs in the impacted soil for future recreational and commercial/industrial site users. Regulatory acceptance of this alternative would require an LUC and long-term O&M for the cap over the dioxin impacted soil.

7.2.9 Community Acceptance

This criterion involves the evaluation of whether each of the alternatives would be acceptable to the community.

Alternative No. 1 – No Action

This alternative may not be acceptable to the community because of the perception of exposure to COCs in site soil by offsite neighbors.

Alternative No. 2 – Excavation and Offsite Disposal – Unrestricted Use

This alternative may be acceptable to the community because it would reduce the health risk associated with exposure to COCs in site soil to levels acceptable for unrestricted land use. The community may be averse to truck traffic during construction and the perception of potential exposure to COCs in airborne dust as it is being transported from the Site along public roads to a disposal facility. However, dust control during excavation, air monitoring to assess and document the effectiveness of dust control, and covering of waste loads and proper routing of truck traffic would likely help the community to accept this alternative.

Alternative No. 3 – Excavation and Offsite Disposal – Recreational and Commercial/Industrial Use

This alternative would likely be acceptable to the community because of the removal of PCP- and petroleum-impacted soil. Additionally, truck traffic and airborne dust will be significantly less than Alternative 2 as only 5% of the material proposed for removal in Alternative 2 will removed from the Site under this alternative.

Alternative No. 4 – Consolidation and Containment by Capping

This alternative would likely be acceptable to the community because PCP- and petroleum-impacted soil will be contained beneath a cap of clean soil. Additionally, there will be reduced potential for exposure to airborne COCs as a result of the capping of the dioxin-impacted soil.

7.3 Results of Removal Action Evaluation

Alternative No. 1 - “no action” is not considered to be an acceptable alternative because it would not protect human health or the environment and would not reduce the toxicity, volume, or mobility of the waste.

Alternative No. 2 - excavation of COC-impacted soil to levels acceptable for unrestricted land use and offsite disposal of the soil would be the most protective of human health and the environment and would reduce the volume of the COCs in site soil to the greatest degree and would, therefore, likely be acceptable to the DTSC and the community. However, the cost of this alternative is the highest and therefore likely to be economically infeasible. Therefore, this alternative is rejected.

Alternative No. 3 - excavation of PCP- and petroleum-impacted soil to levels acceptable for commercial/industrial land use and offsite disposal of the soil would provide protection of human health and the environment by eliminating the routes of exposure to future recreational and commercial/industrial site users. Dioxin-impacted soil would require no further action if the future land use remains recreational and/or commercial/industrial. This alternative can be performed in compliance with State and Federal requirements. Short-term exposure to construction personnel and offsite neighbors can be minimized through the implementation of dust controls (e.g., water spray of disturbed areas). Administrative control of land use through an LUC on the Site would ensure reliable protection of human health on a long-term basis. This alternative would be implemented with DTSC oversight; therefore, regulatory acceptance is anticipated.

Alternative No. 4 – consolidating petroleum-impacted soil onto the eastern portion of the Site with the PCP-impacted soil and capping it with clean fill and/or future structures, pavements, or hardscapes for commercial/industrial use would provide overall protection of human health and the environment by eliminating the routes of exposure to future site users. Dioxin-impacted soil would require no further action if the future land use remains recreational and/or commercial/industrial. This alternative can be performed in compliance with State and Federal requirements. Short-term exposure to construction personnel and offsite neighbors can be minimized through the implementation of dust controls (e.g., water spray of disturbed areas). Administrative control of land use through an LUC and maintenance of the cap in accordance with an OMA would ensure reliable protection of human health on a long-term basis. This alternative would be implemented with DTSC oversight; therefore, regulatory acceptance is anticipated.

7.4 Recommended Remedy

The recommended remedy is Alternative No. 3 - excavation of PCP- and petroleum-impacted soil to levels acceptable for commercial/industrial land use and offsite disposal of the soil. Details pertaining to mitigation measures to implement this remedy alternative are described in Section 8.0.

8.0 MITIGATION MEASURES

The removal action alternative to be implemented at the Site to mitigate exposure to COCs in soil will consist of excavation and offsite disposal of PCP- and petroleum-impacted soil and replacement with clean fill. This mitigation measure will reduce the volume and toxicity of COCs at the Site making the Site suitable for the planned recreational and commercial use. However, the Site will not be acceptable for unrestricted use.

8.1 Remedial Design Implementation Plan

A Remedial Design Implementation Plan (RDIP) or its equivalent will need to be submitted and approved by the DTSC prior to implementing the selected alternative. The RDIP should, at a minimum, include the following:

- Contractor's names and contact information;
- Transportation Plan;
- Health and Safety Plan
- Quality Assurance/Quality Control
- Sample Analysis Plan for confirmation sampling;
- design plans; and
- copies of all permits.

8.2 Excavating Impacted Soil

Soil from the hot spots identified on Figures 2, 4-1, 4-1, 5-1, and listed in the table below will be excavated and stockpiled onsite prior to offsite disposal.

Hot Spot Locations and Quantity Estimates				
Assessment Area	**COC (Highest Concentration)**	**Area (sf)**	**Average Depth (ft)**	**Volume (cy)**
Former Dip Tank and Transfer Pit	PCP (150 mg/kg)	525	2	39
Former Dip Tank and Transfer Pit	PCP (150 mg/kg)	50	8	15
Former Dip Tank and Transfer Pit	PCP (32 mg/kg)	1,950	2	144
Former Dip Tank and Transfer Pit	PCP (9 mg/kg)	265	1.5	15
Former Dip Tank and Transfer Pit	DRO (47,000 mg/kg)	50	1	2
Former Boiler Room	DRO (840 mg/kg)	200	1	7
Former Boiler Room	DRO (1,600 mg/kg)	200	2	15
Former Boiler Room	DRO (5,000 mg/kg) ORO (14,000 mg/kg)	170	5	31
Former Refuse Burner	DRO (1,300 mg/kg)	350	8	104
Former Refuse Burner	DRO (810 mg/kg)	50	1	2

8.3 Offsite Disposal of Impacted Soil

Excavated soil should be segregated in stockpiles and characterized as summarized in Section 10.4 and 10.5. The waste material will be profiled and landfill approval will be obtained before any excavated materials are hauled offsite. Final determination of the landfill used for disposal will be based on approval from the landfill of the waste stream and cost effectiveness of that facility.

8.4 Backfill Material

Excavated areas should be backfilled with clean soil from other areas of the Site or from an approved offsite source. If backfill material is used from an offsite source, it should be certified clean per the DTSCs *Clean Imported Fill Material* Information Advisory.

8.5 Hardscape and Structures

There are currently no hardscape or structures planned for the Site, but the anticipated future use for a community park and commercial use suggest construction of roads, asphalt parking lots, and buildings that may cover portions of the Site.

8.6 Landscaping

A landscaping plan has not been developed for the Site, but the anticipated future use for a community park and commercial use suggest landscaping such as sod, bark, or other materials may be used to cover potions of the Site.

8.7 Utilities

Utilities are not currently proposed for the Site but are likely needed for the anticipated future use. Utility corridors through impacted soil (if any) should be backfilled with clean fill.

8.8 Removal Action Completion Report

A Removal Action Completion Report (RACR) will be prepared and submitted to the DTSC upon completion of the removal action. The RACR will document compliance with this RAW, any deviations from the plan described herein, present the results of confirmation soil sampling and analysis, and document the consolidation and capping of the excavated, COC-impacted soil. The RACR shall contain the following information:

- A description of field activities completed and justifications for deviations from the RAW;
- As-built drawings showing excavation location and final grade;
- Copies of all permits;
- A summary of implementation activities;
- Schedule;

- Description of excavation area with depth and volume figures illustrating the location of confirmation sampling;
- Tabulated confirmation sampling results;
- Contaminated soil disposal location;
- Photograph log during the implementation;
- Site restoration activities;
- Backfill soil borrow source and location;
- Backfill soil quantities and analytical data;
- Statistical analysis of confirmation results to demonstrate whether the remedial action objectives have been met;
- Conclusions and recommendations associated with the goals and objectives of the RAW; and
- Identify any remaining areas of contamination and planned action or monitoring requirements.

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The RACR should also contain the following on a compact disk attachment to the final report:

- Field notes;
- laboratory data sheets; and
- copies of the disposal manifests.

8.9 LUC

The selected alternative will not render the Site suitable for unrestricted land uses because soil containing COCs at concentrations exceeding residential land use screening levels, but less than commercial/industrial screening levels, will remain on the Site. Therefore, recording of an LUC and preparation of a Soil Management Plan will be required.

The LUC will record which COCs are present on the Site and the types of land uses that are allowed. The LUC will recognize that the proposed recreational and commercial/industrial land use is compatible and is acceptable from a health risk standpoint because of the types of activities that site occupants will undertake on the Site should not cause them to be exposed to the COCs. It will state that unrestricted land uses (e.g., residential, schools, daycare, hospital, senior care, etc.) will not be allowed on the Site. The LUC will also recognize that drilling for water, oil and gas is prohibited.

The LUC will be prepared consistent with the DTSC policy and finalized and recorded after the removal action is complete and before the Site is certified by DTSC. The LUC will run with the land and stay in effect as long as the identified COCs limit use of the property and until terminated by DTSC. Pursuant to Section 67391.1 of Title 22, Division 4.5, Chapter 39, CCR, the project proponent will pay all costs for DTSC oversight associated with administration of the LUCs. The DTSC has the authority to require modification or removal of any land improvements placed in violation of the restrictions. Violation of the LUC will be ground for DTSC to file civil or criminal actions as provided by law.

The Soil Management Plan will provide guidelines for proper handling of soil for any potential future excavation. The Soil Management Plan will document where COC-impacted soil is present on the Site and the presence of any cover materials over impacted soil.

9.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Previous investigations at the Site indicate the presence of PCP- and petroleum-impacted soil exceeding the PALs for the Site. The most effective remedial action has been determined to be removal consisting of soil excavation and offsite disposal. This section discusses the ARARs for the proposed soil excavation and offsite disposal.

9.1 Summary of Applicable State and Federal ARARs

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically apply to cleanup at a site. The process for determining applicable standards is set forth in Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). In part, CERCLA states that the more stringent of State or Federal requirements will apply to cleanup sites. Typically, California requirements are more stringent than Federal requirements.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, while not applicable, address problems or circumstances similar to those found where the proposed removal action will be performed, and are well suited to the conditions of the cleanup site. Requirements that are determined to not be legally applicable are evaluated to determine whether they are relevant and appropriate. A requirement must be both relevant and appropriate to be an ARAR. Criteria for determining relevance and appropriateness are listed in Part 40, Code of Federal Regulation (CFR) Section 300.400(g)(2).

According to CERCLA ARAR guidance (USEPA, 1988), requirements may be “applicable” or “relevant and appropriate,” but not both. ARARs are identified on a site-specific basis, using a two-part analysis to determine first if a requirement is applicable, and then, if not applicable, whether it is both relevant and appropriate. Based on CERCLA ARAR guidance, an ARAR qualifies as a State ARAR if it meets the following requirements:

- It is a State law;
- It is an environmental, or facility siting law;
- It is promulgated, and thus generally applicable and legally enforceable;
- It is substantive rather than procedural or administrative;
- It is more stringent than the Federal requirement;
- It is identified in a timely manner; and
- It is consistently applied.

9.2 ARARs for Soil Excavation and Offsite Disposal

9.2.1 Public Participation

California Health and Safety Code Section 2535D.1.5 provides for a public notification process. Public noticing of the mitigation measures will be provided to responsible agencies, public officials, and surrounding property owners. The RAW should be made available for public review and comment.

9.2.2 California Environmental Quality Act (CEQA)

Prior to conducting the site remediation activities all approvals associated with the California Environmental Quality Act (CEQA) will be obtained including biological resource and cultural resource approvals.

9.2.3 Notifications for Property Transfers

This RAW was prepared as a reference for the future Site owner and/or developer. During the property transfer process, the current (and/or future owner) are required to disclose if any hazardous materials exist onsite. Specifically, under Health and Safety Code Section 25359.7, any owner of a non-residential property who knows, or has reasonable cause to believe that hazardous materials exist on or beneath a property, must disclose that information prior to the sale of the property.

9.2.4 Hazardous Waste Management

The excavated soil will be stockpiled onsite and characterized prior to offsite disposal. The soil will be temporarily stockpiled on the existing hardened soil surface or on one of the relic concrete slabs if feasible, and covered with plastic sheeting to minimize run-off and dust generation. A single 4-part composite sample will be obtained from each stockpile and analyzed for PCP, metals, DRO, and ORO, as appropriate based on historical analytical results from soil in the excavated area. Where the total or Waste Extraction Test (WET)-soluble stockpile sample concentrations do not exceed California hazardous waste thresholds, the soil will be transported under non-hazardous manifest to a licensed Class II landfill facility. Where the total or WET soluble stockpile sample concentrations exceed California- or Resource Conservation and Recovery Act (RCRA)-hazardous waste thresholds, the soil will be transported under Uniform Hazardous Waste Manifest to a licensed Class I landfill facility or (if necessary) to an out of state disposal or incineration facility.

If any soil leaving the Site is classified as hazardous waste, the City will be required to obtain a temporary identification number for this action. Persons who generate, transport or offer for transport, treat, store, or dispose of hazardous waste generally must have an Identification (ID) Number, which is used to identify the hazardous waste handler and to track the waste from its point of origin to its final disposal ("From Cradle to Grave"). Instruction on how to obtain a temporary identification number may be obtained by visiting the DTSC website at www.dtsc.ca.gov/IDManifest/index.cfm#identification.

Compliance with DTSC requirements for hazardous waste generation, temporary onsite storage, transportation and disposal is required. Within 90 days of its generation, hazardous waste soil must be transported by a registered hazardous waste hauler under Uniform Hazardous Waste Manifest to the designated offsite disposal facility.

9.2.5 Siskiyou County Air Pollution Control District

Particulate matter emissions are subject to the Siskiyou County Air Pollution Control District (SCAPCD) rules and enforcement. All fieldwork conducted pursuant to this RAW should be in compliance with SCAPCD requirements. Compliance may in include that portions of the Site that will be disturbed by grading and construction equipment should be thoroughly wetted in advance of disturbing activities. Then, during grading and construction, additional water should be applied to control dust. An air monitoring plan should be developed prior to beginning excavation at the Site.

9.2.6 Health and Safety Plan

A health and safety plan (HSP) is required for the project by the Occupational Safety and Health Administration (OSHA) under Title 29 CFR 1920.120, or by California Occupational Safety and Health Administration (Cal-OSHA) under Title 8 California Code of Regulations (CCR) Sections 5192 and 3203. The basic elements of a HSP should include:

- Introduction
- Administrative requirements/controls
- Hazard and control analysis
- General health and safety requirements
- Personal protective equipment
- Decontamination
- Emergency response procedures
- Plan approval

9.2.7 Contractor’s Licensing and Certification Requirements

A contractor performing the excavation, stockpiling, and loading of impacted soil is not required to have licensing or certification as a hazardous substances removal contractor (A-HAZ Contractor), but should have appropriate health and safety awareness training regarding the COCs for its onsite workers. The contractor hauling the soil to the disposal facility will be required to have A-HAZ licensing if any of the waste is profiled as hazardous waste.

9.2.8 Storm Water Pollution Prevention Plan

Because of necessary road improvements and presence of surface water at the Site, a Storm Water Pollution Prevention Plan (SWPPP) may be required for this project. A SWPPP should be prepared prior to the start of grading onsite. General National Pollution Discharge Elimination System requirements for storm water pollution prevention should be followed and mitigation measures implemented including runoff control.

9.2.9 Soil Transportation Plan

A soil transportation plan for offsite disposal of impacted soil and for imported of clean fill will need to be prepared for the removal action. The waste material will be profiled and landfill approval will be obtained before any excavated materials are hauled offsite. Final determination of the landfill used for disposal will be based on approval from the landfill of the waste stream and cost effectiveness of that facility. Once the disposal facility is selected, copies of waste profile reports used to secure disposal permission from the landfill will be provided to DTSC. In addition, compliance with the land disposal restrictions and land ban requirements for hazardous wastes will be documented and provided to DTSC once it is determined which disposal facility will be used.

9.2.10 Endangered Species Act

No special-status species have been formally identified at the Site, but several species were identified that have high to medium potential to occur on the Site. An evaluation of endangered species is a task of the project CEQA review that should be completed prior to development.

10.0 REMOVAL ACTION IMPLEMENTATION

This section describes the removal action to be implemented for the selected remedial alternative – excavation and offsite disposal of PCP-and petroleum-impacted soil and replacement with clean fill.

10.1 Scoping Meeting

Prior to the start of COC-impacted soil removal, a scoping meeting will be held to discuss the removal action, airborne dust mitigation and monitoring, health and safety, and project scheduling. Attendees at the scoping meeting should include representatives of the contractor and subcontractors performing the construction; ownership group personnel; representatives from the City of Mt. Shasta Planning Department, City of Mt. Shasta/Siskiyou County construction inspectors; and DTSC representatives.

10.2 Permits

It is our understanding that no special permits are required for the project. If any applicable permits that are found to be required should be obtained and kept on-hand prior to the implementation of the removal action.

10.3 Work Area Preparation

COC-impacted soil hot spots that will be removed should be marked with white paint or stakes prior to excavation. The markings will be used to guide the excavation contractor and to delineate areas of excavation for utility clearance. The contractor should call Underground Service Alert at 800.227.2600 at least 48 hours prior to the start of excavation to mark the locations of utilities to determine if any are within the excavation areas.

The contractor should establish a construction staging area, site ingress and egress points, designated routes for construction traffic, and take measures to prevent unauthorized and unnecessary access to the Site prior to the start of construction. Track-out, dust control, and air monitoring measures should also be implemented.

The Site is fenced, but additional security measures should be taken, if necessary, to restrict access from trespassers when work is not being performed. Signs should be posted at the gate(s) instructing visitors and contractors of the health and safety requirements prior to entering the Site.

10.4 Excavation Methodology

The excavation of contaminated soil will likely be performed with an excavator and a loader. The planned excavation depths are between 1 and 8 feet. The limits of the excavation areas will be determined using historical soil sample analytical data and conditions encountered in the initial excavations, as shown on Figure 2, and more detailed excavation areas on Figures 3-1, 4-1, and 5-1.

10.4.1 Decontamination Area

Entry to contaminated areas will be limited to only authorized personnel and equipment to avoid unnecessary exposure and related transfer of contaminants. Trucks that are used for transporting excavated soil for offsite disposal will not require decontamination because they will not be allowed access to the contaminated areas. Equipment will be decontaminated in a designated area before leaving the Site.

All equipment and trucks that come in contact with potentially contaminated soil or water will be decontaminated to assure the quality of samples collected and/or to avoid cross contamination. Disposable equipment intended for one time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each designated use of a piece of equipment or truck. All non-disposable sampling equipment used will be decontaminated using the following procedures:

- Non-phosphate detergent and tap water wash, using a brush if necessary.
- Tap water rinse.
- Initial deionized/distilled water rinse.
- Final deionized/distilled water rinse.

Following completed excavation, the backhoe will be dry-decontaminated with brooms, brushes, and/or towels on top of plastic sheeting at a designated decontamination area. Clean bulky equipment will be stored on plastic sheeting in uncontaminated areas. Cleaned small equipment will be stored in plastic bags. Materials to be stored more than a few hours will also be covered. Water used for decontamination purposes will be added to the soil stockpiles for offsite disposal.

10.4.2 Soil Staging and Storage Operations

The soil staging process will be monitored to ensure excessive dust is not created. As soil is excavated, it will be temporarily stored at staging areas onsite until offsite transportation and disposal are available. At the designated staging areas, the excavated soil will be placed on the existing hardened soil surface, and covered with plastic sheeting to minimize run-off and dust generation. The existing surface soil will be scraped clean during subsequent loading of the temporary stockpiles. The perimeter of the covered stockpiles will be bermed with straw wattles to minimize potential run-off.

The temporary onsite storage of excavated soil wastes will be secured and properly labeled with hazardous waste signs until offsite transportation and disposal occur. In no case will the waste storage last longer than 90 days after generation.

10.4.3 Soil Segregation Operations

Prior to stockpiling/staging, the excavated soil will be segregated to the extent possible to minimize the mixture of hazardous and non-hazardous soil. Also, this segregation process will likely minimize the amount of hazardous waste soil generated and its associated disposal cost. Soil segregation will be based upon criteria for hazardous and non-hazardous waste soil relative to historical soil sample concentrations. Specifically, PCP- and petroleum-impacted soil should be stockpiled separately for characterization. Additionally, PCP-impacted soil from the southern end of the dip tank (locations ODT-3 and OM-10) should be segregated and stockpiled separately for characterization because PCP detected in soil from these locations significantly exceeds the Total Threshold Limit Concentration (TTLC) of 17 mg/kg and could be a hazardous waste.

We estimate that up to 15% of the excavated soil (roughly 54 cubic yards or 75 tons) will require offsite landfill disposal as a California- or RCRA- hazardous waste and will be transported to a licensed Class I landfill or (if necessary) to an out of state disposal or incineration facility. The remaining excavated soil (roughly 320 cubic yards or 446 tons) is anticipated to be non-hazardous soil will be transported to a licensed Class II landfill.

10.5 Field Documentation

Soil excavation and offsite removal be overseen by a qualified environmental consultant. Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. The supervising consultant responsible for oversight will prepare and maintain daily field logs that, at minimum, document:

- onsite health and safety tailgate meetings;
- personnel onsite;
- offsite visitor inquiries;
- activities performed that day;
- air monitoring equipment, procedures, and locations;
- airborne dust observations;
- quantity of impacted soils (in terms of California- or RCRA-hazardous wastes, and non-hazardous waste) excavated;
- quantity of impacted soils temporarily stored onsite;
- quantity of excavated soils in truckloads transported offsite;
- names of waste transporters and proposed disposal facilities;
- copies or numbers of manifests or other shipping documents (such as bill of lading) for waste shipments;

- quantity of import fill materials in truckloads;
- deviations from the removal action implementation plan and record of communication with project stakeholders and the DTSC:
- confirmation soil samples collected; and
- other pertinent information.

As applicable, photographs will be taken of each excavation and stockpile location and other areas of interest, as applicable. The time, date, location, weather conditions, and a description of the subject photograph(s) should be recorded in the daily field logbook.

10.6 Waste Profile and Confirmation Soil Sampling and Analysis

10.6.1 Waste Profile Samples

Waste profile samples will be collected from the soil stockpiles and analyzed for COCs and any other constituents specified by the accepting disposal facilities. One four-part composite sample will be collected for each <100 yd^3 soil stockpile. The individual discrete samples will be collected with a clean trowel or hand auger and placed into a one-gallon Ziploc bag and homogenized. A portion of the homogenized sample will then be placed into laboratory-provided sampling jars, properly labeled, and placed in a chilled cooler for transport to the laboratory under chain-of-custody protocol.

10.6.2 Confirmation Samples

Confirmation soil samples will be collected and analyzed to confirm that concentrations of COC in the soil remaining in place do not exceed PALs. If COC concentrations in confirmation soil samples exceed PALs, additional soil may be excavated from that area. Confirmation soil samples will be collected from the base of each excavation on a grid interval appropriate to the size of the excavation. A minimum grid interval of 20 feet (one sample per 400 square feet) will be used for hotspot excavations. Sidewall confirmation soil samples will be collected at similar appropriate intervals based on the size of each excavation. Confirmation soil samples will be analyzed for PCP by USEPA Test Method 8270 and DRO and ORO by USEPA Test Method 8015B, as appropriate per area. Sample handling will follow standard chain-of-custody protocol.

10.7 Airborne Dust Control and Air Monitoring

Airborne dust control measures will be implemented during excavation and soil consolidation. Airborne dust control measures will consist of applying a water spray to soil to be excavated and as soil is being placed in the consolidation area.

Real-time airborne dust monitoring will be performed to demonstrate that generation of airborne dust is minimized during earthwork, and to establish a negative exposure condition for site workers and offsite neighbors. Prevailing wind at the Site varies, so we recommend verifying local conditions and wind direction anticipated for that time of year prior to construction. Daily meteorological conditions such as wind direction and approximate speed will be monitored, recorded, and used to determine monitoring station placement. Up to three air monitoring stations equipped with real-time particulate counters (e.g. pDR-1200 monitors) will be deployed (one upwind and two downwind) and checked hourly. Daily perimeter air samples will also be collected and submitted to an American Industrial Hygiene Association-accredited laboratory for arsenic and lead analysis using National Institute for Occupational Safety and Health Methods 7300/7303 specifying Mass Spectrophotometry to achieve a low limit of detection.

11.0 COMMUNITY PROFILE

This community profile summarizes our understanding of the level of awareness and interest in the Site by the community and provides a list of key contacts and provides recommendations for potential additional public participation efforts. Most of the basic site information required in the community profile, including a description of the Site and surrounding land uses and the proximity to residential areas, schools, daycare centers and other sensitive receptors, is provided in Sections 1.0 and 2.0.

11.1 Demographics

United States Census Bureau census 2010 data for Mt. Shasta shows that Mt. Shasta has a predominantly Caucasian population with approximately 86.3% of the city population listed as Caucasian, 7.0% Hispanic, 0.7% Native American, 1.6% Asian, 1% African American, and 3% other/two or more races.

The economy in Mt. Shasta and the surrounding area is heavily dependent on the timber, agricultural, recreational, and travel industries. Historically, the main economic industry has been timber, which has diminished in recent years while recreation and tourism in the area are growing. Over 60 percent of the land in Siskiyou County is in public ownership. Mt. Shasta attracts recreational users in both the summer and winter months for fishing, hunting, camping, hiking, and skiing activities (Mt. Shasta, 2007).

According to the 2016 American Community Survey data provided though the US Census Bureau, most of the jobs in Mt. Shasta are in the retail industry followed by education services and health care. The median household income in Mt. Shasta is $34,813. Approximately 29.5% of the Mt. Shasta population reportedly lives below the poverty line (US Census Bureau, 2016).

11.2 Local Awareness and Interest

The City maintains a website with environmental and planning documents for The Landing mixed-use development project, which the Site is a part of. At the Landing - New Mill Section, which is similar to the Site, a public review period for a RAW generated no comments or apparent public interest. There is currently no known public interest in the Site; however, the Site is located adjacent to a residential area which may have some interest when the removal action begins.

11.3 Key Contacts

Key contacts for the Site with respect to providing information to the public include:

- Duane White, DTSC Engineer and Site Project Manager – (916)-255-3585;
- USEPA, EPA Brownfields Project Officer – (415) 972-3531;
- Bruce Pope, City of Mt. Shasta, City Manager and Project Director – (530) 926-7510.

11.4 Key Issues and Concerns

We anticipate that the public's greatest concern during construction will be airborne dust and noise. As described above, dust will be controlled by use of water spray during soil disturbing activities and during placement of clean fill, and air will be monitored to document the effectiveness of that control. Noise will be limited to increased truck and equipment traffic during an approximate 30-day period. Work hours will be limited to 8AM to 5PM on a daily basis. Review of a project fact sheet and the RAW during the public notice and review period should provide answers to questions regarding dust control and noise.

11.5 Recommended Public Participation

Public participation efforts will include public notification and public review of and comment on the Final RAW. The DTSC will approve a mailing list that includes nearby residents and businesses, potentially interested organizations and individuals, as well as local public officials. A public meeting may also be necessary to describe the conditions at the Site and the planned removal action depending on the level of community concern.

The Final RAW will be available for public review at the DTSC offices and at least one of the following local public repositories:

- Mt. Shasta Public Library – 515 E. Alma Street, Mt. Shasta;
- City of Mt. Shasta Planning Department – 305 N. Mt. Shasta Boulevard, Mt. Shasta;
- Siskiyou County Environmental Health Division – 806 South Main Street, Yreka; and
- Siskiyou County Library – 719 Fourth Street, Yreka.

12.0 PROJECT SCHEDULE AND REPORT OF COMPLETION

12.1 Project Schedule

Enter into VCA Agreement with DTSC .... Summer/Fall 2018
Public notice of availability of RAW for public review .... Summer/Fall 2018
30-day public comment period .... Summer/Fall 2018
DTSC issues responsiveness summary ....Fall 2018/Winter 2019
Final RAW approval ....Fall 2018/Winter 2019
Begin Construction .... Unknown
Complete Construction .... Unknown
Submit draft Completion Report .... Unknown

12.2 Report of Completion

As described in Section 8.5, a draft RACR will be prepared and submitted to DTSC approximately 30 days following the completion of the removal action. The RACR shall document whether or not the RAO stated in the DTSC-approved RAW was met.

13.0 LIMITATIONS

This RAW has been prepared solely for the City of Mt. Shasta and the DTSC, in consideration of their requirements. Other parties may rely on the findings and conclusions of the RAW for informational purposes only. However, the City and other parties who may rely on the findings and conclusions of the RAW should recognize that this RAW does not constitute a complete set of construction plans or specifications and should not be construed as such. The recommendations as presented in this RAW are predicated on the results of the limited sampling and laboratory testing performed.

The information contained herein is only valid as of the date of the RAW and may require updating to reflect changes to conditions at the mine. Therefore, the RAW should only be deemed conclusive with respect to the information presented. No guarantee of the results of the study used to generate the RAW is implied within the intent of this RAW or any subsequent report, correspondence or consultation, either express or implied. The services performed were conducted in accordance with the local standard of care in the geographic region at the time the services were rendered.

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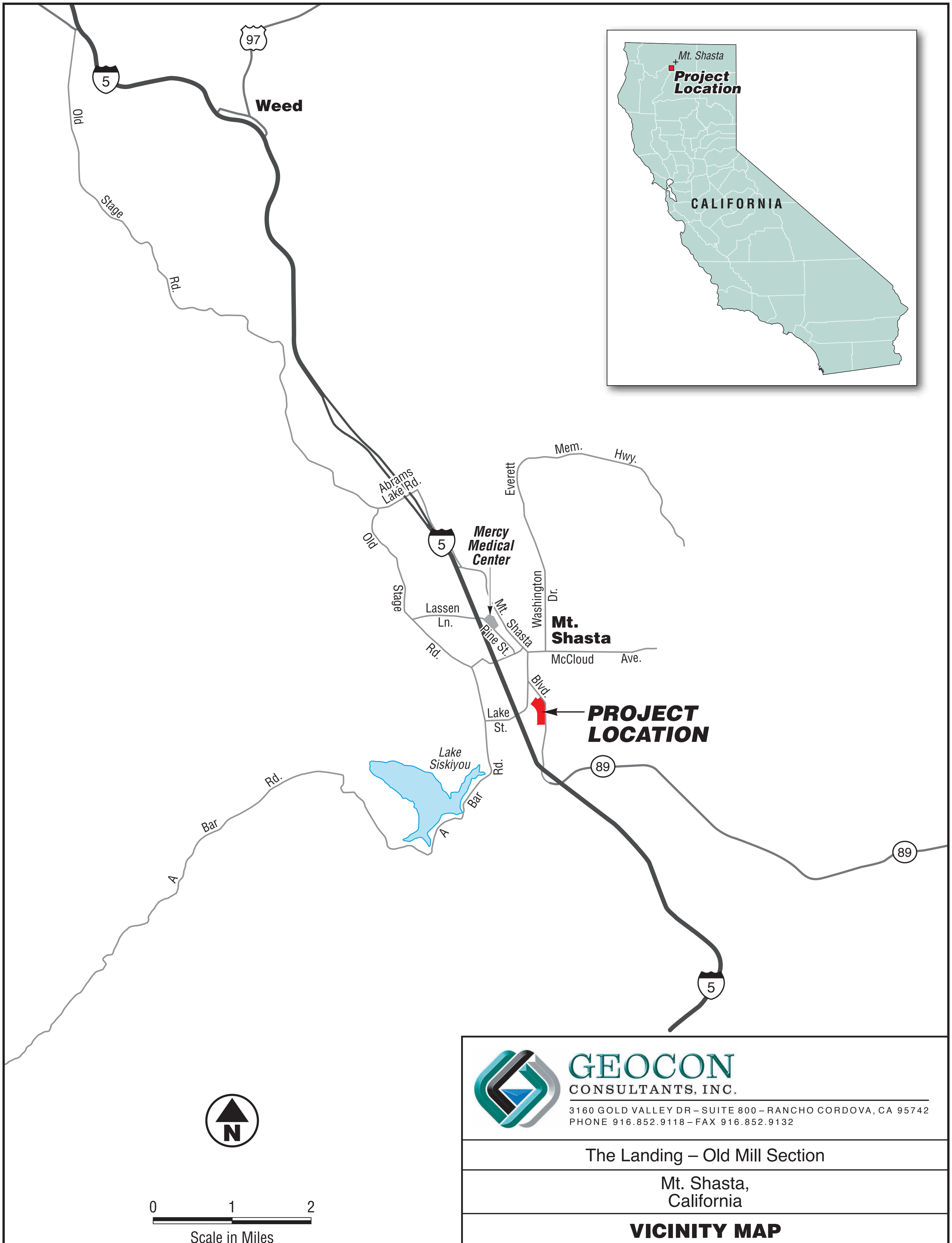

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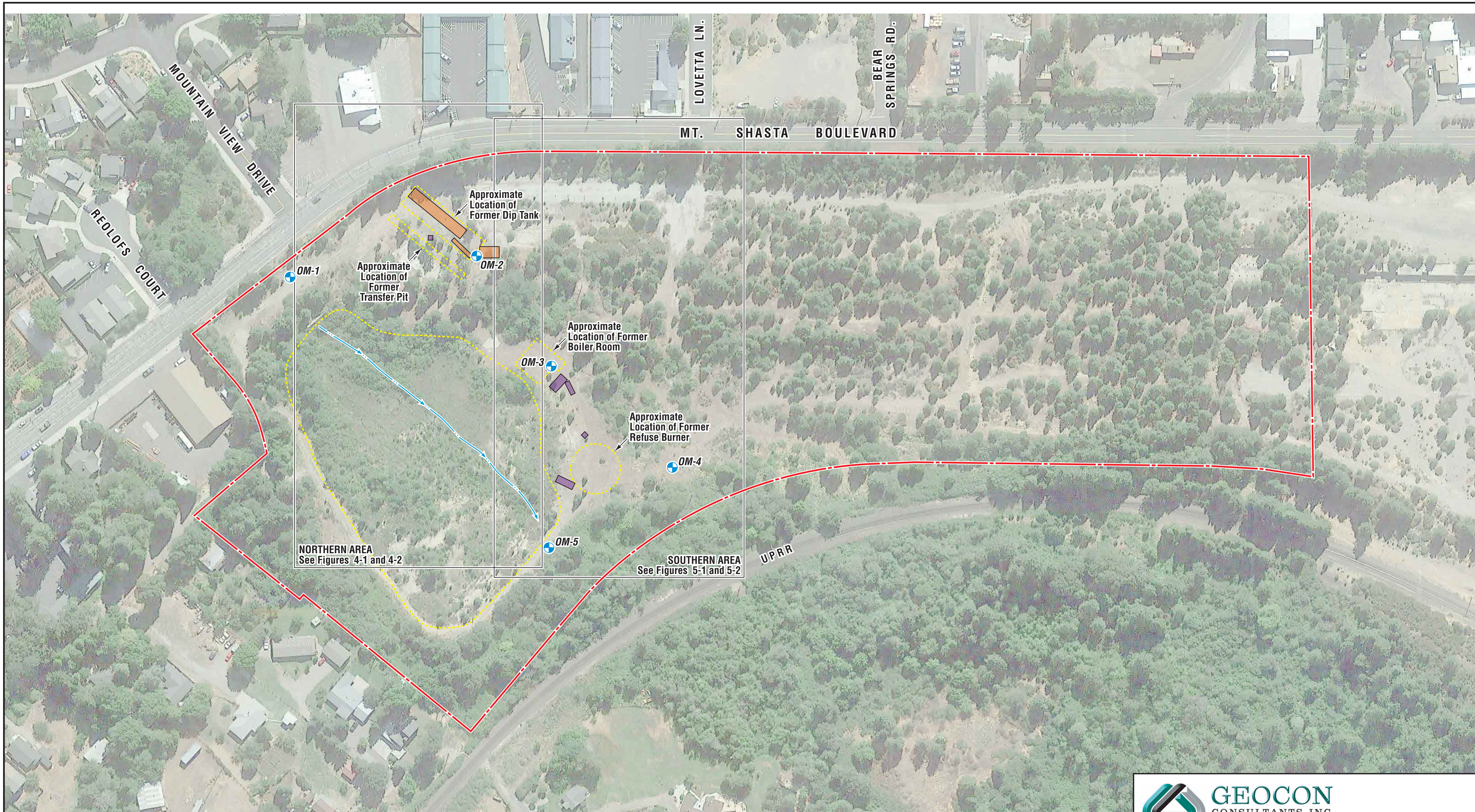
The Landing – Old Mill Section

Mt. Shasta,
California

VICINITY MAP

S9850-03-13B	April 2018	Figure 1



LEGEND:

Study Area Boundary

OM-5 Approximate Monitoring Well Location

Intermittent Drainage (Mill Creek)

Proposed PCE-Impacted Soil Excavation Area

Proposed Petroleum-Impacted Soil Excavation Area

N

0 150

Scale in Feet

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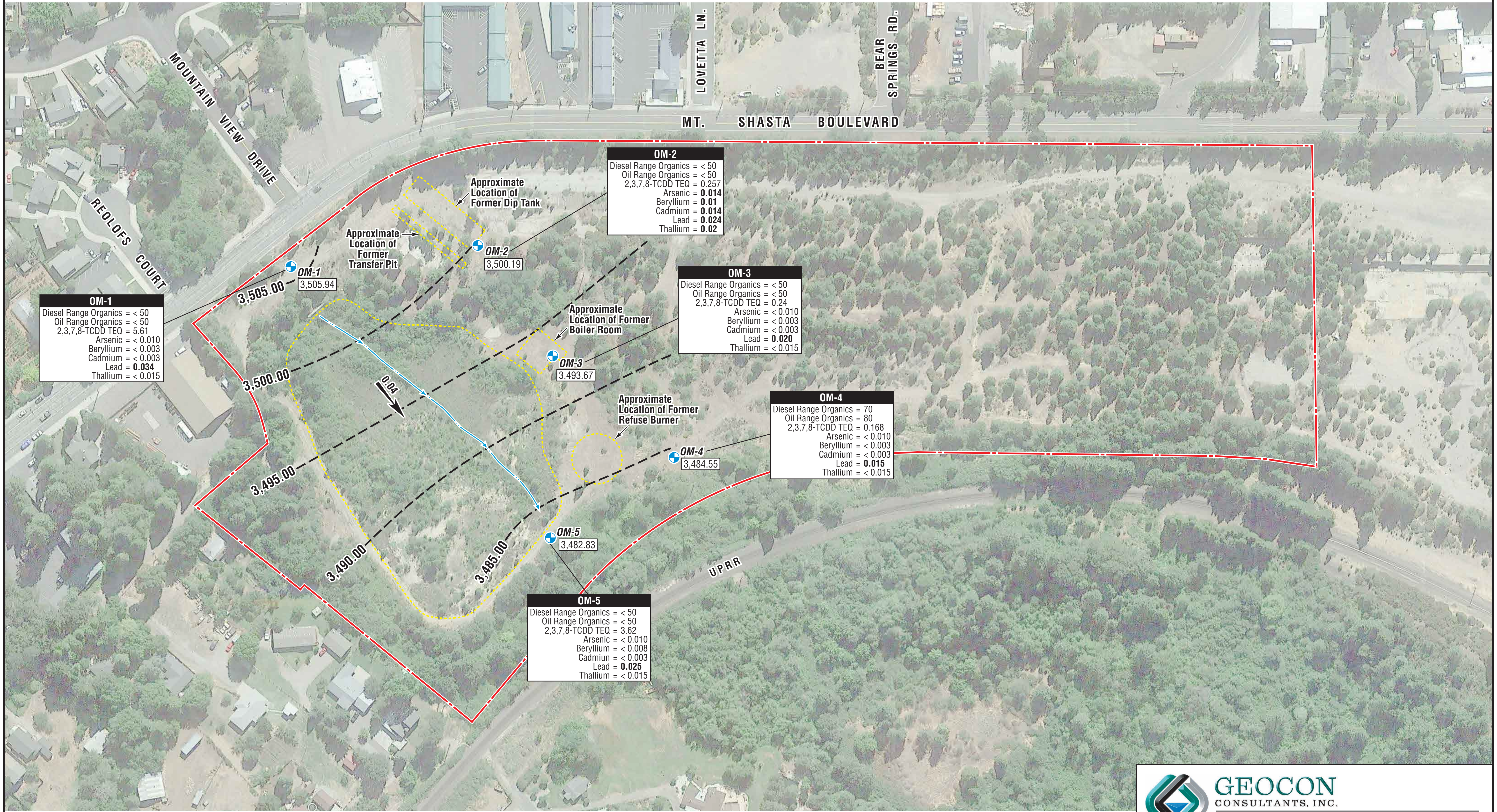
The Landing – Old Mill Section

Mt. Shasta, California

SITE PLAN

S9850-03-13B	April 2018	Figure 2



LEGEND:

- Study Area Boundary
- OM-5 Approximate Monitoring Well Location
- Intermittent Drainage (Mill Creek)
- Groundwater Elevation Contour (Interval = 5.00 Ft.)
- 3,482.83 MSL Elevation of Groundwater Measured on 1/18/18
- 0.04 Approximate Groundwater Direction & Gradient

Bold indicates concentration equal to or greater than Project Action Level

TEQ Concentrations Reported in Picograms Per Liter (pg/l)
DRO/ORO Concentrations Reported in Micrograms Per Liter (µg/l)
Metals Concentrations Reported in Milligrams Per Liter (mg/l)

N

0 150
Scale in Feet

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The Landing – Old Mill Section

Mt. Shasta, California

Groundwater Elevation Map and Chemicals of Concern – January 2018

S9850-03-13B	April 2018	Figure 3

LEGEND:

- Approximate Boring Location (E & E, 1998)
- Approximate Boring Location (E & E, 2005)
- Approximate Boring Location (URS, 2007)
- Approximate Boring Location (Geocon, 2013)
- Approximate Boring Location (Geocon, 2015)
- Approximate Grab Sediment and Surface Water Sample (Geocon, 2015)
- 1' Proposed Excavation Area Depth

Exceeds Project Action Levels
(**DRO - Soil:** 570 mg/kg)
(**ORO - Soil:** 5,100 mg/kg)

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

N

0 50
Scale in Feet

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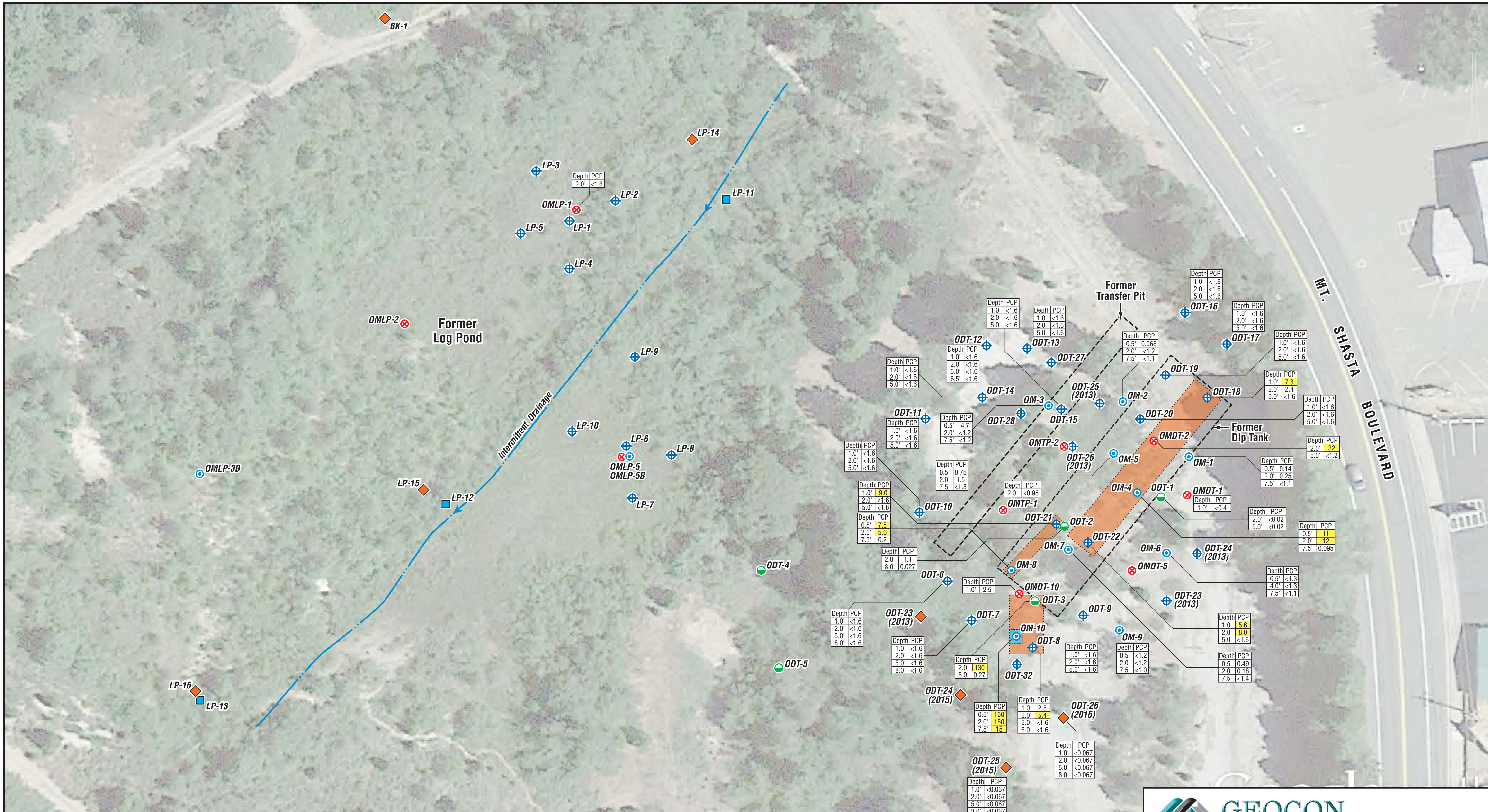
The Landing – Old Mill Section

Mt. Shasta, California

Site Plan – Northern Area –
DRO and ORO Concentrations in Soil

S9850-03-13B	April 2018	Figure 4-1



LEGEND:

- Approximate Boring Location (E & E, 1998)
- Approximate Boring Location (E & E, 2005)
- Approximate Boring Location (URS, 2007)
- Approximate Boring Location (Geocon, 2013)
- Approximate Boring Location (Geocon, 2015)
- Approximate Grab Sediment and Surface Water Sample (Geocon, 2015)
- 2' / 8' Proposed Excavation Area Depth
- Exceeds Project Action Levels (**Soil:** 4.0 mg/kg)

PCP = Pentachlorophenol
Soil Concentrations in Milligrams per Kilogram (mg/kg)

N

0 50
Scale in Feet

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The Landing – Old Mill Section
Mt. Shasta, California

Site Plan – Northern Area – PCP Concentrations in Soil

S9850-03-13B	April 2018	Figure 4-2

LEGEND:

- Approximate Boring Location (E & E, 1998)
- Approximate Boring Location (E & E, 2005)
- Approximate Boring Location (Geocon, 2013)
- Approximate Boring Location (Geocon, 2015)
- Approximate Grab Sediment and Surface Water Sample (Geocon, 2015)
- Approximate Soil Boring Location (Weston, 2016)
- Exceeds Project Action Levels (**DRO - Soil:** 570 mg/kg) (**ORO - Soil:** 5,100 mg/kg)

Soil Concentrations in Milligrams per Kilogram (mg/kg)

1' 2' 5' 8' Proposed Excavation Area Depth

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

N

0 50
Scale in Feet

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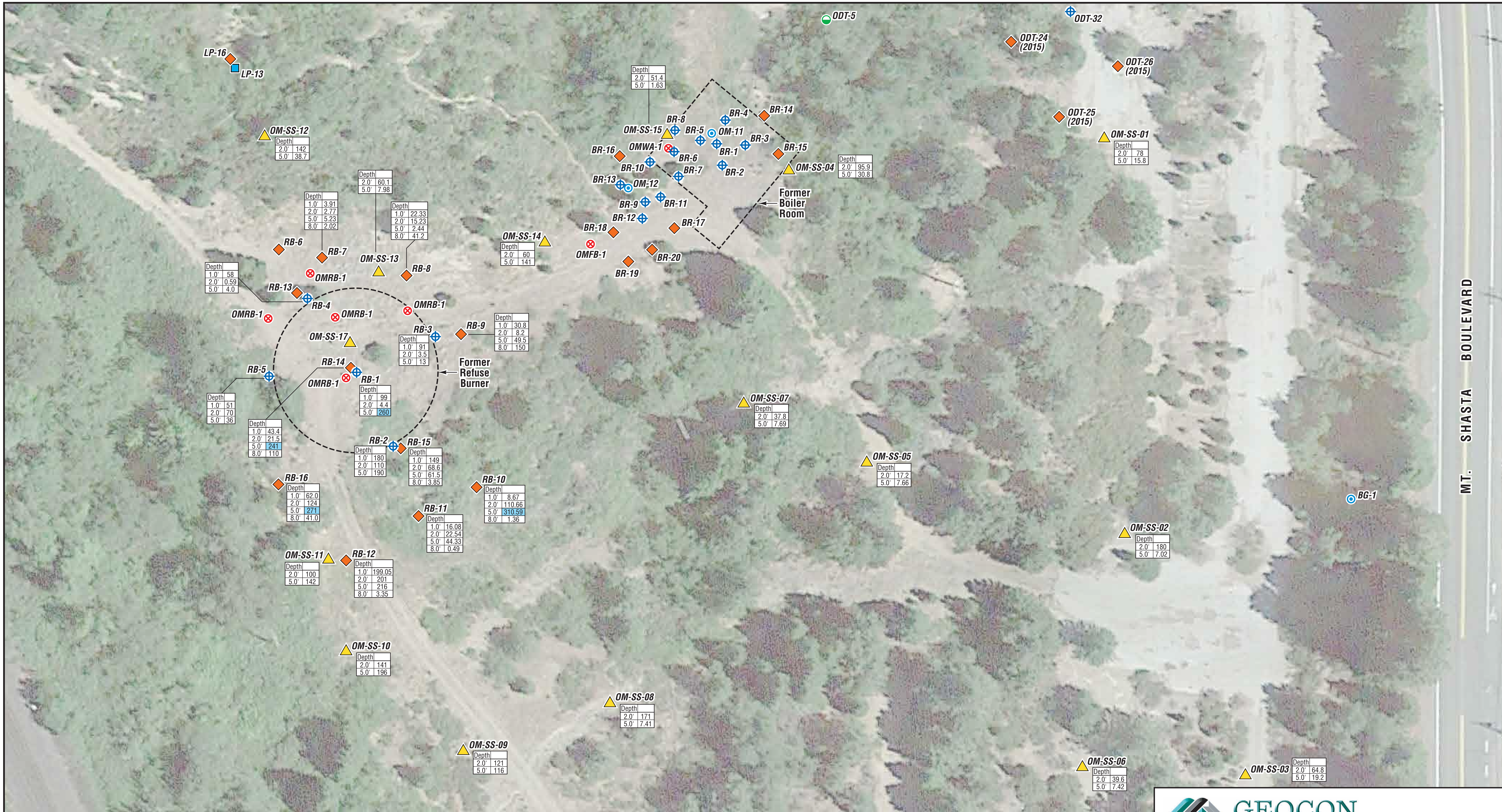
The Landing – Old Mill Section

Mt. Shasta, California

Site Plan – Southern Area – DRO and ORO Concentrations in Soil

S9850-03-13B	April 2018	Figure 5-1



LEGEND:

- Approximate Boring Location (E & E, 1998)
- Approximate Boring Location (E & E, 2005)
- Approximate Boring Location (Geocon, 2013)
- Approximate Boring Location (Geocon, 2015)
- Approximate Grab Sediment and Surface Water Sample (Geocon, 2015)
- Approximate Soil Boring Location (Weston, 2016)

Depth	
2.0'	121

Total 2,3,7,8-Tetrachlorodibenzo-p-dioxin toxicity equivalency concentration in soil

Within Project Action Levels (**Soil:** 220-700 ng/kg)

Soil Concentrations in Nanograms per Kilogram (ng/kg)

N

0 50
Scale in Feet

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The Landing – Old Mill Section

Mt. Shasta, California

Site Plan – Southern Area – Dioxin Concentrations in Soil

S9850-03-13B	April 2018	Figure 5-2

TRANSPORT MECHANISMS AND EXPOSURE MEDIA FOR HUMAN RECEPTORS

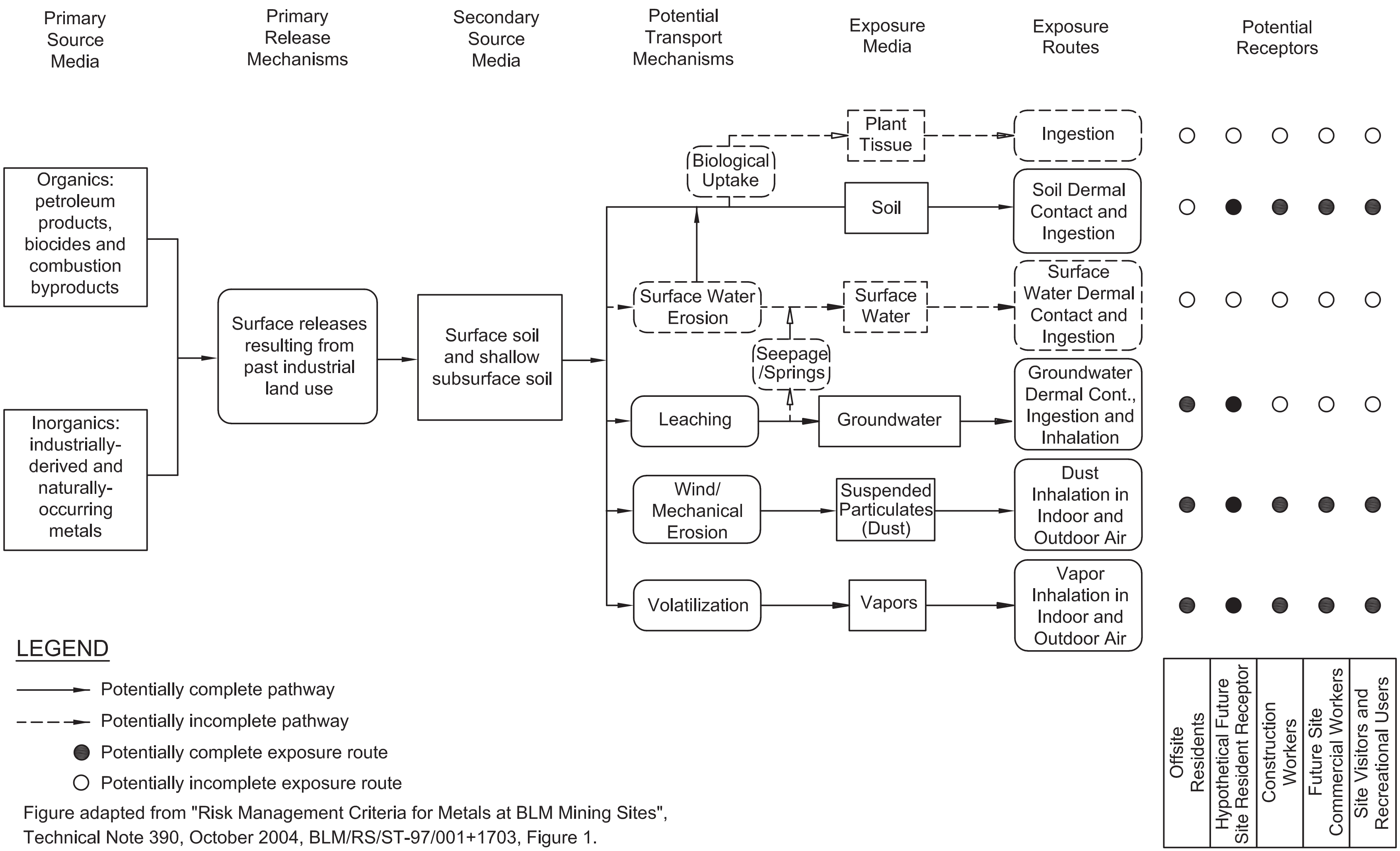

Figure adapted from "Risk Management Criteria for Metals at BLM Mining Sites", Technical Note 390, October 2004, BLM/RS/ST-97/001+1703, Figure 1.

Ref: Holdrege & Kuhl, 2/18

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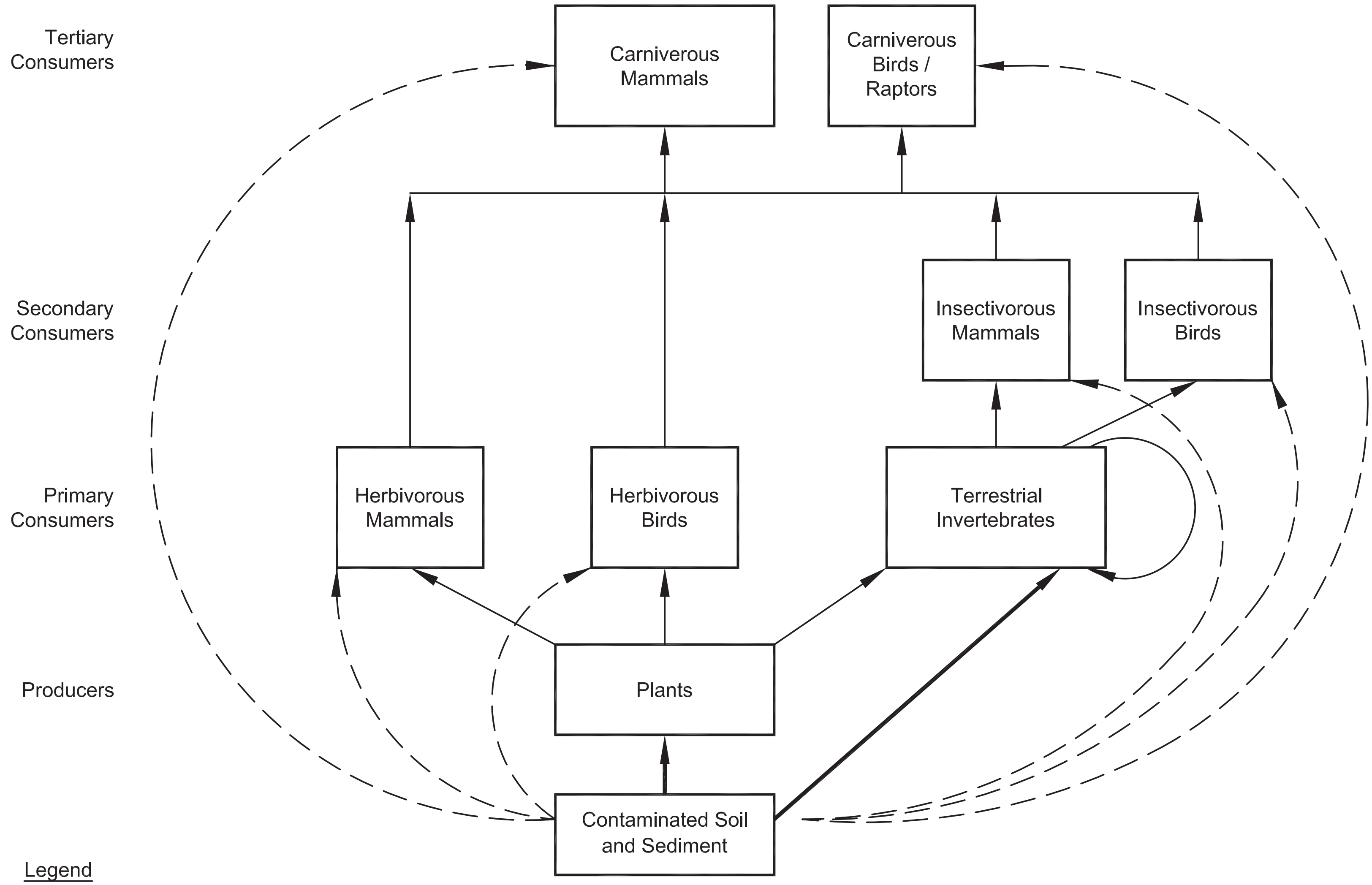
SITE CONCEPTUAL MODEL

The Landing – Old Mill Section

Mt. Shasta, California

S9850-03-13B	April 2018	Figure 6



Legend

- Direct exposure route for producers and invertebrates
- Indirect exposure route for consumers
- Secondary direct exposure route for consumers: incidental soil ingestion, inhalation of soil dust and dermal contact

Ref: Holdrege & Kuhl, 2/18

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ECOLOGICAL SITE CONCEPTUAL MODEL

The Landing – Old Mill Section		
Mt. Shasta, California		
S9850-03-13B	April 2018	Figure 7

TABLE 1

SUMMARY OF LABORATORY ANALYSIS RESULTS - SOIL

PETROLEUM HYDROCARBONS AND PENTACHLOROPHENOL

THE LANDING - OLD MILL SECTION

MT. SHASTA, CALIFORNIA

CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

SAMPLE I.D.	SAMPLE DATE	SAMPLE DEPTH	DRO	ORO	GRO	PENTACHLOROPHENOL
			(mg/kg)			
WESTON 2016 PHASE II						
OM-SS-01-2	6/16/2016	2	100	570	---	---
OM-SS-01-5	6/16/2016	5	---	---	---	---
OM-SS-02-2	6/16/2016	2	56 J	720 J	---	---
OM-SS-02-5	6/16/2016	5	---	---	---	---
OM-SS-03-2	6/16/2016	2	130	4,100	---	---
OM-SS-03-5	6/16/2016	5	---	---	---	---
OM-SS-04-2	6/16/2016	2	160	730	---	---
OM-SS-04-5	6/16/2016	5	---	---	---	---
OM-SS-05-2	6/16/2016	2	9.7	65	---	---
OM-SS-05-5	6/16/2016	5	---	---	---	---
OM-SS-06-2	6/16/2016	2	22	120	---	---
OM-SS-06-5	6/16/2016	5	---	---	---	---
OM-SS-07-2	6/16/2016	2	54	130	---	---
OM-SS-07-5	6/16/2016	5	---	---	---	---
OM-SS-08-2	6/16/2016	2	130	460	---	---
OM-SS-08-5	6/16/2016	5	---	---	---	---
OM-SS-09-2	6/16/2016	2	74	520	---	---
OM-SS-16	6/16/2016	2	490	1,500	---	---
OM-SS-17	6/16/2016	2	270	1,200	---	---
OM-SS-18 (dup OM-SS-02-2)	6/16/2016	2	100 J	1,300 J	---	---
OM-SS-19 (dup OM-SS-16)	6/16/2016	2	450	1,600	---	---
GEOCON 2015 TSI						
Former Boiler Room						
BR-14-0.5-1.0	3/3/2015	1	130	540	---	---
BR-24-0.5-1.0 (dup of BR-14)	3/3/2015	1	160	550	---	---
BR-15-0.5-1.0	3/3/2015	1	93	320	---	---
BR-15-1.5-2.0	3/3/2015	2	410	1,100	---	---
BR-25-1.5-2.0 (dup of BR-15)	3/3/2015	2	310	520	---	---
BR-15-4.5-5.0	3/3/2015	5	1.4	2.7	---	---
BR-16-0.5-1.0	3/3/2015	1	36	160	---	---
BR-16-1.5-2.0	3/3/2015	2	26	89	---	---
BR-16-4.5-5.0	3/3/2015	5	15	41	---	---
BR-17-0.5-1.0	3/3/2015	1	**840**	3,200	---	---
BR-17-1.5-2.0	3/3/2015	2	330	1,100	---	---
BR-17-4.5-5.0	3/3/2015	5	71	350	---	---
BR-18-0.5-1.0	3/3/2015	1	430	1,800	---	---
BR-18-1.5-2.0	3/3/2015	2	490	1,700	---	---
BR-18-4.5-5.0	3/3/2015	5	330	1,200	---	---
BR-19-0.5-1.0	3/3/2015	1	240	1,100	---	---
BR-19-1.5-2.0	3/3/2015	2	**5,000**	**14,000**	---	---
BR-19-4.5-5.0	3/3/2015	5	**730**	2,100	---	---
BR-20-0.5-1.0	3/3/2015	1	**1,200**	4,000	---	---
BR-20-1.5-2.0	3/3/2015	2	**640**	2,400	---	---
BR-20-4.5-.50	3/3/2015	5	**900**	3,000	---	---
Former Refuse Burner						
RB-6-0.5-1.0	3/4/2015	1	340	1,300	---	---
RB-6-1.5-2.0	3/4/2015	2	24	79	---	---
RB-6-4.5-5.0	3/4/2015	5	12	36	---	---

TABLE 1

SUMMARY OF LABORATORY ANALYSIS RESULTS - SOIL

PETROLEUM HYDROCARBONS AND PENTACHLOROPHENOL

THE LANDING - OLD MILL SECTION

MT. SHASTA, CALIFORNIA

CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

SAMPLE I.D.	SAMPLE DATE	SAMPLE DEPTH	DRO	ORO	GRO	PENTACHLOROPHENOL
RB-6-7.5-8.0	3/4/2015	8	11	33	---	---
RB-7-0.5-1.0	3/4/2015	1	**720**	2,300	---	---
RB-7-1.5-2.0	3/4/2015	2	**670**	2,200	---	---
RB-7-4.5-5.0	3/4/2015	5	**960**	3,100	---	---
RB-17-4.5-5.0 (dup of RB-7)	3/4/2015	5	**1,300**	4,500	---	---
RB-7-7.5-8.0	3/4/2015	8	**1,900**	**5,900**	---	---
RB-9-0.5-1.0	3/3/2015	1	**810**	3,500	---	---
RB-19-0.5-1.0 (dup of RB-9)	3/3/2015	1	**640**	2,600	---	---
RB-9-1.5-2.0	3/3/2015	2	59	180	---	---
RB-9-4.5-5.0	3/3/2015	5	240	860	---	---
RB-9-7.5-8.0	3/3/2015	8	210	630	---	---
RB-13-0.5-1.0	3/4/2015	1	**570**	2,400	---	---
RB-13-1.5-2.0	3/4/2015	2	**1,300**	4,600	---	---
RB-13-4.5-5.0	3/4/2015	5	**770**	2,700	---	---
RB-13-7.5-8.0	3/4/2015	8	**630**	2,000	---	---
Former Dip Tank and Transfer Pit						
ODT-25-0.5-1.0	3/3/2015	1	---	---	---	<0.067
ODT-25-1.5-2.0	3/3/2015	2	---	---	---	<0.067
ODT-25-4.5-5.0	3/3/2015	5	---	---	---	<0.067
ODT-25-7.5-8.0	3/3/2015	8	---	---	---	<0.067
ODT-26-0.5-1.0	3/3/2015	1	---	---	---	<0.067
ODT-26-1.5-2.0	3/3/2015	2	---	---	---	<0.067
ODT-26-4.5-5.0	3/3/2015	5	---	---	---	<0.067
ODT-26-7.5-8.0	3/3/2015	8	---	---	---	<0.067
GEOCON 2014 PHASE II ESA						
Former Dip Tank and Transfer Pit						
ODT-6-1	12/3/2013	1	7.9	16	---	<1.6
ODT-6-2	12/3/2013	2	5.5	6.7	---	<1.6
ODT-6-5	12/3/2013	5	3.4	2.5	---	<1.6
ODT-31-5 (dup ODT-6-5)	12/3/2013	5	3.2	2.2	---	<1.6
ODT-6-8	12/3/2013	8	6.9	4.0	---	<1.6
ODT-7-1	12/3/2013	1	58	150	---	<1.6
ODT-7-2	12/3/2013	2	3.5	4.3	---	<1.6
ODT-7-5	12/3/2013	5	2.9	2.4	---	<1.6
ODT-7-8	12/3/2013	8	2.1	1.3	---	<1.6
ODT-8-1	12/3/2013	1	2.7	2.6	---	2.5
ODT-8-2	12/3/2013	2	6.0	6.5	---	**5.4**
ODT-8-5	12/3/2013	5	3.8	4.0	---	<1.6
ODT-8-8	12/3/2013	8	2.6	1.9	---	<1.6
ODT-9-1	12/3/2013	1	2.3	3.1	---	<1.6
ODT-9-2	12/3/2013	2	1.6	1.6	---	<1.6
ODT-9-5	12/3/2013	5	2.4	1.8	---	<1.6
ODT-10-1	12/3/2013	1	---	---	---	<1.6
ODT-10-2	12/3/2013	2	---	---	---	<1.6
ODT-10-5	12/3/2013	5	---	---	---	<1.6
ODT-11-1	12/3/2013	1	---	---	---	<1.6
ODT-11-2	12/3/2013	2	---	---	---	<1.6
ODT-11-5	12/3/2013	5	---	---	---	<1.6
ODT-12-1	12/2/2013	1	---	---	---	<1.6
ODT-12-2	12/2/2013	2	---	---	---	<1.6
ODT-12-5	12/2/2013	5	---	---	---	<1.6
ODT-12-6.5	12/2/2013	6.5	---	---	---	<1.6

TABLE 1

SUMMARY OF LABORATORY ANALYSIS RESULTS - SOIL

PETROLEUM HYDROCARBONS AND PENTACHLOROPHENOL

THE LANDING - OLD MILL SECTION

MT. SHASTA, CALIFORNIA

CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

SAMPLE I.D.	SAMPLE DATE	SAMPLE DEPTH	DRO	ORO	GRO	PENTACHLOROPHENOL
ODT-13-1	12/2/2013	1	---	---	---	<1.6
ODT-13-2	12/2/2013	2	---	---	---	<1.6
ODT-13-5	12/2/2013	5	---	---	---	<1.6
ODT-14-1	12/2/2013	1	---	---	---	<1.6
ODT-14-2	12/2/2013	2	---	---	---	<1.6
ODT-14-5	12/2/2013	5	---	---	---	<1.6
ODT-15-1	12/3/2013	1	41	86	---	<1.6
ODT-15-2	12/3/2013	2	19	31	---	<1.6
ODT-15-5	12/3/2013	5	10	13	---	<1.6
ODT-16-1	12/3/2013	1	---	---	---	<1.6
ODT-29-1 (dup ODT-16-1)	12/3/2013	1	---	---	---	<1.6
ODT-16-2	12/3/2013	2	---	---	---	<1.6
ODT-29-2 (dup ODT-16-2)	12/3/2013	2	---	---	---	<1.6
ODT-16-5	12/3/2013	5	---	---	---	<1.6
ODT-17-1	12/3/2013	1	---	---	---	<1.6
ODT-17-2	12/3/2013	2	---	---	---	<1.6
ODT-17-5	12/3/2013	5	---	---	---	<1.6
ODT-18-1	12/3/2013	1	11/4.3 (1)	8.7/3.7 (1)	<1.0	**7.3**
ODT-30-1 (dup ODT-18-1)	12/3/2013	1	790/62 (1)	730/44 (1)	---	**7.5**
ODT-18-2	12/3/2013	2	5.8	4.5	<1.0	2.4
ODT-18-5	12/3/2013	5	4.2	3.2	<1.0	<1.6
ODT-30-5 (dup ODT-18-5)	12/3/2013	5	3.1	2.4	---	<1.6
ODT-19-1	12/3/2013	1	---	---	---	<1.6
ODT-19-2	12/3/2013	2	---	---	---	<1.6
ODT-19-5	12/3/2013	5	---	---	---	<1.6
ODT-20-1	12/3/2013	1	---	---	---	<1.6
ODT-20-2	12/3/2013	2	---	---	---	<1.6
ODT-20-5	12/3/2013	5	---	---	---	<1.6
ODT-21-1	12/3/2013	1	---	---	---	**9.0**
ODT-21-2	12/3/2013	2	---	---	---	<1.6
ODT-21-5	12/3/2013	5	---	---	---	<1.6
ODT-22-1	12/3/2013	1	---	---	---	**5.6**
ODT-22-2	12/3/2013	2	---	---	---	**8.0**
ODT-22-5	12/3/2013	5	---	---	---	<1.6
ODT-23-1	12/3/2013	1	4.0	3.9	---	---
ODT-23-2	12/3/2013	2	3.1	2.2	---	---
ODT-23-5	12/3/2013	5	4.0	2.6	---	---
ODT-24-1	12/3/2013	1	4.9	7.8	---	---
ODT-24-2	12/3/2013	2	3.2	2.3	---	---
ODT-24-5	12/3/2013	5	2.8	1.9	---	---
ODT-25-1	12/3/2013	1	4.3	4.6	---	---
ODT-25-2	12/3/2013	2	3.7	3.7	---	---
ODT-25-5	12/3/2013	5	3.6	2.8	---	---
ODT-26-1	12/3/2013	1	4.7	4.2	---	---
ODT-26-2	12/3/2013	2	3.1	2.2	---	---
ODT-26-5	12/3/2013	5	3.1	2.3	---	---
ODT-27-1	12/2/2013	1	33	83	---	---
ODT-27-2	12/2/2013	2	54	130	---	---
ODT-27-5	12/2/2013	5	15	23	---	---
ODT-28-1	12/2/2013	1	4.9	6.4	---	---
ODT-28-2	12/2/2013	2	9.8	17	---	---
ODT-28-5	12/2/2013	5	3.0	2.6	---	---

TABLE 1

SUMMARY OF LABORATORY ANALYSIS RESULTS - SOIL

PETROLEUM HYDROCARBONS AND PENTACHLOROPHENOL

THE LANDING - OLD MILL SECTION

MT. SHASTA, CALIFORNIA

CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

SAMPLE I.D.	SAMPLE DATE	SAMPLE DEPTH	DRO	ORO	GRO	PENTACHLOROPHENOL
Former Boiler Room						
BR-1-1	12/2/2013	1	130	270	---	---
BR-1-2	12/2/2013	2	6.8	10	---	---
BR-1-5	12/2/2013	5	1.7	1.1	---	---
BR-2-1	12/2/2013	1	72	120	---	---
BR-2-2	12/2/2013	2	56	91	---	---
BR-2-5	12/2/2013	5	2.4	3.0	---	---
BR-3-1	12/2/2013	1	55	110	---	---
BR-3-2	12/2/2013	2	310	920	---	---
BR-3-5	12/2/2013	5	2.0	1.7	---	---
BR-4-1	12/2/2013	1	73	98	---	---
BR-4-2	12/2/2013	2	9.6	54	---	---
BR-4-5	12/2/2013	5	31	85	---	---
BR-5-1	12/2/2013	1	120	240	---	---
BR-5-2	12/2/2013	2	3.8	3.1	---	---
BR-5-5	12/2/2013	5	3.1	3.7	---	---
BR-6-1	12/2/2013	1	140	350	---	---
BR-6-2	12/2/2013	2	7.2	14	---	---
BR-6-5	12/2/2013	5	2.1	1.6	---	---
BR-7-1	12/2/2013	1	130	280	---	---
BR-7-2	12/2/2013	2	78	120	---	---
BR-7-5	12/2/2013	5	71	160	---	---
BR-8-1	12/2/2013	1	120	320	---	---
BR-8-2	12/2/2013	2	68	120	---	---
BR-8-5	12/2/2013	5	55	140	---	---
BR-9-1	12/2/2013	1	**650**	1,400	---	---
BR-9-2	12/2/2013	2	17	39	---	---
BR-9-5	12/2/2013	5	5.8	5.5	---	---
BR-10-1	12/2/2013	1	320	1,000	---	---
BR-14-1 (dup BR-10-1)	12/2/2013	1	260	420	---	---
BR-10-2	12/2/2013	2	10	18	---	---
BR-14-2 (dup BR-10-2)	12/2/2013	2	12	28	---	---
BR-10-5	12/2/2013	5	10	17	---	---
BR-11-1	12/2/2013	1	310	830	---	---
BR-11-2	12/2/2013	2	520	1,000	---	---
BR-11-5	12/2/2013	5	5.6	7.5	---	---
BR-12-1	12/2/2013	1	**590**	1,500	---	---
BR-12-2	12/2/2013	2	**1,600**	3,500	---	---
BR-12-5	12/2/2013	5	6.3	9.1	---	---
BR-13-1	12/2/2013	1	34	78	---	---
BR-15-1 (dup BR-13-1)	12/2/2013	1	33	89	---	---
BR-13-2	12/2/2013	2	130	310	---	---
BR-13-5	12/2/2013	5	52	100	---	---
BR-15-5 (dup BR-13-5)	12/2/2013	5	7.3	10	---	---
Former Log Pond						
LP-1-0.5	12/4/2013	0.5	72	89	---	---
LP-2-0.5	12/4/2013	0.5	29	46	---	---
LP-3-0.5	12/4/2013	0.5	38	66	---	---
LP-4-0.5	12/4/2013	0.5	80	120	---	---
LP-5-0.5	12/4/2013	0.5	57	95	---	---
LP-6-0.5	12/4/2013	0.5	69	130	---	---

TABLE 1

SUMMARY OF LABORATORY ANALYSIS RESULTS - SOIL

PETROLEUM HYDROCARBONS AND PENTACHLOROPHENOL

THE LANDING - OLD MILL SECTION

MT. SHASTA, CALIFORNIA

CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

SAMPLE I.D.	SAMPLE DATE	SAMPLE DEPTH	DRO	ORO	GRO	PENTACHLOROPHENOL
LP-11-0.5 (dup LP-6-0.5)	12/4/2013	0.5	54	100	---	---
LP-7-0.5	12/4/2013	0.5	67	140	---	---
LP-8-0.5	12/4/2013	0.5	83	160	---	---
LP-9-0.5	12/4/2013	0.5	23	82	---	---
LP-10-0.5	12/4/2013	0.5	18	35	---	---
Former Refuse Burner						
RB-1-1	12/3/2013	1	190	400	---	---
RB-1-2	12/3/2013	2	150	300	---	---
RB-1-5	12/3/2013	5	39	95	---	---
RB-2-1	12/3/2013	1	8.3	21	---	---
RB-2-2	12/3/2013	2	14	21	---	---
RB-2-5	12/3/2013	5	1.7	1.3	---	---
RB-3-1	12/3/2013	1	300	420	---	---
RB-3-2	12/3/2013	2	170	280	---	---
RB-3-5	12/3/2013	5	170	270	---	---
RB-4-1	12/3/2013	1	410	780	---	---
RB-4-2	12/3/2013	2	**580**	720	---	---
RB-4-5	12/3/2013	5	**860**	1,200	---	---
RB-5-1	12/3/2013	1	8.1	13	---	---
RB-5-2	12/3/2013	2	8.9	16	---	---
RB-5-5	12/3/2013	5	5.4	10	---	---
URS 2007 TSI						
Former Dip Tank and Transfer Pit						
ODT-1-2	5/31/2007	2	---	---	---	<0.020
ODT-1-5	5/31/2007	5	---	---	---	<0.020
ODT-2-2	5/31/2007	2	<1.0	<50	---	1.1
ODT-2-8	5/31/2007	8	<0.99	<50	---	0.027
ODT-3-2	5/31/2007	2	44	<50	---	**130**
ODT-3-8	5/31/2007	8	<0.99	<50	---	0.27
E&E 2005 TSA						
Background						
BG-1-0.5	3/1/2005	0.5	<8.6	82	---	---
BG-2-0.5	3/1/2005	0.5	<5.9	38	---	---
BG-2-2	3/1/2005	2	<3.5	<14	<3.9	---
BG-2-7.5	3/1/2005	7.5	<3.4	<14	---	---
BG-3-0.5	3/1/2005	0.5	<3.2	<13	---	---
Former Dip Tank and Transfer Pit						
OM-1-0.5	3/2/2005	0.5	---	---	---	0.14 J
OM-1-2	3/2/2005	2	---	---	<3.8	0.25 J
OM-1-7.5	3/2/2005	7.5	---	---	---	<1.1
OM-2-0.5	3/2/2005	0.5	---	---	---	0.068 J
OM-2-2	3/2/2005	2	---	---	---	<1.2
OM-2-7.5	3/2/2005	7.5	---	---	---	<1.1
OM-3-0.5	3/2/2005	0.5	---	---	---	<4.7
OM-3-2	3/2/2005	2	---	---	<3.7	<1.2
OM-3-7.5	3/2/2005	7.5	---	---	---	<1.2
OM-4-0.5	3/2/2005	0.5	---	---	---	**11**
OM-4-2	3/2/2005	2	---	---	---	**12**
OM-4-7.5	3/2/2005	7.5	---	---	---	0.095 J
OM-5-0.5	3/2/2005	0.5	---	---	---	0.75 J
OM-5-2	3/2/2005	2	---	---	<2.9	1.5

TABLE 1
SUMMARY OF LABORATORY ANALYSIS RESULTS - SOIL
PETROLEUM HYDROCARBONS AND PENTACHLOROPHENOL
THE LANDING - OLD MILL SECTION
MT. SHASTA, CALIFORNIA
CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

SAMPLE I.D.	SAMPLE DATE	SAMPLE DEPTH	DRO	ORO	GRO	PENTACHLOROPHENOL
OM-5-7.5	3/2/2005	7.5	---	---	---	<1.3
OM-6-0.5	3/2/2005	0.5	---	---	---	<1.3
OM-6-4	3/2/2005	4	---	---	---	<1.3
OM-6-7.5	3/2/2005	7.5	---	---	---	<1.1
OM-7-0.5	3/2/2005	0.5	---	---	---	0.49 J
OM-7-2	3/2/2005	2	<3.5	<14	<6.1	0.18 J
OM-7-7.5	3/2/2005	7.5	<3.8	<15	---	<1.4
OM-8-0.5	3/2/2005	0.5	---	---	---	**7.5**
OM-8-2	3/2/2005	2	<3.3	<13	---	**5.6**
OM-8-7.5	3/2/2005	7.5	---	---	---	0.2 J
OM-9-0.5	3/2/2005	0.5	<35	520	---	<1.2
OM-9-2	3/2/2005	2	<8.9	170	<3.9	<1.2
OM-9-7.5	3/2/2005	7.5	<3.3	<13	---	<1.0
OM-10-0.5	3/2/2005	0.5	---	---	---	**150**
OM-10-2	3/2/2005	2	---	---	---	**150**
OM-10-7.5	3/2/2005	7.5	---	---	---	**15**
Former Boiler Room						
OM-11-2	3/2/2005	2	---	---	<7.0	---
OM-12-2	3/2/2005	2	---	---	<11	---
OM-16-4 (dup)	3/2/2005	4	---	---	---	0.075 J

E&E 1998 TSA

SAMPLE I.D.	SAMPLE DATE	SAMPLE DEPTH	DRO	ORO	GRO	PENTACHLOROPHENOL
Former Boiler Room						
OMWA-1-1	May-98	1	**784**	---	<1.52	<1.3
OMFB-1-15	May-98	15	<14	---	<1.4	---
Former Dip Tank and Transfer Pit						
OMTP-1-2	May-98	2	---	---	---	<0.95
OMTP-2-1	May-98	1	**47,000**	---	<1.13	---
OMDT-1-1	May-98	1	---	---	---	<0.4
OMDT-2-2	May-98	2	---	---	---	**32**
OMDT-2-5	May-98	5	---	---	---	<1.2
OMDT-10-1	May-98	1	---	---	---	2.5
Former Log Pond						
OMLP-1-1	May-98	2	---	---	---	<1.6
OMLP-1-2	May-98	2	**594**	---	<1.39	---
PALs[2]			570	5,100	770	4.0

Notes:

mg/kg = milligrams per kilogram

< = Less than laboratory reporting limits

PAL = Project Action Level; PALs for TPH = ESL for direct-exposure/leaching to groundwater; PAL for PCP = Ind. RSL

[1] = Sample reanalyzed for DRO and ORO due to elevated concentrations when compared with duplicate and remaining samples

[2] PALs were determined based on project specific goals

Bold = concentration > PALs

--- = not analyzed

TABLE 2
SUMMARY OF LABORATORY ANALYSIS RESULTS - GROUNDWATER AND SURFACE WATER
PETROLEUM HYDROCARBONS AND PENTACHLOROPHENOL
THE LANDING - OLD MILL SECTION
MT. SHASTA, CALIFORNIA
CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

SAMPLE I.D.	SAMPLE DATE	DRO	ORO	GRO	PCP
		(µg/l)			
OLD MILL GROUNDWATER MONITORING WELLS					
OM-1	1/18/2018	<50	<50	---	---
	3/17/2016	70	80	---	<0.1
	3/12/2015	<50	<50	---	<1.0
OM-2	1/18/2018	<50	<50	---	---
	3/17/2016	<50	<50	---	<0.1
	3/12/2015	<50	<50	---	<1.0
OM-3	1/18/2018	<50	<50	---	---
	3/17/2016	90	100	---	<0.1
	3/12/2015	**160**	150	---	<1.0
OM-3A (duplicate)	3/17/2016	90	100	---	<0.1
	3/12/2015	**150**	150	---	<1.0
OM-4	1/18/2018	70	80	---	---
	3/17/2016	<50	<50	---	<0.1
	3/12/2015	<50	<50	---	<1.0
OM-5	1/18/2018	<50	<50	---	---
	3/17/2016	**170**	170	---	<0.1
	3/12/2015	<50	<50	---	<1.0
GEOCON TSI 2015					
ODT-23-GW	3/3/2015	<60	<60	---	<1.0
ODT-24-GW	3/3/2015	**150**	220	---	**7.7**
ODT-34-GW (dup ODT-24)	3/3/2015	110	170	---	**7.9**
ODT-25-GW	3/3/2015	--	--	---	<1.0
ODT-26-GW	3/3/2015	--	--	---	<1.0
BR-18-GW	3/3/2015	**650**	920	---	---
BR-19-GW	3/3/2015	**670**	670	---	---
BR-20-GW	3/3/2015	**1,100**	1,900	---	---
LP-14-GW	3/5/2015	3	6	---	---
LP-15-GW	3/5/2015	<60	80	---	---
LP-16-GW	3/5/2015	**360**	610	---	---
RB-13-GW	3/5/2015	**2,800**	2,200	---	---
LP-11-SW*	3/5/2015	<50	<50	---	---
LP-12-SW*	3/5/2015	<50	<50	---	---
LP-22-SW* (dup of LP-12)	3/5/2015	<50	<50	---	---
LP-13-SW*	3/5/2015	<50	<50	---	---

TABLE 2
SUMMARY OF LABORATORY ANALYSIS RESULTS - GROUNDWATER AND SURFACE WATER
PETROLEUM HYDROCARBONS AND PENTACHLOROPHENOL
THE LANDING - OLD MILL SECTION
MT. SHASTA, CALIFORNIA
CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

SAMPLE I.D.	SAMPLE DATE	DRO	ORO	GRO	PCP
		(µg/l)			
GEOCON 2014 PHASE II ESA					
Former Dip Tank and Transfer Pit					
ODT-6	12/3/2013	100	<50	---	<1.0
ODT-7	12/3/2013	70	60	---	**1.8**
ODT-9	12/3/2013	70	<60	---	<1.0
ODT-10	12/3/2013	---	---	---	<1.1
ODT-11	12/3/2013	---	---	---	<1.1
ODT-12	12/2/2013	---	---	---	<1.1
ODT-15	12/3/2013	70	50	---	<1.0
ODT-17	12/3/2013	---	---	---	<1.0
ODT-18	12/3/2013	70	<50	<50	**2.5**
ODT-30 (dup ODT-18)	12/3/2013	70	<50	---	**15**
ODT-19	12/3/2013	---	---	---	<1.0
ODT-20	12/3/2013	---	---	---	<1.0
ODT-23	12/3/2013	60	<50	---	---
ODT-24	12/3/2013	80	<60	---	---
ODT-32	12/3/2013	70	<50	---	**11**
Former Boiler Room					
BR-1	12/2/2013	80	<50	---	---
BR-6	12/2/2013	60	<50	---	---
BR-9	12/2/2013	**260**	300	---	---
Former Log Pond					
LP-1	12/4/2013	**610**	1,100	---	---
LP-6	12/4/2013	**200**	260	---	---
LP-11 (dup LP-6)	12/4/2013	110	110	---	---
URS 2007 TSI					
ODT-1-8	5/31/2007	---	---	---	<1.0
ODT-2-10	5/31/2007	<50	<500	---	<1.0
ODT-3-10	5/31/2007	93	<500	---	**4.5**
ODT-4-15	5/31/2007	<50	<500	---	<1.0
ODT-5-15	5/31/2007	<50	<500	---	<1.0

TABLE 2

SUMMARY OF LABORATORY ANALYSIS RESULTS - GROUNDWATER AND SURFACE WATER

PETROLEUM HYDROCARBONS AND PENTACHLOROPHENOL

THE LANDING - OLD MILL SECTION

MT. SHASTA, CALIFORNIA

CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

SAMPLE I.D.	SAMPLE DATE	DRO	ORO	GRO	PCP
		(µg/l)			
E&E 2005 TSA					
OM-9W	3/2/2005	<120	910 J	<25	<5.0
OM-10W	3/2/2005	**340 J**	<500	<25	**110**
OM-110W (dup OM-10W)	3/2/2005	**210 J**	<500	<25	**110**
E&E 1998 TSA					
MW1-GW	May-98	---	---	<100	---
MW2-GW	May-98	<1000	---	<100	---
MW3-GW	May-98	<1000	---	<100	---
MW4-GW (dup MW2)	May-98	<1000	---	<100	---
OMDT-1-GW	May-98	<1000	---	**734**	---
OMDT-5-GW	May-98	<1000	---	<100	---
OMDT-10-GW	May-98	<100	---	<100	---
PALs[1]		150	5,000	220	1.0

Notes:

DRO = diesel-range organics

ORO = oil-range organics

GRO = gasoline-range organics

PCP = pentachlorophenol

µg/l = micrograms per liter

< = less than laboratory reporting limits

[1] PALs = Project Action Levels - California Maximum Contaminant Levels for drinking water

Bold = concentrations > PALs

J = reported concentration is estimated

--- = not analyzed

* Surface Water

TABLE 3
SUMMARY OF LABORATORY ANALYSIS RESULTS - SOIL
DIOXIN
THE LANDING - OLD MILL SECTION
MT. SHASTA, CALIFORNIA
CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

SAMPLE ID	SAMPLE DEPTH	2,3,7,8-TCDD	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCD	1,2,3,6,7,8-HxCD	1,2,3,7,8,9-HxCD	1,2,3,4,6,7,8-HpC	OCDD	2,3,7,8-TCDF	1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF	1,2,3,4,7,8-HxCD	1,2,3,6,7,8-HxCD	2,3,4,6,7,8-HxCD	1,2,3,7,8,9-HxCD	1,2,3,4,6,7,8-Hp	1,2,3,4,7,8,9-Hp	OCDF	2,3,7,8-TCDD TEQ[1]	
		(ng/kg)																		
WESTON 2016 Phase II																				
OM-SS-01-2	2																		78	
OM-SS-01-5	5																		15.8	
OM-SS-02-2	2																		180	
OM-SS-02-5	5																		7.02	J
OM-SS-03-2	2																		64.8	
OM-SS-03-5	5																		19.2	
OM-SS-04-2	2																		95.9	
OM-SS-04-5	5																		30.8	
OM-SS-05-2	2																		17.2	
OM-SS-05-5	5																		7.66	J
OM-SS-06-2	2																		39.6	
OM-SS-06-5	5																		7.42	J
OM-SS-07-2	2																		37.8	
OM-SS-07-5	5																		7.69	J
OM-SS-08-2	2																		171	
OM-SS-08-5	5																		7.41	J
OM-SS-09-2	2																		121	
OM-SS-09-5	5																		116	
OM-SS-10-2	2																		141	
OM-SS-10-5	5																		196	
OM-SS-11-2	2																		100	
OM-SS-11-5	5																		142	
OM-SS-12-2	2																		142	
OM-SS-12-5	5																		38.7	J
OM-SS-13-2	2																		60.1	
OM-SS-13-5	5																		7.98	J
OM-SS-14-2	2																		60	
OM-SS-14-5	5																		144	
OM-SS-15-2	2																		51.4	
OM-SS-15-5	5																		1.63	J
OM-SS-20 (dup OM-SS-10-5)	5																		**450**	
OM-SS-21 (OM-SS-12-2)	2																		41.1	
GEOCON 2015 TSI																				
RB-7-0.5-1.0	1	<0.497	0.617 J	0.947 J	6.26	2.44 J	95	1,030	<0.497	0.249 J	0.246 J	1.07 J	1.17 J	1.61 J	0.200 J	56.1	1.18 J	37	3.91	
RB-7-1.5-2.0	2	<0.493	0.510 J	0.694 J	4.6	1.93 J	66	659	<0.493	0.168 J	0.132 J	0.738 J	<2.47	1.02 J	<2.47	44.3	<2.47	27	2.77	
RB-7-4.5-5.0	5	<0.495	0.694 J	1.44 J	8.07	3.26	120	1,160	0.151 J	0.264 J	0.387 J	1.46 J	1.57 J	2.33 J	0.266 J	97.5	1.63 J	55	5.23	
17-4.5-5.0 (dup of R	5	<0.494	<2.47	0.799 J	4.86	2.11 J	86	871	0.149 J	<2.47	0.233 J	0.984 J	1.08 J	1.62 J	<2.47	65.9	1.31 J	41	3.04	
RB-7-7.5-8.0	8	<0.492	0.368 J	0.606 J	2.41 J	1.28 J	53	549	<0.492	<2.46	0.330 J	0.724 J	<2.46	0.990 J	<2.46	25	<2.46	24	2.02	
RB-8-0.5-1.0	1	0.348 J	2.33	3.57	31.1	6.58	321	2,281	28.2	2.59	3.12 J	9.82	8.9	12.9	5.28	400	5.70	178	22.33	
18-0.5-1.0 (dup of R	1	0.44 J	3.71	3.92	40.5	8.00	430	2,722	29.7	2.75	2.76 J	12.0	10.5	15.2	7.52	466	7.40	187	27.71	
RB-8-1.5-2.0	2	0.17	1.60	2.62	19.1	4.95	250	1,986	13.5	1.26 J	1.00	6.27 J	6.97	8.81	2.8 J	344	4.62	147	15.23	
RB-8-4.5-5.0	5	0.139	0.501 J	0.449 J	2.145 J	0.549 J	32.9	268	2.26 J	0.309	0.479	0.826	0.981	1.16	0.833	30.5 J	0.953 J	17.9	2.44	
RB-8-7.5-8.0	8	8.47	22.0	9.29	32.5	22.4	354	1,133	1.14	0.236	0.226	0.544	0.329	0.475	0.637	4.54	0.306	4.64 J	41.2	
RB-9-0.5-1.0	1	0.562	3.48	6.09	47.5	15.2	689	6,810	0.340 J	1.41 J	1.75 J	9.04	8.6	12.5	1.64 J	695	9.39	361	30.8	
19-0.5-1.0 (dup of R	1	<0.499	5.38	11.3	77.9	25.5	1,140	10,600	0.438 J	2.06 J	2.69	12.7	11.8	18.6	1.97 J	1130	14.4	631	48.5	
RB-9-1.5-2.0	2	<0.499	1.16 J	1.83 J	11.9	4.45	177	1,410	<0.499	<2.49	0.619 J	2.72	3.06	4.15	0.451 J	175	2.53	88	8.2	
RB-9-4.5-5.0	5	1.27	6.00	9.72	79.7	25.2	1,080	9,870	0.829	2.25 J	1.9 J	13.2	12.3	19.9	2.33 J	1120	13.5	645	49.5	
RB-9-7.5-8.0	8	8.17	36.5	22.1	345	150	2,030	12,400	0.914	2.93	3.45	19.3	22.3	35.1	2.6	2000	24.5	1,170	150	
RB-10-0.5-1.0	1	0.724 J	2.04	0.657 J	27.9	7.86	85.7	308.72	3.01 J	0.325	1.56 J	0.634	0.665	0.922	0.737	22.3 J	0.669	13.20	8.67	
RB-10-1.5-2.0	2	0.902	5.82	496	454	22.0	258	120	6.31	1.29	6.51 J	1.63	0.887	0.835	2.27	95.0	1.88	87.80	110.66	
RB-10-4.5-5.0	5	2.9 J	26.5	54.9	369	140	8,710	203,000	42.0 J	2.12	65.7	50.6	21.5 J	38.9	13.6 J	3,690	127	7,280	**310.59**	
RB-10-7.5-8.0	8	0.040	0.230	0.196	2.15	0.777	27.4 J	615	0.53	0.269	0.102	0.544	0.157	0.307	0.082	10.0	0.623	23.6 J	1.36	

TABLE 3

SUMMARY OF LABORATORY ANALYSIS RESULTS - SOIL

DIOXIN

THE LANDING - OLD MILL SECTION

MT. SHASTA, CALIFORNIA

CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

SAMPLE ID	SAMPLE DEPTH	2,3,7,8-TCDD	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDD	OCDD	2,3,7,8-TCDF	1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	OCDF	2,3,7,8-TCDD TEQ[1]
		(ng/kg)																	
RB-11-1.5-2.0	2	4.7	11.4	5.73	17.4	12.9	226	724	2.04 J	0.21	0.082	0.24	0.34	0.148	0.554	3.24	0.249	3.56 J	22.54
RB-11-4.5-5.0	5	3.19	12.7	12.1	53.4	25.2	811	8562	11.0	1.09 J	5.26	5.43 J	4.71 J	6.74 J	1.95	393	6.07	204.00	44.33
RB-11-7.5-8.0	8	0.048	0.174	0.166	0.093	0.103	1.40	9.24 J	1.00	0.07	0.075	0.26	0.163	0.042	0.64	1.08	0.205	1.14	0.49
RB-12-0.5-1.0	1	4.54 J	42.8	41.5	272	130	4,070	35,700	72.7	3.65	60.7	29.3	19.4 J	29.1	10.5 J	2,080	35.8	1,240	199.05
RB-12-1.5-2.0	2	4.81	26.5	51.4	336	143	4,610	49,500	0.857	5.5	6.82	40.7	28.6	45.4	4.95	4,030	47.1	2,200	201
RB-12-4.5-5.0	5	11.4	34.9	69.6	281	139	3,410	31,200	0.619	5.26	5.4	38.9	37	50.4	5.00	6,150	38.3	2,630	216
RB-12-7.5-8.0	8	<0.499	<2.50	3.24	4.21	1.19 J	109	909	<0.499	0.131 J	<2.50	0.931 J	0.612 J	1.40 J	<2.50	77.5	2.26	107	3.35
RB-14-0.5-1.0	1	0.895	5.67	8.86	73.7	22.8	915	7,740	0.638	2.23 J	3.3	12.2	11.1	17.7	1.21 J	916	13.3	543	43.4
RB-14-1.5-2.0	2	<0.484	3.18	4.57	41.1	10.7	439	3,420	1.2	2.17 J	2.01 J	6.58	6.06	10.2	1.20 J	388	7.56	260	21.5
RB-14-4.5-5.0	5	11.4	54.8	10.3	1040	438	1,890	1,430	0.394 J	0.910 J	0.799 J	4.54	5.09	8.66	1.12 J	396	7.52	333	241
RB-14-7.5-8.0	8	35	48.9	28.3	87.5	51.7	743	1,980	0.460 J	0.766 J	0.527 J	1.42 J	2.25 J	1.73 J	<2.50	32.4	1.19 J	16	110
RB-15-0.5-1.0	1	10.6	43.1	12.2	482	195	1,440	7,250	0.982	1.61 J	1.75 J	7.87	8.54	12.3	1.00 J	564	9.04	366	149
RB-15-1.5-2.0	2	7.27	17.4	15.6	151	60.3	1,590	10,000	<0.501	<2.50	0.509 J	2.17 J	2.31 J	3.45	0.441 J	130	3.77	106	68.6
RB-15-4.5-5.0	5	4.99	14.2	14.4	82.5	41.6	1,960	13,800	0.273 J	0.639 J	0.637 J	4.03	3.83	5.55	<2.55	303	5.36	222	61.5
RB-15-7.5-8.0	8	<0.487	<2.43	<2.43	3.5	1.23 J	12.6	16.1	<0.487	0.243 J	0.337 J	5.61	2.53	3.36	<2.43	195	2.21 J	46.6	3.85
RB-16-0.5-1.0	1	1.55	8.23	12.1	104	39.1	1,380	13,800	0.458 J	2.16 J	1.61 J	14.4	11.6	18.6	1.29 J	1,320	14.4	698	62.0
RB-16-1.5-2.0	2	3.78	18.8	27.2	181	85.6	2,940	44,400	0.417 J	2.33 J	1.69 J	20.6	16.5	25.1	2.76	2,160	26.7	1,450	124
RB-16-4.5-5.0	5	12.1	78.3	374	336	246	6,120	26,800	0.355 J	1.75 J	1.51 J	14	13	20.2	1.71 J	1,020	17.2	648	271
RB-16-7.5-8.0	8	2.53	10.5	12.3	72.4	43.5	1,180	5,030	<0.506	0.357 J	0.388 J	1.74 J	1.79 J	1.82 J	<2.53	117	1.32 J	53.5	41.0
BK-1-0.5-1.0	1	<0.494	0.468 J	0.755 J	4.53	1.85 J	105	1310	<0.494	0.513 J	0.521 J	1.36 J	1.06 J	1.53 J	0.369 J	36.4	1.09 J	25.9	3.61
GEOCON 2014 Phase II ESA																			
RB-1-1	1																		99
RB-1-2	2																		4.4
RB-1-5	5																		260
RB-2-1	1																		180
RB-2-2	2																		110
RB-2-5	5																		190
RB-3-1	1																		91
RB-3-2	2																		3.5
RB-3-5	5																		13
RB-4-1	1																		58
RB-4-2	2																		0.59
RB-4-5	5																		4.0
RB-5-1	1																		51
RB-5-2	2																		70
RB-5-5	5																		36
E&E 1998 TSA																			
OMRB-1-1C		<2.1	3.5	<15	37	19	560	7200	<3.8	<0.57	<5.2	8.2	8.7	<7	15	630	<26	200	30
PAL																			220-700

Notes:

ng/kg = nanograms per kilogram

2,3,7,8-TCDD TEQ = total 2,3,7,8- tetrachlorodibenzo-p-dioxin toxicity equivalency

[1]Dioxins/furans, reported as total 2,3,7,8-TCDD TEQ using the EPA-recommended 2005 World Health Organization toxicity equivalency factors

< = Less than the laboratory reporting limit

J = reported concentration estimated

PAL = 220-700 ng/kg per DTSC HERO Note 2 com/ind and 50 ng/kg for residential

TABLE 4
SUMMARY OF LABORATORY ANALYSIS RESULTS - GROUNDWATER
DIOXIN
MT. SHASTA, CALIFORNIA
CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

SAMPLE ID	SAMPLE DATE	% SOLIDS	2,3,7,8-TCDD	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDD	OCDD	2,3,7,8-TCDF	1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	OCDF	2,3,7,8-TCDD TEQ[1]
			(pg/l)																	
OLD MILL GROUNDWATER MONITORING WELLS																				
OM-1	3/18/2018	---																		5.61
	3/17/2016	0.18%	<10.9	22.5 J	41.3	134	88	2,570	18,900 B	<0.911	<3.65	16.4	74.5	61.2	74	29	23,500 B	68	**10,500**	**348**
	3/12/2015	0.07%	<5.46	8.56 J	11.5 J	35.9	21.5 J	606	4,200	<5.46	1.87 J	4.91 J	24.3 J	19.8 J	27 J	4.08 J	6,900	22.1 J	**3,030**	**102**
OM-2	3/18/2018	---																		0.257
	3/17/2016	0.07%	<0.778	<1.67	<1.60	21.9 J	5.49 J	521	6,240	<0.602	<0.809	<0.704	7.31 J	6.3 J	9.52 J	<2.05	982	11.3 J	**651**	22.3
	3/12/2015	0.08%	<5.47	<27.4	<27.4	10.4 J	<27.4	167	1,570	<5.47	<27.4	<27.4	3.07 J	3.14 J	4.51 J	<27.4	413	6.32 J	**257**	8.52
OM-3	3/18/2018	---																		0.24
	3/17/2016	0.07%	<0.857	<1.09	<0.956	2.45 J	<1.12	35	388 B	<0.761	<1.34	<1.17	<0.706	<0.660	<0.732	<1.12	30.9 B	<0.937	**<17.1**	1.02
	3/12/2015	0.34%	<5.34	2.56 J	9.84 J	27.9	10.8 J	474	5,800	<5.34	<26.7	2.29 J	5.76 J	6.64 J	8.35 J	<26.7	356	6.89 J	**201**	20.3
OM-3A (duplicate)	3/12/2015	0.43%	<5.32	<26.6	7.44 J	26.6	9.45 J	420	5,130	<5.32	<26.6	<26.6	6.00 J	<26.6	<26.6	<26.6	329	5.18 J	194	14.1
OM-4	3/18/2018	---																		0.168
	3/17/2016	0.08%	<0.610	<1.55	<0.924	<1.7	<1.01	23.5 J	157	<0.484	<0.594	<0.565	<0.622	<0.643	<0.596	<0.909	26.3	<0.850	18.7 J	0.551
	3/12/2015	0.06%	<5.56	<27.8	<27.8	4.05 J	<27.8	62	625	<5.56	<27.8	<27.8	<27.8	<27.8	<27.8	<27.8	52.1	<27.8	<55.6	1.73
OM-5	3/18/2018	---																		3.62
	3/17/2016	0.24%	<0.603	11.7 J	21.2 J	67.5	42.3	897	6820 B	<1.17	1.99 J	4.9 J	9.68 J	8.91 J	12.7 J	4.64 J	924 B	7.48 J	390	**50.4**
	3/12/2015	1.03%	6.05	27	49.4	152	93.4	2,050	15,500	<5.41	4.46 J	4.73 J	29.1	29.8	43.6	<27.0	3,000	25.1 J	1,110	**130**
OM-5A (duplicate)	3/17/2016	0.12%	<1.25	<2.64	2.11 J	<11.1	<7.5	174	1,260	<0.727	<0.702	<1.119	<0.954	<0.990	<0.992	<1.44	155	<1.52	**74.6**	3.9
GRAB GROUNDWATER SAMPLES																				
RB-14-GW	3/4/2015	2.61%	1,680	5,620	7,600	34,200	16,400	430,000	1,190,000	24.9	79.6	71.1	494	449	641	40.7	31,700	511	15,100	**18,300**
RB-24-GW (dup of RB-14)	3/4/2015	3.16%	3,750	13,200	19,400	81,200	39,200	967,000	3,180,000	60	200	149	1,320	1,190	1,670	157	80,800	1,300	38,100	**42,900**
RB-15-GW	3/4/2015	0.22%	<6.10	9.47 J	11.3 J	85.0	40.0	1,260	11,100	<6.10	2.09 J	4.31 J	26.2 J	17.8 J	27.1 J	<30.5	1,090	16.4 J	437	**58.7**
RB-25-GW (dup of RB-15)	3/4/2015	N/A	13.9	52.2	14.2	569	233	1750	7230	1.42	1.97 J	3.05	7.8	8.84	13.2	1.28 J	542	8.84	360	**177**
RB-16-GW	3/4/2015	0.56%	<5.93	23.5 J	40	210	128	3,370	20,000	<5.93	6.56 J	7.57 J	33.6	49.5	97.6	7.99 J	4,570	91	5,010	**170**
	PAL[1]																			30 [2]

Notes:

pg/l = picograms per liter

2,3,7,8-TCDD TEQ = total 2,3,7,8- tetrachlorodibenzo-p-dioxin toxicity equivalency

[1]Dioxins/furans, reported as total 2,3,7,8-TCDD TEQ using the EPA-recommended 2005 World Health Organization toxicity equivalency factors

PAL = Project Action Level

[1] PALs based on project specific goals

[2] California Maximum Contaminant Level for drinking water

Bold = concentrations > PALs

< = Less than the laboratory reporting limit

J = value estimated

TABLE 5
SUMMARY OF LABORATORY ANALYSIS RESULTS - SOIL
METALS
THE LANDING - MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT
FORMER ROSEBURG LUMBER "OLD MILL"
MT. SHASTA, CALIFORNIA

SAMPLE ID	SAMPLE DEPTH (feet)	SAMPLE DATE	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury	Hexavalent Chromium
			(mg/kg)																	
Geocon 2014 Phase II ESA																				
Former Refuse Burner																				
RB-1-1	1	12/3/2013	<2.0	<1.0	63	<1.0	<1.0	10	2.7	11	7.5	<1.0	12	<1.0	<1.0	<1.0	21	19	<0.10	--
RB-1-2	2	12/3/2013	<2.0	<1.0	39	<1.0	<1.0	7.6	1.7	6.0	2.6	<1.0	9.3	<1.0	<1.0	<1.0	8.9	10	<0.10	--
RB-1-5	5	12/3/2013	<2.0	**1.2**	270	<1.0	<1.0	8.5	1.4	34	9.3	1.2	11	<1.0	<1.0	<1.0	9.8	56	<0.10	--
RB-2-1	1	12/3/2013	<2.0	**1.9**	320	<1.0	<1.0	24	4.0	30	13	<1.0	38	<1.0	<1.0	<1.0	15	45	<0.10	--
RB-2-2	2	12/3/2013	<2.0	**3.1**	380	<1.0	<1.0	25	3.3	44	15	<1.0	29	<1.0	<1.0	<1.0	11	98	<0.10	--
RB-2-5	5	12/3/2013	<2.0	**2.2**	100	<1.0	<1.0	11	3.0	17	6.5	<1.0	12	<1.0	<1.0	<1.0	31	20	0.13	--
RB-3-1	1	12/3/2013	<2.0	<1.0	30	<1.0	<1.0	4.9	1.5	5.9	2.9	<1.0	6.2	<1.0	<1.0	<1.0	8.5	9.9	<0.10	--
RB-3-2	2	12/3/2013	<2.0	<1.0	5.5	<1.0	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.3	<0.10	--
RB-3-5	5	12/3/2013	<2.0	**2.5**	610	<1.0	<1.0	30	5.3	49	25	<1.0	46	<1.0	<1.0	<1.0	24	97	<0.10	--
RB-4-1	1	12/3/2013	<2.0	<1.0	34	<1.0	<1.0	3.3	1.4	4.2	1.2	<1.0	3.1	<1.0	<1.0	<1.0	8.4	8.3	<0.10	--
RB-4-2	2	12/3/2013	<2.0	<1.0	43	<1.0	<1.0	5.8	2.1	9.3	2.9	<1.0	4.9	<1.0	<1.0	<1.0	19	15	<0.10	--
RB-4-5	5	12/3/2013	<2.0	<1.0	40	<1.0	<1.0	7.0	2.1	7.6	2.8	<1.0	5.3	2.3	<1.0	<1.0	17	14	<0.10	--
RB-5-1	1	12/3/2013	<2.0	**3.2**	180	<1.0	<1.0	19	5.2	39	5.8	<1.0	24	<1.0	<1.0	<1.0	48	24	<0.10	--
RB-5-2	2	12/3/2013	<2.0	**3.9**	210	<1.0	<1.0	27	7.2	18	7.7	<1.0	25	<1.0	<1.0	<1.0	68	26	<0.10	--
RB-5-5	5	12/3/2013	<2.0	**3.4**	180	<1.0	<1.0	29	6.4	16	5.9	<1.0	26	<1.0	<1.0	<1.0	69	24	<0.10	--
E&E 2005 TSA																				
OM-1-0.5	0.5	4/27/2005	<7.0 J	<1.2 J	<18.3 J	<0.21 J	<0.58	5.2 J	1.6 J	11.4	2.4 J	---	9.0 J	<4.1	<1.2	<2.9 J	29.0	11.8 J	0.072 J	<0.9
OM-1-2	2	4/27/2005	<8.8 J	**2.2 J**	112 J	1.2 J	0.29 J	35.1 J	7.2 J	40.4 J	9.1	---	35.0 J	<5.1 J	<1.5	<3.7	80.1 J	29.8	<0.15	<1.2
OM-1-7.5	7.5	4/27/2005	<8.0 J	**1.0 J**	46.6 J	<0.57 J	0.21 J	22.2 J	2.5 J	19.1 J	2.7	---	12.7 J	<4.7 J	<1.3	<3.3	46.4 J	21.1 J	<0.13	<0.1
OM-2-0.5	0.5	4/27/2005	<7.9 J	**2.3 J**	117 J	<0.71 J	0.26 J	22.1 J	4.0 J	27.9 J	34.4	---	20.2 J	<4.6 J	<1.3	<3.3	54.8 J	45.6 J	0.16	--
OM-2-2	2	4/27/2005	<8.3 J	**3.2**	416 J	<0.97 J	0.32 J	32.1 J	6.5 J	30.7 J	8.4	---	26.7 J	<4.8	<1.4	<3.5	70.3 J	38.9 J	<0.14	--
OM-2-7.5	7.5	4/27/2005	<8.3 J	**2.7 J**	117 J	<1.0 J	0.35 J	39.8 J	4.1 J	26.8 J	7.5	---	33.0 J	<4.9	<1.4	<3.5	73.3 J	33.2 J	0.12 J	--
OM-3-0.5	0.5	4/27/2005	<7.0 J	<0.60 J	27.7 J	<0.18 J	0.20 J	6.5 J	1.8 J	16.5 J	25.6	---	10.6 J	<4.1 J	<1.2	<2.9	21.6 J	31.8 J	0.040 J	--
OM-3-2	2	4/27/2005	<6.9 J	<1.1	12.0 J	<0.090 J	<0.57	28.4 J	17.3 J	82.6 J	2.2	---	89.8 J	<4.0 J	<1.1	<2.9	19.6 J	30.6 J	<0.11	<0.5
OM-3-7.5	7.5	4/27/2005	<9.1 J	<2.1 J	143 J	<0.92 J	0.25 J	33.0 J	5.9 J	26.8 J	9.0	---	27.5 J	<5.3 J	<1.5	<3.8	78.6 J	65.2 J	0.053 J	<1.2
OM-4-0.5	0.5	4/27/2005	<8.3 J	<2.3 J	132 J	<0.92 J	0.25 J	26.1 J	4.0 J	29.0 J	23.1	---	29.7 J	<4.8 J	<1.4	<3.4	62.9 J	43.3 J	2.4	--
OM-4-2	2	4/27/2005	<8.2 J	<2.4 J	252 J	<0.92 J	0.28 J	28.8 J	6.6 J	27.2 J	7.7	---	28.3 J	<4.8 J	<1.4	<3.4	66.8 J	34.1 J	0.17	--

TABLE 5

SUMMARY OF LABORATORY ANALYSIS RESULTS - SOIL

METALS

THE LANDING - MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT

FORMER ROSEBURG LUMBER "OLD MILL"

MT. SHASTA, CALIFORNIA

SAMPLE ID	SAMPLE DEPTH (feet)	SAMPLE DATE	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury	Hexavalent Chromium
			(mg/kg)																	
OM-4-7.5	7.5	4/27/2005	<8.2 J	<2.3 J	38.9 J	<0.60 J	0.25 J	18.9 J	1.9 J	17.4 J	3.1	---	10.3 J	<4.8 J	<1.4	<3.4	46.0 J	18.1 J	<0.14	--
OM-5-0.5	0.5	4/27/2005	<8.1 J	<2.7	136 J	<0.85 J	0.29 J	25.6 J	4.7 J	27.4 J	7.6	---	23.6 J	<4.7 J	<1.4	<3.4	64.0 J	36.1 J	0.045 J	<0.5
OM-5-2	2	4/27/2005	<8.0 J	<2.5 J	311 J	<0.72 J	0.18 J	27.7 J	3.3 J	21.4 J	7.1	---	21.5 J	<4.7 J	<1.3	<3.3	60.2 J	26.4 J	<0.13	<0.6
OM-5-7.5	7.5	4/27/2005	<9.9 J	<2.9 J	185 J	<1.3 J	0.36 J	45.4 J	6.3 J	35.1 J	9.3	---	47.4 J	<5.8 J	<1.6	<4.1	101 J	43.4 J	0.16 J	<1.1
OM-6-0.5	0.5	4/27/2005	<8.1 J	<1.8 J	138 J	<1.2 J	0.37 J	3.3 J	8.0 J	28.7 J	9.2	---	30.8 J	<4.7 J	<1.3	<3.4	73.6 J	39.7 J	0.10 J	--
OM-6-4	2	4/27/2005	<9.0 J	<2.3 J	161 J	1.2 J	0.53 J	41.1 J	10.5 J	30.3 J	8.8	---	45.6 J	<5.3 J	<1.5	<3.8	86.5 J	40.4 J	<0.15	--
OM-6-7.5	7.5	4/27/2005	<7.6	<2.4 J	144 J	0.83 J	0.15 J	30.9 J	5.7 J	31.1	6.6	---	26.1 J	<4.4	<1.3	<3.2	80.0 J	35.6 J	<0.13	--
OM-7-0.5	0.5	4/27/2005	<8.1	**3.2**	137 J	1.3 J	0.40 J	30.5 J	6.0 J	32.1 J	9.6	---	29.9 J	<4.7	<1.3	<3.4	78.1 J	36.9 J	<0.13	<0.6
OM-7-2	2	4/27/2005	<9.0	<2.5 J	163 J	1.4 J	0.42 J	28.9 J	7.6 J	25.0 J	10.2	---	31.7 J	<5.2	<1.5	<3.7	70.3 J	40.2 J	<0.15	<0.7
OM-7-7.5	7.5	4/27/2005	<9.8	**1.8 J**	138 J	1.3 J	0.60 J	43.5 J	2.2 J	30.4 J	9.6	---	28.6 J	<5.7	<1.6	<4.1	86.6 J	28.6 J	<0.16	<1.1
OM-8-0.5	0.5	4/27/2005	<7.9	**2.4 J**	126 J	1.0 J	0.35 J	25.1 J	6.0 J	28.0 J	7.3	---	24.3 J	<4.6	<1.3	<3.3	53.0 J	33.1 J	0.067 J	--
OM-8-2	2	4/27/2005	<8.1	**1.9 J**	122 J	0.97 J	0.36 J	24.3 J	4.8 J	25.9 J	6.9	---	24.1 J	<4.7	<1.3	<3.4	58.0 J	29.5 J	0.054 J	--
OM-8-7.5	7.5	4/27/2005	<9.0	**3.0**	255 J	1.4 J	0.59 J	49.3 J	14.1 J	35.4 J	10.8	---	45.7 J	<5.2	<1.5	<3.7	106 J	45.1 J	<0.15	--
OM-9-0.5	0.5	4/27/2005	<8.7	**3.5**	202 J	1.5 J	0.67 J	33.2 J	6.8 J	29.6 J	11.1	---	34.3 J	<5.1	<1.5	<3.6	78.5 J	41.2 J	<0.15	<0.6
OM-9-2	2	4/27/2005	<8.8	**1.9 J**	168 J	1.3 J	0.49 J	36.8 J	7.6 J	27.9 J	9.4	---	35.9 J	<5.1	<1.5	<3.7	79.3 J	36.6 J	<0.15	<1.2
OM-9-7.5	7.5	4/27/2005	<7.7	**1.6 J**	106 J	0.77 J	0.24 J	31.5 J	7.5 J	30.5 J	7.4	---	29.3 J	<4.5	<1.3	<3.2	68.6 J	40.8 J	<0.13	<0.5
OM-10-0.5	0.5	4/27/2005	<1.5 J	**2.7 J**	132	0.81 J	0.50 J	27.5 J	6.1 J	39.3	70.3 J	---	30.4	<5.1	<1.5	<3.6 J	68.1	71.3	2.3	--
OM-10-2	2	4/27/2005	<8.5 J	**3.0**	122 J	1.1 J	0.37 J	30.0 J	6.2 J	34.9 J	23.9	---	28.2 J	<4.9 J	<1.4	<3.5	72.3 J	46.4 J	**8.0**	--
OM-10-7.5	7.5	4/27/2005	<9.0 J	**2.7 J**	109 J	1.4 J	0.42 J	39.4 J	5.6 J	25.6 J	10.0	---	35.8 J	<5.2 J	<1.5	<3.7	81.0 J	36.8 J	1.2	--
OM-16-4	4	4/27/2005	<8.9 J	**1.7 J**	146 J	<1.2 J	0.57 J	39.6 J	8.8 J	28.1 J	8.7	---	37.3 J	<5.2 J	<1.5	<3.7	83.9 J	38.1 J	0.061 J	--
OMLP-3B-0.5	0.5	4/27/2005	<8.7 J	**3.9**	168	1.5	0.49 J	39.8	2.1 J	17.8	9.0	---	24.5	<5.1 J	<1.4	<3.6	57.3	32.1	<0.14	<1.1
OMLP-3B-2	2	4/27/2005	<8.9 J	**3.5**	299	1.5	0.85 J	66.9	13.7 J	28.8	13.4	---	71.8	<5.2 J	<1.5	<3.7	134	56.5	0.091 J	<1.2
OMLP-5B-0.5	0.5	4/27/2005	<9.5 J	**3.5**	282	1.1 J	0.55 J	68.4	11.9 J	33.2	21.6	---	75.8	<5.5 J	<1.6	<4.0	103	64.5	<0.16	--
OMLP-5B-2	2	4/27/2005	<8.4 J	**2.7 J**	304	<0.88 J	0.44 J	51.4	8.7 J	40.8	11.1	---	44.0	<4.9 J	<1.4	<3.5	127	40.8	0.048 J	--
BG-1-0.5	0.5	4/27/2005	<7.6 J	**1.2 J**	118	<1.0 J	0.54 J	48.4	10.5 J	38.5	27.5	---	56.6	<4.4 J	<1.3	<3.2	90.1	64.4	<0.13	<0.5
BG-2-0.5	0.5	4/27/2005	<8.3 J	<1.4	37.8 J	<1.1 J	0.59 J	6.9	1.8 J	20.6	8.3	---	7.4 J	<4.8 J	<1.4	<3.5	40.7	8.6 J	<0.14	<0.1
BG-2-2	2	4/27/2005	<0.96 J	<1.4	14.4 J	<1.1 J	0.54 J	10.8	<7.0	18.4	7.5	---	11.9	<4.9 J	<1.4	<3.5	36.9	7.5 J	<0.14	0.2 J
BG-2-7.5	7.5	4/27/2005	<1.6 J	**0.97 J**	199	<1.3 J	0.70 J	14.4	<7.1	34.1	9.5	---	13.9	<5.0 J	<1.4	<3.6	50.0	21.9	0.057 J	<0.1
BG-3-0.5	0.5	4/27/2005	<7.7 J	**2.4 J**	429	1.5	0.93 J	48.7	11.2 J	45.6	23.0	---	42.7	<4.6 J	<1.3	<3.2	98.4	55.7	<0.13	<0.5
BG-4-0.5	0.5	4/27/2005	<7.8 J	**1.8 J**	194	<1.3	0.66 J	43.6	6.1 J	39.6	20.5	---	39.1	<4.6 J	<1.3	<3.3	94.3	49.7	<0.13	<1.1

TABLE 5

SUMMARY OF LABORATORY ANALYSIS RESULTS - SOIL

METALS

THE LANDING - MT. SHASTA BUSINESS PARK ASSESSMENT PROJECT

FORMER ROSEBURG LUMBER "OLD MILL"

MT. SHASTA, CALIFORNIA

SAMPLE ID	SAMPLE DEPTH (feet)	SAMPLE DATE	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury	Hexavalent Chromium
			(mg/kg)																	
E&E 1998 TSA																				
OMDT-5-5	5	5/1/1998	4.8 J	**5.7**	224	1.1 J	---	42.0 J	14.6 J	31.3	9.1	---	35.5 J	---	<0.32	---	87.4	40.5 J	<0.08	--
OMDT-10-5	5	5/1/1998	3.3 J	**7.3**	118	1.2 J	---	25.8 J	7.1 J	19.3	9.3	---	22.1 J	---	0.62 J	---	56.9	33.9 J	<0.07	--
OMTP-2-1	1	5/1/1998	1.4 J	<0.63	25.3 J	<0.21	---	18.9 J	9.4 J	61.8	8.0	---	42.2 J	---	<0.21	---	19.3	109 J	<0.06	--
OMWA-1-1	1	5/1/1998	3.6 J	**4.1**	273	0.57 J	---	29.7 J	6.8 J	39.0	33.1	---	36.9 J	---	<0.28	---	53.2	82.9 J	<0.07	--
OMLP-2-1	1	5/1/1998	4.5 J	**8.0**	412	1.0 J	---	74.5 J	14.7 J	31.9	11.6	---	84.8 J	---	<0.32	---	102	76.1 J	<0.07	--
OMLP-5-2	2	5/1/1998	1.6 J	**3.2**	113	0.38 J	---	80.5 J	10.4 J	22.6	9.9	---	82.6 J	---	<0.27	---	57.0	35.3 J	<0.07	--
Project Action Levels																				
RSL/*DTSC SL* (Commercial/Industrial)			580	*0.36*	220,000	*210*	*7.3*	*170,000*	350	47,000	*320*	5,800	*3,100*	5,800	*1,500*	12	*1,000*	350,000	*4.5*	6.3
Background Concentrations[(1)]																				
Minimum			0.15	0.6	133	0.25	0.05	23	2.7	9.1	12.4	0.1	9.0	0.015	0.10	0.17	39	88	0.10	--
Maximum			1.95	11	1,400	2.70	1.70	1,579	46.9	96.4	97.1	9.6	509	0.430	8.30	1.10	288	236	0.90	--
Mean			0.60	3.5	509	1.28	0.36	122	14.9	28.7	23.9	1.3	57	0.058	0.80	0.56	112	149	0.26	--

Notes:

mg/kg = milligrams per kilogram

< = Less than laboratory reporting limits

RSLs = U.S. Environmental Protection Agency Region 9, Regional Screening Levels, Updated November 2017

DTSC SL = California Department of Toxic Substances Control Modified Screening Level

(1) *Background Concentrations of Trace and Major Elements in California Soils* (Kearney Foundation of Soil Science, Division of Agricultural and Natural Resources, University of California, March 1996)

--- = Not analyzed

TABLE 6

SUMMARY OF LABORATORY ANALYSIS RESULTS - GROUNDWATER AND SURFACE WATER

METALS

THE LANDING - OLD MILL SECTION

MT. SHASTA, CALIFORNIA

Sample ID	Sample Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury
		(mg/l)																
OM-1	1/18/2018	<0.010	<0.010	0.85	<0.0030	<0.0030	0.0079	0.016	0.05	**0.034**	<0.005	0.0082	<0.010	<0.0030	<0.015	0.039	<0.025	<0.20
	3/17/2016	<0.010	<0.010	0.24	<0.0030	<0.0030	0.024	0.0072	0.03	**0.02**	<0.005	0.020	<0.010	<0.0030	<0.015	0.074	0.039	<0.20
	3/12/2015	**0.035**	**0.021**	**1.20**	**0.016**	<0.0030	**0.11**	0.029	0.16	**0.084**	<0.005	0.098	<0.010	<0.0030	<0.015	0.37	0.190	<0.20
OM-2	1/18/2018	0.014	**0.014**	0.18	**0.01**	**0.014**	0.02	0.018	0.013	**0.024**	0.016	0.018	<0.01	0.0089	**0.02**	0.019	<0.025	<0.20
	3/17/2016	<0.010	<0.010	0.16	<0.0030	<0.0030	0.0084	0.0034	<0.0090	<0.005	<0.005	0.0054	<0.010	<0.0030	<0.015	0.022	<0.025	<0.20
	3/12/2015	**0.013**	**0.011**	**1.20**	**0.0058**	<0.0030	**0.057**	0.023	0.06	**0.018**	<0.005	0.045	<0.010	<0.0030	<0.015	0.16	0.110	<0.20
OM-3	1/18/2018	<0.010	<0.010	0.36	<0.0030	<0.0030	0.0059	0.0059	0.019	**0.020**	<0.005	0.0066	<0.010	<0.0030	<0.015	0.033	0.130	<0.20
	3/17/2016	<0.010	<0.010	0.35	<0.0030	<0.0030	0.028	0.011	0.036	**0.022**	<0.005	0.022	<0.010	<0.0030	<0.015	0.058	0.016	<0.20
	3/12/2015	<0.010	<0.010	**1.60**	**0.0044**	<0.0030	0.037	0.02	0.11	**0.042**	<0.005	0.031	<0.010	<0.0030	<0.015	0.13	0.370	<0.20
OM-3A (duplicate)	3/17/2016	<0.010	<0.010	0.29	<0.0030	<0.0030	0.021	0.0096	0.028	**0.018**	<0.005	0.017	<0.010	<0.0030	<0.015	0.045	0.140	<0.20
	3/12/2015	**0.023**	**0.011**	**1.40**	**0.01**	<0.0030	**0.1**	0.035	0.13	**0.069**	<0.005	0.081	<0.010	<0.0030	<0.015	0.23	0.4	<0.20
OM-4	1/18/2018	<0.010	<0.010	0.11	<0.0030	<0.0030	<0.0030	0.0034	<0.0090	**0.015**	<0.005	<0.005	<0.010	<0.0030	<0.015	0.012	<0.025	<0.20
	3/17/2016	<0.010	<0.010	0.048	<0.0030	<0.0030	0.0036	<0.0030	<0.0090	<0.005	<0.005	<0.005	<0.010	<0.0030	<0.015	0.0057	<0.025	<0.20
	3/12/2015	**0.022**	<0.010	**1.10**	**0.013**	<0.0030	**0.095**	0.027	0.1	**0.032**	<0.005	0.075	<0.010	<0.0030	<0.015	0.18	0.19	<0.20
OM-5	1/18/2018	<0.010	<0.010	0.69	<0.0030	<0.0030	0.012	0.014	0.068	**0.025**	<0.005	0.013	<0.010	<0.0030	<0.015	0.064	0.093	<0.20
	3/17/2016	<0.010	<0.010	0.18	<0.0030	<0.0030	**0.058**	0.014	0.034	0.013	<0.005	0.049	<0.010	<0.0030	<0.015	0.057	0.05	<0.20
	3/12/2015	**0.1**	**0.024**	**3.30**	**0.045**	<0.0030	1.1	0.14	0.62	**0.19**	<0.005	**0.86**	<0.010	<0.0030	<0.015	0.97	0.71	**0.42**
Surface Water Samples																		
LP-11-SW	3/5/2015	<0.010	<0.010	0.0049	<0.0030	<0.0030	<0.0030	<0.0030	<0.0090	<0.005	<0.005	<0.005	<0.010	<0.0030	<0.015	0.0045	0.058	<0.20
LP-12-SW	3/5/2015	<0.010	<0.010	0.0052	<0.0030	<0.0030	<0.0030	<0.0030	<0.0090	<0.005	<0.005	<0.005	<0.010	<0.0030	<0.015	0.0036	<0.025	<0.20
LP-22-SW	3/5/2015	<0.010	<0.010	0.0051	<0.0030	<0.0030	<0.0030	<0.0030	<0.0090	<0.005	<0.005	<0.005	<0.010	<0.0030	<0.015	0.0037	<0.025	<0.20
LP-13-SW	3/5/2015	<0.010	<0.010	0.0053	<0.0030	<0.0030	<0.0030	<0.0030	<0.0090	<0.005	<0.005	<0.005	<0.010	<0.0030	<0.015	0.0033	<0.025	<0.20
PALs		0.006	0.010	1.0	0.004	0.005	0.05	N/A	1.3	0.015	N/A	0.1	0.05	N/A	0.002	N/A	N/A	0.002

Notes:

mg/l = milligrams per liter

< = Less than laboratory reporting limits

PALs = California Maximum Contaminant Levels for drinking water

TABLE 7
MONITORING WELL INFORMATION
THE LANDING – NEW MILL SECTION
MT. SHASTA, CALIFORNIA
CONTRACT NO. 15-T4055 AND WORK ORDER NO. 1-055-1.0-102246

MONITORING WELL ID	TOTAL DEPTH OF WELL (feet BTOC)	SCREEN LENGTH (feet)	DEPTH TO WATER (feet BTOC)	ELEVATION OF TOP OF CASING (feet MSL)	GROUNDWATER ELEVATION (feet MSL)
OM-1	16.85	7	5.10	3511.04	3505.94
OM-2	21.98	10	8.88	3509.07	3500.19
OM-3	25.6	15	9.62	3503.29	3493.67
OM-4	30.38	15	6.24	3490.79	3484.55
OM-5	32.83	15	20.31	3503.14	3482.83

Notes: BTOC = below top of casing
MSL = mean sea level

TABLE 8
GPS COORDINATES - SAMPLE LOCATIONS & WELLS
THE LANDING – OLD MILL SECTION
MT. SHASTA, CALIFORNIA
CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

BORING ID	DATE	LATITUDE	LONGITUDE
Westin 2016 PHASE II			
OM-SS-01	6/16/2016	41.3011891027	-122.3068513540
OM-SS-02	6/16/2016	41.3006587607	-122.3068153500
OM-SS-03	6/16/2016	41.3003338591	-122.3066001220
OM-SS-04	6/16/2016	41.3011492870	-122.3074158970
OM-SS-05	6/16/2016	41.3007550045	-122.3072755260
OM-SS-06	6/16/2016	41.3003438403	-122.3068900360
OM-SS-07	6/16/2016	41.3008341305	-122.3074975720
OM-SS-08	6/16/2016	41.3004266282	-122.3077415310
OM-SS-09	6/16/2016	41.3003604359	-122.3080095350
OM-SS-10	6/16/2016	41.3004956270	-122.3082257390
OM-SS-11	6/16/2016	41.3006212744	-122.3082536650
OM-SS-12	6/16/2016	41.3012019025	-122.3083700110
OM-SS-13	6/16/2016	41.3010128183	-122.3081547980
OM-SS-14	6/16/2016	41.3010532828	-122.3078553910
OM-SS-15	6/16/2016	41.3011974764	-122.3076337470
OM-SS-16	6/16/2016	---	---
OM-SS-17	6/16/2016	41.3009158553	-122.3082068670
Geocon 2015 TSI			
ODT-23	Mar-15	41.30142497	-122.307096
ODT-24	Mar-15	41.30131738	-122.3070232
ODT-25	Mar-15	41.30121715	-122.3069386
ODT-26	Mar-15	41.30128481	-122.306834
BR-14	Mar-15	41.30122169	-122.307462
BR-15	Mar-15	41.30116901	-122.3074372
BR-16	Mar-15	41.30116827	-122.3077228
BR-17	Mar-15	41.30106965	-122.307625
BR-18	Mar-15	41.30106558	-122.3077347
BR-19	Mar-15	41.3010256	-122.307707
BR-20	Mar-15	41.30104105	-122.3076639
RB-6	Mar-15	41.30104128	-122.3083362
RB-7	Mar-15	41.30103005	-122.3082585
RB-8	Mar-15	41.3010072	-122.3081079
RB-9	Mar-15	41.30092552	-122.3080103
RB-10	Mar-15	41.30071882	-122.307986
RB-11	Mar-15	41.30067795	-122.3080904
RB-12	Mar-15	41.30061774	-122.3082242
RB-13	Mar-15	41.30097635	-122.3083061
RB-14	Mar-15	41.30088161	-122.3082092
RB-15	Mar-15	41.30077346	-122.3081238
RB-16	Mar-15	41.30072297	-122.3083442

TABLE 8

GPS COORDINATES - SAMPLE LOCATIONS & WELLS

THE LANDING – OLD MILL SECTION

MT. SHASTA, CALIFORNIA

CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

BORING ID	DATE	LATITUDE	LONGITUDE
LP-11	Mar-15	41.30200251	-122.3074444
LP-12	Mar-15	41.30157396	-122.3079707
LP-13	Mar-15	41.30129601	-122.3084314
LP-14	Mar-15	41.30208593	-122.3075088
LP-15	Mar-15	41.30159488	-122.3080113
LP-16	Mar-15	41.30130944	-122.3084408
BK-1	Mar-15	41.30224687	-122.3080743
Monitoring Wells			
OM-1	2010	41.3022908	-122.3070683
OM-2	2010	41.30146302	-122.3069482
OM-3	2010	41.30112956	-122.3075923
OM-4	2010	41.3005948	-122.3082021
OM-5	2010	41.3011461	-122.308675
Geocon Phase II 2013/2014			
ODT-6	12/3/2013	41.301473546	-122.307047538
ODT-7	12/3/2013	41.301420040	-122.307003191
ODT-8	12/3/2013	41.301382063	-122.306890836
ODT-9	12/3/2013	41.301426820	-122.306797408
ODT-10	12/3/2013	41.301567947	-122.307097500
ODT-11	12/3/2013	41.301697137	-122.307087072
ODT-12	12/2/2013	41.301795971	-122.306976336
ODT-13	12/2/2013	41.301792028	-122.306901923
ODT-14	12/2/2013	41.301725465	-122.306983259
ODT-15	12/3/2013	41.301709238	-122.306839906
ODT-16	12/3/2013	41.301840411	-122.306614766
ODT-17	12/3/2013	41.301798286	-122.306540477
ODT-18	12/3/2013	41.301724342	-122.306572572
ODT-19	12/3/2013	41.301755929	-122.306647978
ODT-20	12/3/2013	41.301695604	-122.306694512
ODT-21	12/3/2013	41.301551272	-122.306846191
ODT-22	12/3/2013	41.301525334	-122.306788379
ODT-23	12/3/2013	41.301445427	-122.306645043
ODT-24	12/3/2013	41.301510800	-122.306589474
ODT-25	12/3/2013	41.301716909	-122.306769447
ODT-26	12/3/2013	41.301657910	-122.306819483
ODT-27	12/2/2013	41.301773486	-122.306858430
ODT-28	12/2/2013	41.301702680	-122.306920315
ODT-32	12/2/2013	41.301358809	-122.306918674

TABLE 8
GPS COORDINATES - SAMPLE LOCATIONS & WELLS
THE LANDING – OLD MILL SECTION
MT. SHASTA, CALIFORNIA
CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

BORING ID	DATE	LATITUDE	LONGITUDE
BR-1	12/2/2013	41.301183751	-122.307547962
BR-2	12/2/2013	41.301155431	-122.307537365
BR-3	12/2/2013	41.301182158	-122.307497137
BR-4	12/2/2013	41.301216061	-122.307532705
BR-5	12/2/2013	41.301188601	-122.307577292
BR-6	12/2/2013	41.301173553	-122.307624658
BR-7	12/2/2013	41.301140115	-122.307617043
BR-8	12/2/2013	41.301201999	-122.307622455
BR-9	12/2/2013	41.301105951	-122.307677237
BR-10	12/2/2013	41.301159617	-122.307667434
BR-11	12/2/2013	41.301112363	-122.307649226
BR-12	12/2/2013	41.301083634	-122.307681296
BR-13	12/2/2013	41.301129844	-122.307720763
LP-1	12/4/2013	41.301972286	-122.307736999
LP-2	12/4/2013	41.301999953	-122.307651922
LP-3	12/4/2013	41.302041494	-122.307799809
LP-4	12/4/2013	41.301904895	-122.307738041
LP-5	12/4/2013	41.301955210	-122.307828828
LP-6	12/4/2013	41.301656546	-122.307632439
LP-7	12/4/2013	41.301585152	-122.307620647
LP-8	12/4/2013	41.301644658	-122.307548287
LP-9	12/4/2013	41.301781628	-122.307616207
LP-10	12/4/2013	41.301677734	-122.307732811
RB-1	12/3/2013	41.300876277	-122.308200723
RB-2	12/3/2013	41.300774487	-122.308132401
RB-3	12/3/2013	41.300923988	-122.308056418
RB-4	12/3/2013	41.300975448	-122.308285900
RB-5	12/3/2013	41.300870616	-122.308357305
SS-1	12/3/2013	41.300275759	-122.308384950
URS 2007 TSI			
ODT-1	6/25/2007	41.301588899	-122.306657148
ODT-2	6/25/2007	41.301548031	-122.306832715
ODT-3	6/25/2007	41.301447600	-122.306884680
ODT-4	6/25/2007	41.301486076	-122.307382935
ODT-5	6/25/2007	41.301351049	-122.307352266
E&E 2005 TSI			
BG-1	4/21/2005	41.30078798	-122.30642998
BG-2*	4/21/2005	41.29725300	-122.30639400

TABLE 8

GPS COORDINATES - SAMPLE LOCATIONS & WELLS

THE LANDING – OLD MILL SECTION

MT. SHASTA, CALIFORNIA

CONTRACT NO. 17-T4360 AND WORK ORDER NO. 1-360-1.0-102246

BORING ID	DATE	LATITUDE	LONGITUDE
BG-3	4/21/2005	41.29558991	-122.30546305
OM-1*	4/21/2005	41.30164400	-122.30661600
OM-2	4/21/2005	41.30171986	-122.30672760
OM-3	4/21/2005	41.30171428	-122.30686215
OM-4	4/21/2005	41.30159493	-122.30669970
OM-5	4/21/2005	41.30164933	-122.30674272
OM-6	4/21/2005	41.30151233	-122.30664558
OM-7	4/21/2005	41.30151634	-122.30682575
OM-8	4/21/2005	41.30148870	-122.30693060
OM-9	4/21/2005	41.30140593	-122.30673150
OM-10	4/21/2005	41.30139714	-122.30692037
OM-11	4/21/2005	41.30119818	-122.30755773
OM-12	4/21/2005	41.30112571	-122.30770737
E&E 1998 TSI			
OMDT-1	May-98	41.301590	-122.306610
OMDT-2	May-98	41.301666	-122.306671
OMDT-5	May-98	41.301487	-122.306709
OMDT-10	May-98	41.301456	-122.306915
OMTP-1	May-98	41.301571	-122.306946
OMTP-2	May-98	41.301655	-122.306816
OMWA-1	May-98	41.301182	-122.307632
OMLP-1	May-98	41.301987	-122.307724
OMLP-2	May-98	41.301796	-122.308098
OMLP-5	May-98	41.301643	-122.307625
OMRB-1	May-98	41.301010	-122.308281
OMRB-1	May-98	41.300949	-122.308357
OMRB-1	May-98	41.300880	-122.308205
OMRB-1	May-98	41.300964	-122.308113
OMRB-1	May-98	41.300961	-122.30822
OMFB-1	May-98	41.301052	-122.307785

Notes:

* Latitude and longitude is an estimate based on consultants placement of location on associated figure and Google Earth

TABLE 9

REMEDIATION COST ESTIMATE SUMMARY – ALTERNATIVE NO. 2

EXCAVATION AND OFFSITE DISPOSAL OF IMPACTED SOIL FOR UNRESTRICTED LAND USE

THE LANDING - OLD MILL SECTION

MT SHASTA, CALIFORNIA

Site Work		**Unit**	**Unit Cost**	**Estimated Cost**
Stormwater BMPs	1	Lump Sum	$6,000	$6,000
Clearing, Grubbing, and Light Road Improvements	1	Lump Sum	$16,000	$16,000
Excavation and Stockpiling of 8,000 cy of Impacted Soil	1	Lump Sum	$35,000	$35,000
Offsite Transport and Disposal, Class II Designated Material	11,063	Tons	$127	$1,405,001
Offsite Transport and Disposal, Class I Hazardous Material	75	Tons	$298	$22,350
Confirmation Sampling	150	Each	$125	$18,750
Loading of Stockpiled Soil for Disposal	1	Lump Sum	$15,000	$15,000
Import and Placement of Clean Fill	8,000	Cubic Yard	$35	$280,000
Subtotal of Direct Costs				**$1,798,101**
Management and Engineering (Sampling and Analysis Plan, Transportation Plan, etc.)	1	Lump Sum	$20,000	$20,000
Site Control and Monitoring	1	Lump Sum	$10,000	$10,000
Removal Action Completion Report	1	Lump Sum	$10,000	$10,000
Subtotal of Indirect Costs				**$40,000**
Contingency		**% Direct Costs**	**10%**	**$179,810**
Total Estimated Capitol Cost				**$2,017,911**

	Quantity	**Unit**	**Unit Cost**	**Estimated Cost**
5-year reviews and O&M	0	Lump Sum	$5,000	$0
Cost for DTSC Oversight	0	Lump Sum	$3,500	$0
Estimated 30-Year O&M Cost				**$0**

TABLE 10

REMEDIATION COST ESTIMATE SUMMARY – ALTERNATIVE NO. 3

EXCAVATION AND OFFSITE DISPOSAL OF IMPACTED SOIL FOR COMMERCIAL/INDUSTRIAL LAND USE

THE LANDING - OLD MILL SECTION

MT SHASTA, CALIFORNIA

Site Work		**Unit**	**Unit Cost**	**Estimated Cost**
Stormwater BMPs	1	Lump Sum	$2,000	$2,000
Clearing, Grubbing, and Light Road Improvements	1	Lump Sum	$8,000	$8,000
Excavation and Stockpiling of 320 cy of Impacted Soil	1	Lump Sum	$10,000	$10,000
Offsite Transport and Disposal, Class II Designated Material	446	Tons	$127	$56,642
Offsite Transport and Disposal, Class I Hazardous Material	75	Tons	$298	$22,350
Loading of Stockpiled Soil for Disposal	1	Lump Sum	$5,000	$5,000
Confirmation Sampling	30	Each	$125	$3,750
Import and Placement of Clean Fill	375	Cubic Yard	$35	$13,125
Subtotal of Direct Costs				**$120,867**
Management and Engineering (Sampling and Analysis Plan, Transportation Plan, etc.)	1	Lump Sum	$20,000	$20,000
Site Control and Monitoring	1	Lump Sum	$5,000	$5,000
Removal Action Completion Report	1	Lump Sum	$10,000	$10,000
Subtotal of Indirect Costs				**$35,000**
Contingency		**% Direct Costs**	**10%**	**$12,087**
Total Estimated Capitol Cost				**$167,954**

	Quantity	**Unit**	**Unit Cost**	**Estimated Cost**
5-year reviews and O&M	0	Lump Sum	$5,000	$0
Cost for DTSC Oversight	0	Lump Sum	$3,500	$0
Estimated 30-Year O&M Cost				**$0**

TABLE 11

REMEDIATION COST ESTIMATE SUMMARY – ALTERNATIVE NO. 4

EXCAVATION AND OFFSITE DISPOSAL OF PCP & PETROLEUM HYDROCARBON IMPACTED SOIL AND CAPPING OF DIOXIN AND REMAINING PETROLEUM HYDROCARBON IMPACTED SOIL

THE LANDING - OLD MILL SECTION

MT SHASTA, CALIFORNIA

Site Work		Unit	Unit Cost	Estimated Cost
Stormwater BMPs	1	Lump Sum	$2,000	$2,000
Clearing, Grubbing, and Light Road Improvements	1	Lump Sum	$8,000	$8,000
Excavation and Stockpiling of 320 cy of Impacted Soil	1	Lump Sum	$10,000	$10,000
On Site Transport and Placement	1	Lump Sum	$5,000	$5,000
Confirmation Sampling	20	Each	$125	$2,500
Import and Placement of Clean Fill (1 ft cap)	150	Cubic Yard	$35	$5,250
Subtotal of Direct Costs				**$32,750**
Management and Engineering (Sampling and Analysis Plan, Transportation Plan, etc.)	1	Lump Sum	$20,000	$20,000
Site Control and Monitoring	1	Lump Sum	$5,000	$5,000
Removal Action Completion Report	1	Lump Sum	$10,000	$10,000
Subtotal of Indirect Costs				**$35,000**
Contingency		**% Direct Costs**	**10%**	**$3,275**
Total Estimated Capitol Cost				**$71,025**
	Quantity	**Unit**	**Unit Cost**	**Estimated Cost**
5-year reviews and O&M	6	Lump Sum	$5,000	$30,000
Cost for DTSC Oversight	6	Lump Sum	$3,500	$21,000
Estimated 30-Year O&M Cost				**$51,000**

APPENDIX A

ADVANCED TECHNOLOGY
LABORATORIES

January 29, 2018

Nicole Hastings-Bethel
Geocon Consultants, Inc.
3160 Gold Valley Drive, Suite 800
Rancho Cordova, CA 95742
Tel: (916) 852-9118
Fax:(916) 852-9132

ELAP No.: 1838
CSDLAC No.: 10196
ORELAP No.: CA300003

Re: ATL Work Order Number : 1800302
Client Reference : The Landing-Oil Mill, S9850-03-13B, S9850-03-13B

Enclosed are the results for sample(s) received on January 20, 2018 by Advanced Technology Laboratories. The sample(s) are tested for the parameters as indicated on the enclosed chain of custody in accordance with applicable laboratory certifications. The laboratory results contained in this report specifically pertains to the sample(s) submitted.

Thank you for the opportunity to serve the needs of your company. If you have any questions, please feel free to contact me or your Project Manager.

Sincerely,

Eddie Rodriguez
Laboratory Director

Certificate of Analysis

Geocon Consultants, Inc.		Project Number :	The Landing-Oil Mill, S9850-03-13B, S9ε
3160 Gold Valley Drive, Suite 800		Report To :	Nicole Hastings-Bethel
Rancho Cordova , CA 95742		Reported :	01/29/2018

SUMMARY OF SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
OM-2	1800302-01	Groundwater	1/18/18 11:50	1/20/18 9:39
OM-4	1800302-02	Groundwater	1/18/18 12:20	1/20/18 9:39
OM-3	1800302-03	Groundwater	1/18/18 12:35	1/20/18 9:39
OM-1	1800302-04	Groundwater	1/18/18 12:55	1/20/18 9:39
OM-5	1800302-05	Groundwater	1/18/18 13:15	1/20/18 9:39

Certificate of Analysis

Geocon Consultants, Inc.		Project Number :	The Landing-Oil Mill, S9850-03-13B, S9(
3160 Gold Valley Drive, Suite 800		Report To :	Nicole Hastings-Bethel
Rancho Cordova , CA 95742		Reported :	01/29/2018

Client Sample ID OM-2
Lab ID: 1800302-01

Title 22 Metals by ICP-AES EPA 6010B — **Analyst: GO**

Analyte	Result (mg/L)	PQL (mg/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
Antimony	**0.014**	0.010	1	B8A0636	01/24/2018	01/25/18 09:27	
Arsenic	**0.014**	0.010	1	B8A0636	01/24/2018	01/25/18 09:27	
Barium	**0.18**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:27	
Beryllium	**0.010**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:27	
Cadmium	**0.014**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:27	
Chromium	**0.020**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:27	
Cobalt	**0.018**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:27	
Copper	**0.013**	0.0090	1	B8A0636	01/24/2018	01/25/18 09:27	
Lead	**0.024**	0.0050	1	B8A0636	01/24/2018	01/25/18 09:27	
Molybdenum	**0.016**	0.0050	1	B8A0636	01/24/2018	01/25/18 09:27	
Nickel	**0.018**	0.0050	1	B8A0636	01/24/2018	01/25/18 09:27	
Selenium	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:27	
Silver	**0.0089**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:27	
Thallium	**0.020**	0.015	1	B8A0636	01/24/2018	01/25/18 09:27	
Vanadium	**0.019**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:27	
Zinc	ND	0.025	1	B8A0636	01/24/2018	01/25/18 09:27	

Mercury by AA (Cold Vapor) EPA 7470A — **Analyst: KEK**

Analyte	Result (ug/L)	PQL (ug/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
Mercury	ND	0.20	1	B8A0639	01/24/2018	01/24/18 15:06	

Diesel Range Organics by EPA 8015B — **Analyst: TKT**

Analyte	Result (mg/L)	PQL (mg/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
DRO	ND	0.05	1	B8A0658	01/24/2018	01/25/18 00:12	
ORO	ND	0.05	1	B8A0658	01/24/2018	01/25/18 00:12	
Surrogate: p-Terphenyl	*68.6 %*	*20 - 150*		B8A0658	01/24/2018	*01/25/18 00:12*	

Certificate of Analysis

Geocon Consultants, Inc.		Project Number :	The Landing-Oil Mill, S9850-03-13B, S9!
3160 Gold Valley Drive, Suite 800		Report To :	Nicole Hastings-Bethel
Rancho Cordova , CA 95742		Reported :	01/29/2018

Client Sample ID OM-4
Lab ID: 1800302-02

Title 22 Metals by ICP-AES EPA 6010B

Analyst: GO

Analyte	Result (mg/L)	PQL (mg/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
Antimony	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:28	
Arsenic	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:28	
Barium	**0.11**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:28	
Beryllium	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:28	
Cadmium	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:28	
Chromium	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:28	
Cobalt	**0.0034**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:28	
Copper	ND	0.0090	1	B8A0636	01/24/2018	01/25/18 09:28	
Lead	**0.015**	0.0050	1	B8A0636	01/24/2018	01/25/18 09:28	
Molybdenum	ND	0.0050	1	B8A0636	01/24/2018	01/25/18 09:28	
Nickel	ND	0.0050	1	B8A0636	01/24/2018	01/25/18 09:28	
Selenium	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:28	
Silver	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:28	
Thallium	ND	0.015	1	B8A0636	01/24/2018	01/25/18 09:28	
Vanadium	**0.012**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:28	
Zinc	ND	0.025	1	B8A0636	01/24/2018	01/25/18 09:28	

Mercury by AA (Cold Vapor) EPA 7470A

Analyst: KEK

Analyte	Result (ug/L)	PQL (ug/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
Mercury	ND	0.20	1	B8A0639	01/24/2018	01/24/18 15:07	

Diesel Range Organics by EPA 8015B

Analyst: TKT

Analyte	Result (mg/L)	PQL (mg/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
DRO	**0.07**	0.05	1	B8A0658	01/24/2018	01/25/18 00:29	
ORO	**0.08**	0.05	1	B8A0658	01/24/2018	01/25/18 00:29	
Surrogate: p-Terphenyl	*112 %*	*20 - 150*		B8A0658	01/24/2018	*01/25/18 00:29*	

Certificate of Analysis

Geocon Consultants, Inc.
3160 Gold Valley Drive, Suite 800
Rancho Cordova , CA 95742

Project Number : The Landing-Oil Mill, S9850-03-13B, S98

Report To : Nicole Hastings-Bethel

Reported : 01/29/2018

Client Sample ID OM-3
Lab ID: 1800302-03

Title 22 Metals by ICP-AES EPA 6010B

Analyst: GO

Analyte	Result (mg/L)	PQL (mg/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
Antimony	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:29	
Arsenic	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:29	
Barium	**0.36**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:29	
Beryllium	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:29	
Cadmium	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:29	
Chromium	**0.0059**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:29	
Cobalt	**0.0059**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:29	
Copper	**0.019**	0.0090	1	B8A0636	01/24/2018	01/25/18 09:29	
Lead	**0.020**	0.0050	1	B8A0636	01/24/2018	01/25/18 09:29	
Molybdenum	ND	0.0050	1	B8A0636	01/24/2018	01/25/18 09:29	
Nickel	**0.0066**	0.0050	1	B8A0636	01/24/2018	01/25/18 09:29	
Selenium	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:29	
Silver	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:29	
Thallium	ND	0.015	1	B8A0636	01/24/2018	01/25/18 09:29	
Vanadium	**0.033**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:29	
Zinc	**0.13**	0.025	1	B8A0636	01/24/2018	01/25/18 09:29	

Mercury by AA (Cold Vapor) EPA 7470A

Analyst: KEK

Analyte	Result (ug/L)	PQL (ug/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
Mercury	ND	0.20	1	B8A0639	01/24/2018	01/24/18 15:13	

Diesel Range Organics by EPA 8015B

Analyst: TKT

Analyte	Result (mg/L)	PQL (mg/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
DRO	ND	0.05	1	B8A0658	01/24/2018	01/25/18 00:46	
ORO	ND	0.05	1	B8A0658	01/24/2018	01/25/18 00:46	
Surrogate: p-Terphenyl	*96.2 %*	*20 - 150*		B8A0658	01/24/2018	*01/25/18 00:46*	

Certificate of Analysis

Geocon Consultants, Inc.	Project Number :	The Landing-Oil Mill, S9850-03-13B, S9!
3160 Gold Valley Drive, Suite 800	Report To :	Nicole Hastings-Bethel
Rancho Cordova , CA 95742	Reported :	01/29/2018

Client Sample ID OM-1
Lab ID: 1800302-04

Title 22 Metals by ICP-AES EPA 6010B

Analyst: GO

Analyte	Result (mg/L)	PQL (mg/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
Antimony	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:30	
Arsenic	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:30	
Barium	**0.85**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:30	
Beryllium	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:30	
Cadmium	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:30	
Chromium	**0.0079**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:30	
Cobalt	**0.016**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:30	
Copper	**0.049**	0.0090	1	B8A0636	01/24/2018	01/25/18 09:30	
Lead	**0.034**	0.0050	1	B8A0636	01/24/2018	01/25/18 09:30	
Molybdenum	ND	0.0050	1	B8A0636	01/24/2018	01/25/18 09:30	
Nickel	**0.0082**	0.0050	1	B8A0636	01/24/2018	01/25/18 09:30	
Selenium	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:30	
Silver	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:30	
Thallium	ND	0.015	1	B8A0636	01/24/2018	01/25/18 09:30	
Vanadium	**0.039**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:30	
Zinc	ND	0.025	1	B8A0636	01/24/2018	01/25/18 09:30	

Mercury by AA (Cold Vapor) EPA 7470A

Analyst: KEK

Analyte	Result (ug/L)	PQL (ug/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
Mercury	ND	0.20	1	B8A0639	01/24/2018	01/24/18 15:15	

Diesel Range Organics by EPA 8015B

Analyst: TKT

Analyte	Result (mg/L)	PQL (mg/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
DRO	ND	0.05	1	B8A0658	01/24/2018	01/25/18 01:04	
ORO	ND	0.05	1	B8A0658	01/24/2018	01/25/18 01:04	
Surrogate: p-Terphenyl	*100 %*	*20 - 150*		B8A0658	01/24/2018	*01/25/18 01:04*	

Certificate of Analysis

Geocon Consultants, Inc.	Project Number :	The Landing-Oil Mill, S9850-03-13B, S9!
3160 Gold Valley Drive, Suite 800	Report To :	Nicole Hastings-Bethel
Rancho Cordova , CA 95742	Reported :	01/29/2018

Client Sample ID OM-5
Lab ID: 1800302-05

Title 22 Metals by ICP-AES EPA 6010B

Analyst: GO

Analyte	Result (mg/L)	PQL (mg/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
Antimony	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:34	
Arsenic	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:34	
Barium	**0.69**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:34	
Beryllium	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:34	
Cadmium	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:34	
Chromium	**0.012**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:34	
Cobalt	**0.014**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:34	
Copper	**0.068**	0.0090	1	B8A0636	01/24/2018	01/25/18 09:34	
Lead	**0.025**	0.0050	1	B8A0636	01/24/2018	01/25/18 09:34	
Molybdenum	ND	0.0050	1	B8A0636	01/24/2018	01/25/18 09:34	
Nickel	**0.013**	0.0050	1	B8A0636	01/24/2018	01/25/18 09:34	
Selenium	ND	0.010	1	B8A0636	01/24/2018	01/25/18 09:34	
Silver	ND	0.0030	1	B8A0636	01/24/2018	01/25/18 09:34	
Thallium	ND	0.015	1	B8A0636	01/24/2018	01/25/18 09:34	
Vanadium	**0.064**	0.0030	1	B8A0636	01/24/2018	01/25/18 09:34	
Zinc	**0.093**	0.025	1	B8A0636	01/24/2018	01/25/18 09:34	

Mercury by AA (Cold Vapor) EPA 7470A

Analyst: KEK

Analyte	Result (ug/L)	PQL (ug/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
Mercury	ND	0.20	1	B8A0639	01/24/2018	01/24/18 15:17	

Diesel Range Organics by EPA 8015B

Analyst: TKT

Analyte	Result (mg/L)	PQL (mg/L)	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
DRO	ND	0.05	1	B8A0658	01/24/2018	01/25/18 01:21	
ORO	ND	0.05	1	B8A0658	01/24/2018	01/25/18 01:21	
Surrogate: p-Terphenyl	*97.3 %*	*20 - 150*		B8A0658	01/24/2018	*01/25/18 01:21*	

QUALITY CONTROL SECTION

Title 22 Metals by ICP-AES EPA 6010B - Quality Control

Analyte	Result (mg/L)	PQL (mg/L)	MDL (mg/L)	Spike Level	Source Result	% Rec	% Rec Limits	RPD	RPD Limit	Notes
Batch B8A0636 - EPA 3010A_W										
Blank (B8A0636-BLK1)					Prepared: 1/24/2018 Analyzed: 1/25/2018					
Antimony	ND	0.010	0.0088							
Arsenic	ND	0.010	0.0078							
Barium	ND	0.0030	0.0026							
Beryllium	ND	0.0030	0.0016							
Cadmium	ND	0.0030	0.0024							
Chromium	ND	0.0030	0.0020							
Cobalt	ND	0.0030	0.0016							
Copper	ND	0.0090	0.0038							
Lead	ND	0.0050	0.0047							
Molybdenum	ND	0.0050	0.0030							
Nickel	ND	0.0050	0.0046							
Selenium	ND	0.010	0.0093							
Silver	ND	0.0030	0.0024							
Thallium	ND	0.015	0.0085							
Vanadium	ND	0.0030	0.0022							
Zinc	ND	0.025	0.0057							
LCS (B8A0636-BS1)					Prepared: 1/24/2018 Analyzed: 1/25/2018					
Antimony	0.954012	0.010	0.0088	1.00000		95.4	80 - 120			
Arsenic	0.926054	0.010	0.0078	1.00000		92.6	80 - 120			
Barium	0.969026	0.0030	0.0026	1.00000		96.9	80 - 120			
Beryllium	0.948156	0.0030	0.0016	1.00000		94.8	80 - 120			
Cadmium	0.917760	0.0030	0.0024	1.00000		91.8	80 - 120			
Chromium	0.950164	0.0030	0.0020	1.00000		95.0	80 - 120			
Cobalt	0.962684	0.0030	0.0016	1.00000		96.3	80 - 120			
Copper	0.984322	0.0090	0.0038	1.00000		98.4	80 - 120			
Lead	1.06477	0.0050	0.0047	1.00000		106	80 - 120			
Molybdenum	0.934826	0.0050	0.0030	1.00000		93.5	80 - 120			
Nickel	0.943812	0.0050	0.0046	1.00000		94.4	80 - 120			
Selenium	0.912139	0.010	0.0093	1.00000		91.2	80 - 120			
Silver	0.942465	0.0030	0.0024	1.00000		94.2	80 - 120			
Thallium	0.970325	0.015	0.0085	1.00000		97.0	80 - 120			
Vanadium	0.961358	0.0030	0.0022	1.00000		96.1	80 - 120			
Zinc	0.913070	0.025	0.0057	1.00000		91.3	80 - 120			
Duplicate (B8A0636-DUP1)			**Source: 1800274-04**		Prepared: 1/24/2018 Analyzed: 1/25/2018					
Antimony	ND	0.010	0.0088		ND			NR	20	
Arsenic	ND	0.010	0.0078		9.9032E-3			NR	20	
Barium	ND	0.0030	0.0026		0.009756			NR	20	
Beryllium	ND	0.0030	0.0016		0.004820			NR	20	

Certificate of Analysis

Geocon Consultants, Inc.	Project Number :	The Landing-Oil Mill, S9850-03-13B, S9!
3160 Gold Valley Drive, Suite 800	Report To :	Nicole Hastings-Bethel
Rancho Cordova , CA 95742	Reported :	01/29/2018

Title 22 Metals by ICP-AES EPA 6010B - Quality Control (cont'd)

Analyte	Result (mg/L)	PQL (mg/L)	MDL (mg/L)	Spike Level	Source Result	% Rec	% Rec Limits	RPD	RPD Limit	Notes
Batch B8A0636 - EPA 3010A_W (continued)										
Duplicate (B8A0636-DUP1) - Continued			**Source: 1800274-04**		Prepared: 1/24/2018 Analyzed: 1/25/2018					
Cadmium	ND	0.0030	0.0024		0.007069			NR	20	
Chromium	ND	0.0030	0.0020		0.009860			NR	20	
Cobalt	ND	0.0030	0.0016		0.007970			NR	20	
Copper	ND	0.0090	0.0038		5.0995E-3			NR	20	
Lead	0.077670	0.0050	0.0047		0.203569			89.5	20	R
Molybdenum	ND	0.0050	0.0030		0.007814			NR	20	
Nickel	ND	0.0050	0.0046		0.009347			NR	20	
Selenium	ND	0.010	0.0093		ND			NR	20	
Silver	ND	0.0030	0.0024		0.004757			NR	20	
Thallium	ND	0.015	0.0085		0.010837			NR	20	
Vanadium	ND	0.0030	0.0022		5.5015E-3			NR	20	
Zinc	ND	0.025	0.0057		0.018776			NR	20	
Matrix Spike (B8A0636-MS1)			**Source: 1800274-04**		Prepared: 1/24/2018 Analyzed: 1/25/2018					
Antimony	2.27970	0.010	0.0088	2.50000	ND	91.2	60 - 130			
Arsenic	2.24576	0.010	0.0078	2.50000	9.9032E-3	89.4	69 - 123			
Barium	2.34921	0.0030	0.0026	2.50000	0.009756	93.6	67 - 129			
Beryllium	2.41070	0.0030	0.0016	2.50000	0.004820	96.2	74 - 120			
Cadmium	2.23477	0.0030	0.0024	2.50000	0.007069	89.1	69 - 116			
Chromium	2.31460	0.0030	0.0020	2.50000	0.009860	92.2	74 - 120			
Cobalt	2.32019	0.0030	0.0016	2.50000	0.007970	92.5	70 - 116			
Copper	2.33274	0.0090	0.0038	2.50000	5.0995E-3	93.1	76 - 123			
Lead	2.27584	0.0050	0.0047	2.50000	0.203569	82.9	69 - 117			
Molybdenum	2.32246	0.0050	0.0030	2.50000	0.007814	92.6	68 - 120			
Nickel	2.27974	0.0050	0.0046	2.50000	0.009347	90.8	70 - 115			
Selenium	2.21817	0.010	0.0093	2.50000	ND	88.7	66 - 120			
Silver	2.52150	0.0030	0.0024	2.50000	0.004757	101	73 - 123			
Thallium	2.34200	0.015	0.0085	2.50000	0.010837	93.2	57 - 124			
Vanadium	2.33411	0.0030	0.0022	2.50000	5.5015E-3	93.1	72 - 123			
Zinc	2.19631	0.025	0.0057	2.50000	0.018776	87.1	73 - 111			
Matrix Spike Dup (B8A0636-MSD1)			**Source: 1800274-04**		Prepared: 1/24/2018 Analyzed: 1/25/2018					
Antimony	2.35344	0.010	0.0088	2.50000	ND	94.1	60 - 130	3.18	20	
Arsenic	2.32436	0.010	0.0078	2.50000	9.9032E-3	92.6	69 - 123	3.44	20	
Barium	2.53371	0.0030	0.0026	2.50000	0.009756	101	67 - 129	7.56	20	
Beryllium	2.46877	0.0030	0.0016	2.50000	0.004820	98.6	74 - 120	2.38	20	
Cadmium	2.41205	0.0030	0.0024	2.50000	0.007069	96.2	69 - 116	7.63	20	
Chromium	2.50314	0.0030	0.0020	2.50000	0.009860	99.7	74 - 120	7.83	20	
Cobalt	2.49503	0.0030	0.0016	2.50000	0.007970	99.5	70 - 116	7.26	20	
Copper	2.59702	0.0090	0.0038	2.50000	5.0995E-3	104	76 - 123	10.7	20	
Lead	2.34363	0.0050	0.0047	2.50000	0.203569	85.6	69 - 117	2.93	20	
Molybdenum	2.51246	0.0050	0.0030	2.50000	0.007814	100	68 - 120	7.86	20	

Certificate of Analysis

Geocon Consultants, Inc.	Project Number :	The Landing-Oil Mill, S9850-03-13B, S98
3160 Gold Valley Drive, Suite 800	Report To :	Nicole Hastings-Bethel
Rancho Cordova , CA 95742	Reported :	01/29/2018

Title 22 Metals by ICP-AES EPA 6010B - Quality Control (cont'd)

Batch B8A0636 - EPA 3010A_W (continued)

Matrix Spike Dup (B8A0636-MSD1) - Continued **Source: 1800274-04** Prepared: 1/24/2018 Analyzed: 1/25/2018

Analyte	Result (mg/L)	PQL (mg/L)	MDL (mg/L)	Spike Level	Source Result	% Rec	% Rec Limits	RPD	RPD Limit	Notes
Nickel	2.45931	0.0050	0.0046	2.50000	0.009347	98.0	70 - 115	7.58	20	
Selenium	2.28563	0.010	0.0093	2.50000	ND	91.4	66 - 120	3.00	20	
Silver	2.76697	0.0030	0.0024	2.50000	0.004757	110	73 - 123	9.28	20	
Thallium	2.43239	0.015	0.0085	2.50000	0.010837	96.9	57 - 124	3.79	20	
Vanadium	2.52253	0.0030	0.0022	2.50000	5.5015E-3	101	72 - 123	7.76	20	
Zinc	2.36385	0.025	0.0057	2.50000	0.018776	93.8	73 - 111	7.35	20	

Certificate of Analysis

Geocon Consultants, Inc.	Project Number :	The Landing-Oil Mill, S9850-03-13B, S9ℓ
3160 Gold Valley Drive, Suite 800	Report To :	Nicole Hastings-Bethel
Rancho Cordova , CA 95742	Reported :	01/29/2018

Mercury by AA (Cold Vapor) EPA 7470A - Quality Control

Analyte	Result (ug/L)	PQL (ug/L)	MDL (ug/L)	Spike Level	Source Result	% Rec	% Rec Limits	RPD	RPD Limit	Notes
Batch B8A0639 - EPA 245.1/7470_W										
Blank (B8A0639-BLK1)					Prepared: 1/24/2018 Analyzed: 1/24/2018					
Mercury	ND	0.20	0.05							
LCS (B8A0639-BS1)					Prepared: 1/24/2018 Analyzed: 1/24/2018					
Mercury	9.82754	0.20	0.05	10.0000		98.3	80 - 120			
Duplicate (B8A0639-DUP1)			**Source: 1800298-27**		Prepared: 1/24/2018 Analyzed: 1/24/2018					
Mercury	ND	0.20	0.05		ND			NR	20	
Matrix Spike (B8A0639-MS1)			**Source: 1800298-27**		Prepared: 1/24/2018 Analyzed: 1/24/2018					
Mercury	9.60124	0.20	0.05	10.0000	ND	96.0	70 - 130			
Matrix Spike Dup (B8A0639-MSD1)			**Source: 1800298-27**		Prepared: 1/24/2018 Analyzed: 1/24/2018					
Mercury	9.71659	0.20	0.05	10.0000	ND	97.2	70 - 130	1.19	20	
Post Spike (B8A0639-PS1)			**Source: 1800298-27**		Prepared: 1/24/2018 Analyzed: 1/24/2018					
Mercury	4.80729			5.00000	-4.1949E-3	96.1	85 - 115			

Certificate of Analysis

Geocon Consultants, Inc.	Project Number :	The Landing-Oil Mill, S9850-03-13B, S9!
3160 Gold Valley Drive, Suite 800	Report To :	Nicole Hastings-Bethel
Rancho Cordova , CA 95742	Reported :	01/29/2018

Diesel Range Organics by EPA 8015B - Quality Control

Analyte	Result (mg/L)	PQL (mg/L)	MDL (mg/L)	Spike Level	Source Result	% Rec	% Rec Limits	RPD	RPD Limit	Notes
Batch B8A0658 - GCSEMI_DRO_W										
Blank (B8A0658-BLK1)					Prepared: 1/24/2018 Analyzed: 1/24/2018					
DRO	ND	0.05	0.05							
ORO	ND	0.05	0.05							
Surrogate: p-Terphenyl	*0.07987*			*8.00000E-2*		*99.8*	*20 - 150*			
LCS (B8A0658-BS1)					Prepared: 1/24/2018 Analyzed: 1/24/2018					
DRO	1.07020	0.05	0.05	1.00000		107	42 - 142			
Surrogate: p-Terphenyl	*0.08300*			*8.00000E-2*		*104*	*20 - 150*			
Matrix Spike (B8A0658-MS1)		**Source: 1800318-01**			Prepared: 1/24/2018 Analyzed: 1/24/2018					
DRO	0.908540	0.05	0.05	1.00000	ND	90.9	42 - 142			
Surrogate: p-Terphenyl	*0.07439*			*8.00000E-2*		*93.0*	*20 - 150*			
Matrix Spike Dup (B8A0658-MSD1)		**Source: 1800318-01**			Prepared: 1/24/2018 Analyzed: 1/24/2018					
DRO	0.990040	0.05	0.05	1.00000	ND	99.0	42 - 142	8.59	20	
Surrogate: p-Terphenyl	*0.09150*			*8.00000E-2*		*114*	*20 - 150*			

Certificate of Analysis

Geocon Consultants, Inc.		Project Number :	The Landing-Oil Mill, S9850-03-13B, S9
3160 Gold Valley Drive, Suite 800		Report To :	Nicole Hastings-Bethel
Rancho Cordova , CA 95742		Reported :	01/29/2018

Notes and Definitions

R	RPD value outside acceptance criteria. Calculation is based on raw values.
ND	Analyte is not detected at or above the Practical Quantitation Limit (PQL). When client requests quantitation against MDL, analyte is not detected at or above the Method Detection Limit (MDL)
PQL	Practical Quantitation Limit
MDL	Method Detection Limit
NR	Not Reported
RPD	Relative Percent Difference
CA2	CA-ELAP (CDPH)
OR1	OR-NELAP (OSPHL)

Notes:
(1) The reported MDL and PQL are based on prep ratio variation and analytical dilution.
(2) The suffix [2C] of specific analytes signifies that the reported result is taken from the instrument's second column.
(3) Results are wet unless otherwise specified.

ADVANCED TECHNOLOGY LABORATORIES
3275 Walnut Ave., Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

CHAIN OF CUSTODY RECORD

Page 1 of 1

Instruction: Complete all shaded areas.

For Laboratory Use Only — ATLCOC Ver: 20130715

Method of Transport: ☐ Client ☐ FedEx ☐ GSO ☐ Other: ____ ☐ ATL ☑ OnTrac

Sample Conditions Upon Receipt

Condition	Y	N	Condition	Y	N
1. CHILLED	☑	☐	5. # OF SAMPLES MATCH COC	☑	☐
2. HEADSPACE (VOA)	☐	☐	6. PRESERVED	☑	☐
3. CONTAINER INTACT	☑	☐	7. COOLER TEMP, deg C: 2.0		
4. SEALED	☐	☑			

CUSTOMER

Company: Geocon Consultant Inc.
Address: 3160 Gold Valley Dr. #800
City: Rancho Cordova State: CA Zip: 95742
Tel: 916-852-9118 Fax: 916-852-9132

SEND REPORT TO:
Attn: Nicole Hasting Email: hasting@geoconinc.com
Company:
Address:
City: State: Zip:

SEND INVOICE TO: ☐ same as SEND REPORT TO
Attn: Email:
Company:
Address:
City: State: Zip:

PROJECT SAMPLES

Project Name: The Landing - Old Mill
Project No.: S9850-03-13B
Sampler: J. Esquivel
Quote No:
PO #:
Special Instructions/Comments:

Encircle or Write Requested Analysis: 8260 / 624 (Volatiles); 8015(GRO); 8015(DRO) + ORO; 8270(Semi-volatiles); 8081(Organochlorine Pesticides); 8082(PCBs); 6010 / 7000(Title 22 Metals); TO-15

Encircle Sample Matrix: SOIL / SEDIMENT / SLUDGE; SOLIDS / WIPE / FILTER; WATER - DRINKING / GROUND; WATER - STORM / WASTE; AQUEOUS / LAYERED - OIL

Container — Type: 1=Tube; 2=VOA; 3=Liter; 4=Pint; 5=Jar; 6=Tedlar; 7=Canister. Material: 1=Glass; 2=Plastic; 3=Metal. Preservative: 1=HCl; 2=HNO3; 3=H2SO4; 4=4C; 5=Zn (Ac)2; 6=NaOH; 7=NA2S2O3

QA/QC: ☑ Routine ☐ Caltrans ☐ Legal ☐ RWQCB ☐ Level IV

ITEM	Lab No.	Sample ID / Location	Date	Time	8015(DRO) + ORO	6010 / 7000	Water - Ground	TAT	#	Type	Material	Preservative	REMARKS
1	1800302-01	OM-2	1/18/18	1150	X	X	X	5	4	3/4	1/2	4/2	
2	-02	OM-4	↓	1220	↓	↓	↓	↓	↓	↓	↓	↓	
3	-03	OM-3	↓	1235	↓	↓	↓	↓	↓	↓	↓	↓	
4	-04	OM-1	↓	1255	↓	↓	↓	↓	↓	↓	↓	↓	
5	-05	OM-5	↓	1315	↓	↓	↓	↓	↓	↓	↓	↓	
6													
7													
8													
9													
10													

1. Sample receiving hours: 7:30 AM to 7:30 PM Monday - Friday; Saturday 8:00 AM to 12:00 PM.
2. Samples Submitted AFTER 3:00 PM, are considered received the following Business day at 8:00 AM.
3. The following turnaround time conditions apply:
   - TAT = 0 : 300% Surcharge SAME BUSINESS DAY if received by 9:00 AM
   - TAT = 1 : 100% Surcharge NEXT BUSINESS DAY (COB 5:00 PM)
   - TAT = 2 : 50% Surcharge 2ND BUSINESS DAY (COB 5:00 PM)
   - TAT = 3 : 30% Surcharge 3RD BUSINESS DAY (COB 5:00 PM)
   - TAT = 4 : 20% Surcharge 4TH BUSINESS DAY (COB 5:00 PM)
   - TAT = 5 : NO SURCHARGE 5th BUSINESS DAY (COB 5:00 PM)
4. Weekend, holiday, after-hours work - ask for quote.
5. Subcontract TAT is 10 - 15 business days. Projects requiring shorter TATs will incur a surcharge respective to the subcontract lab --- ask for quote.
6. Liquid and solid samples will be disposed of after 45 calendar days from receipt of samples; air samples will be disposed of after 14 calendar days after receipt of samples.
7. Electronic records maintained for five (5) years from report date.
8. Hard copy reports will be disposed of after 45 calendar days from report date.
9. Storage and Report Fees:
   - Liquid & solid samples: Complimentary storage for forty-five (45) calendar days from receipt of samples; $2/sample/month if extended storage or hold is requested.
   - Air samples: Complimentary storage for ten (10) calendar days from receipt of samples; $20/ sample/week if extended storage is requested.
   - Hard copy and regenerated reports/EDDs: $17.50 per hard copy report requested; $50.00 per regenerated/reforma? ed report; $35 per reprocessed EDD.
10. Rush TCLP/STLC samples: add 2 days to analysis TAT for extraction on procedure.
11. Unanalyzed samples will incur a disposal fee of $7 per sample.

As the authorized agent of the company above, I hereby purchase laboratory services from ATL as shown above and hereby guarantee payment as quoted.

N. Hastings — Submitter Print Name
Signature

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
J. Esquivel	1/19/18	1600	Ontrac	1/19/18	1600
			Foown	1/20/18	0939

February 02, 2018

Vista Work Order No. 1800154

Ms. Nicole Hastings-Bethel
Geocon Consultants, Inc.
3160 Gold Valley Drive, Suite 800
Rancho Cordova, CA 95742

Dear Ms. Hastings-Bethel,

Enclosed are the results for the sample set received at Vista Analytical Laboratory on January 19, 2018. This sample set was analyzed on a standard turn-around time, under your Project Name '59850-03-13B'.

Vista Analytical Laboratory is committed to serving you effectively. If you require additional information, please contact me at 916-673-1520 or by email at mmaier@vista-analytical.com.

Thank you for choosing Vista as part of your analytical support team.

Sincerely,

Martha Maier
Laboratory Director

Vista Analytical Laboratory certifies that the report herein meets all the requirements set forth by NELAP for those applicable test methods. Results relate only to the samples as received by the laboratory. This report should not be reproduced except in full without the written approval of Vista.

Vista Analytical Laboratory 1104 Windfield Way El Dorado Hills, CA 95762 ph: 916-673-1520 fx: 916-673-0106 www.vista-analytical.com

Vista Work Order No. 1800154
Case Narrative

Sample Condition on Receipt:

Five groundwater samples were received in good condition and within the method temperature requirements. The samples were received and stored securely in accordance with Vista standard operating procedures and EPA methodology.

Analytical Notes:

EPA Method 8290

These samples were extracted and analyzed for tetra-through-octa chlorinated dioxins and furans by EPA Method 8290 using a ZB-5MS GC column.

Holding Times

The method holding time criteria were met for these samples.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Ongoing Precision and Recovery (OPR) sample were extracted and analyzed with the preparation batch. No analytes were detected in the Method Blank. The OPR recoveries were within the method acceptance criteria.

Labeled standard recoveries for all QC and field samples were within method acceptance criteria.

TABLE OF CONTENTS

Sample Inventory Report

Vista Sample ID	Client Sample ID	Sampled	Received	Components/Containers
1800154-01	OM-2	18-Jan-18 11:50	19-Jan-18 16:11	Amber Glass NM Bottle, 1L
				Amber Glass NM Bottle, 1L
1800154-02	OM-4	18-Jan-18 12:20	19-Jan-18 16:11	Amber Glass NM Bottle, 1L
				Amber Glass NM Bottle, 1L
1800154-03	OM-3	18-Jan-18 12:35	19-Jan-18 16:11	Amber Glass NM Bottle, 1L
				Amber Glass NM Bottle, 1L
1800154-04	OM-1	18-Jan-18 12:55	19-Jan-18 16:11	Amber Glass NM Bottle, 1L
				Amber Glass NM Bottle, 1L
1800154-05	OM-5	18-Jan-18 13:15	19-Jan-18 16:11	Amber Glass NM Bottle, 1L
				Amber Glass NM Bottle, 1L

ANALYTICAL RESULTS

Sample ID: Method Blank			**EPA Method 8290**
Matrix: Aqueous Sample Size: 1.00 L	QC Batch: B8A0169 Date Extracted: 29-Jan-2018 7:47	Lab Sample: B8A0169-BLK1 Date Analyzed : 31-Jan-18 19:57 Column: ZB-5MS	

Analyte	Conc. (pg/L)	DL	EMPC	Qualifiers		Labeled Standard	%R	LCL-UCL	Qualifiers
2,3,7,8-TCDD	ND	0.414			IS	13C-2,3,7,8-TCDD	89.9	40 - 135	
1,2,3,7,8-PeCDD	ND	0.703				13C-1,2,3,7,8-PeCDD	91.7	40 - 135	
1,2,3,4,7,8-HxCDD	ND	0.805				13C-1,2,3,4,7,8-HxCDD	85.9	40 - 135	
1,2,3,6,7,8-HxCDD	ND	0.812				13C-1,2,3,6,7,8-HxCDD	86.0	40 - 135	
1,2,3,7,8,9-HxCDD	ND	0.893				13C-1,2,3,7,8,9-HxCDD	84.6	40 - 135	
1,2,3,4,6,7,8-HpCDD	ND	0.638				13C-1,2,3,4,6,7,8-HpCDD	71.5	40 - 135	
OCDD	ND	1.04				13C-OCDD	58.4	40 - 135	
2,3,7,8-TCDF	ND	0.402				13C-2,3,7,8-TCDF	80.3	40 - 135	
1,2,3,7,8-PeCDF	ND	0.847				13C-1,2,3,7,8-PeCDF	79.6	40 - 135	
2,3,4,7,8-PeCDF	ND	0.879				13C-2,3,4,7,8-PeCDF	79.8	40 - 135	
1,2,3,4,7,8-HxCDF	ND	0.424				13C-1,2,3,4,7,8-HxCDF	82.7	40 - 135	
1,2,3,6,7,8-HxCDF	ND	0.410				13C-1,2,3,6,7,8-HxCDF	84.7	40 - 135	
2,3,4,6,7,8-HxCDF	ND	0.454				13C-2,3,4,6,7,8-HxCDF	86.8	40 - 135	
1,2,3,7,8,9-HxCDF	ND	0.605				13C-1,2,3,7,8,9-HxCDF	81.9	40 - 135	
1,2,3,4,6,7,8-HpCDF	ND	0.496				13C-1,2,3,4,6,7,8-HpCDF	77.5	40 - 135	
1,2,3,4,7,8,9-HpCDF	ND	0.548				13C-1,2,3,4,7,8,9-HpCDF	78.4	40 - 135	
OCDF	ND	1.42				13C-OCDF	60.0	40 - 135	
					CRS	37Cl-2,3,7,8-TCDD	97.2	40 - 135	
						Toxic Equivalent Quotient (TEQ) Data (pg/L)			
						TEQMinWHO2005Dioxin	0.00		
TOTALS									
Total TCDD	1.41								
Total PeCDD	ND	0.703							
Total HxCDD	ND	0.838							
Total HpCDD	ND	0.638							
Total TCDF	ND	0.402							
Total PeCDF	ND	0.864							
Total HxCDF	ND	0.468							
Total HpCDF	ND	0.521							

DL - Sample specifc estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL- Lower control limit - upper control limit

Min-The TEQ is calculated using zero for the concentration of congeners that are not detected.

Sample ID: OPR								**EPA Method 8290**

Matrix: Aqueous Sample Size: 1.00 L	QC Batch: B8A0169 Date Extracted: 29-Jan-2018 7:47	Lab Sample: B8A0169-BS1 Date Analyzed: 31-Jan-18 18:21 Column: ZB-5MS

Analyte	Amt Found (pg/L)	Spike Amt	%R	Limits		Labeled Standard	%R	LCL-UCL
2,3,7,8-TCDD	207	200	104	70 - 130	IS	13C-2,3,7,8-TCDD	84.6	40 - 135
1,2,3,7,8-PeCDD	1010	1000	101	70 - 130		13C-1,2,3,7,8-PeCDD	75.4	40 - 135
1,2,3,4,7,8-HxCDD	936	1000	93.6	70 - 130		13C-1,2,3,4,7,8-HxCDD	83.8	40 - 135
1,2,3,6,7,8-HxCDD	989	1000	98.9	70 - 130		13C-1,2,3,6,7,8-HxCDD	81.3	40 - 135
1,2,3,7,8,9-HxCDD	940	1000	94.0	70 - 130		13C-1,2,3,7,8,9-HxCDD	83.1	40 - 135
1,2,3,4,6,7,8-HpCDD	1010	1000	101	70 - 130		13C-1,2,3,4,6,7,8-HpCDD	72.5	40 - 135
OCDD	1830	2000	91.7	70 - 130		13C-OCDD	59.1	40 - 135
2,3,7,8-TCDF	206	200	103	70 - 130		13C-2,3,7,8-TCDF	79.8	40 - 135
1,2,3,7,8-PeCDF	1010	1000	101	70 - 130		13C-1,2,3,7,8-PeCDF	69.7	40 - 135
2,3,4,7,8-PeCDF	959	1000	95.9	70 - 130		13C-2,3,4,7,8-PeCDF	66.8	40 - 135
1,2,3,4,7,8-HxCDF	1050	1000	105	70 - 130		13C-1,2,3,4,7,8-HxCDF	81.1	40 - 135
1,2,3,6,7,8-HxCDF	1030	1000	103	70 - 130		13C-1,2,3,6,7,8-HxCDF	82.1	40 - 135
2,3,4,6,7,8-HxCDF	1050	1000	105	70 - 130		13C-2,3,4,6,7,8-HxCDF	82.6	40 - 135
1,2,3,7,8,9-HxCDF	1060	1000	106	70 - 130		13C-1,2,3,7,8,9-HxCDF	81.9	40 - 135
1,2,3,4,6,7,8-HpCDF	1020	1000	102	70 - 130		13C-1,2,3,4,6,7,8-HpCDF	76.6	40 - 135
1,2,3,4,7,8,9-HpCDF	1010	1000	101	70 - 130		13C-1,2,3,4,7,8,9-HpCDF	79.6	40 - 135
OCDF	2240	2000	112	70 - 130		13C-OCDF	62.4	40 - 135
					CRS	37Cl-2,3,7,8-TCDD	86.1	40 - 135

LCL-UCL - Lower control limit - upper control limit

Sample ID: OM-2 **EPA Method 8290**

Client Data		Sample Data		Laboratory Data			
Name:	Geocon Consultants, Inc.	Matrix:	Groundwater	Lab Sample:	1800154-01	Date Received:	19-Jan-2018 16:11
Project:	59850-03-13B	Sample Size:	0.993 L	QC Batch:	B8A0169	Date Extracted:	29-Jan-2018 7:47
Date Collected:	18-Jan-2018 11:50			Date Analyzed :	31-Jan-18 22:20	Column: ZB-5MS	

Analyte	Conc. (pg/L)	DL	EMPC	Qualifiers		Labeled Standard	%R	LCL-UCL	Qualifiers
2,3,7,8-TCDD	ND	0.349			IS	13C-2,3,7,8-TCDD	82.2	40 - 135	
1,2,3,7,8-PeCDD	ND	0.675				13C-1,2,3,7,8-PeCDD	73.4	40 - 135	
1,2,3,4,7,8-HxCDD	ND	0.837				13C-1,2,3,4,7,8-HxCDD	77.7	40 - 135	
1,2,3,6,7,8-HxCDD	ND	0.881				13C-1,2,3,6,7,8-HxCDD	77.6	40 - 135	
1,2,3,7,8,9-HxCDD	ND	0.926				13C-1,2,3,7,8,9-HxCDD	78.6	40 - 135	
1,2,3,4,6,7,8-HpCDD	6.14			J		13C-1,2,3,4,6,7,8-HpCDD	69.1	40 - 135	
OCDD	70.2					13C-OCDD	60.3	40 - 135	
2,3,7,8-TCDF	ND	0.354				13C-2,3,7,8-TCDF	79.5	40 - 135	
1,2,3,7,8-PeCDF	ND	0.738				13C-1,2,3,7,8-PeCDF	69.8	40 - 135	
2,3,4,7,8-PeCDF	ND	0.785				13C-2,3,4,7,8-PeCDF	70.6	40 - 135	
1,2,3,4,7,8-HxCDF	ND	0.518				13C-1,2,3,4,7,8-HxCDF	77.1	40 - 135	
1,2,3,6,7,8-HxCDF	ND	0.527				13C-1,2,3,6,7,8-HxCDF	74.7	40 - 135	
2,3,4,6,7,8-HxCDF	ND	0.597				13C-2,3,4,6,7,8-HxCDF	76.1	40 - 135	
1,2,3,7,8,9-HxCDF	ND	0.732				13C-1,2,3,7,8,9-HxCDF	76.0	40 - 135	
1,2,3,4,6,7,8-HpCDF	17.0			J		13C-1,2,3,4,6,7,8-HpCDF	76.2	40 - 135	
1,2,3,4,7,8,9-HpCDF	ND	0.695				13C-1,2,3,4,7,8,9-HpCDF	79.0	40 - 135	
OCDF	15.0			J		13C-OCDF	60.4	40 - 135	
					CRS	37Cl-2,3,7,8-TCDD	89.6	40 - 135	

Toxic Equivalent Quotient (TEQ) Data (pg/L)

TEQMinWHO2005Dioxin	0.257

TOTALS

Total TCDD	ND	0.349
Total PeCDD	ND	0.675
Total HxCDD	ND	0.882
Total HpCDD	12.4	
Total TCDF	ND	0.354
Total PeCDF	ND	0.762
Total HxCDF	5.84	
Total HpCDF	31.7	

DL - Sample specifc estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL- Lower control limit - upper control limit

Min-The TEQ is calculated using zero for the concentration of congeners that are not detected.

Sample ID: OM-4 **EPA Method 8290**

Client Data		Sample Data		Laboratory Data			
Name:	Geocon Consultants, Inc.	Matrix:	Groundwater	Lab Sample:	1800154-02	Date Received:	19-Jan-2018 16:11
Project:	59850-03-13B	Sample Size:	0.999 L	QC Batch:	B8A0169	Date Extracted:	29-Jan-2018 7:47
Date Collected:	18-Jan-2018 12:20			Date Analyzed :	31-Jan-18 23:08	Column: ZB-5MS	

Analyte	Conc. (pg/L)	DL	EMPC	Qualifiers		Labeled Standard	%R	LCL-UCL	Qualifiers
2,3,7,8-TCDD	ND	0.761			IS	13C-2,3,7,8-TCDD	79.0	40 - 135	
1,2,3,7,8-PeCDD	ND	1.01				13C-1,2,3,7,8-PeCDD	79.7	40 - 135	
1,2,3,4,7,8-HxCDD	ND	1.03				13C-1,2,3,4,7,8-HxCDD	78.7	40 - 135	
1,2,3,6,7,8-HxCDD	ND	1.04				13C-1,2,3,6,7,8-HxCDD	79.2	40 - 135	
1,2,3,7,8,9-HxCDD	ND	1.08				13C-1,2,3,7,8,9-HxCDD	79.4	40 - 135	
1,2,3,4,6,7,8-HpCDD	5.81			J		13C-1,2,3,4,6,7,8-HpCDD	69.6	40 - 135	
OCDD	52.2					13C-OCDD	61.8	40 - 135	
2,3,7,8-TCDF	ND	0.443				13C-2,3,7,8-TCDF	78.0	40 - 135	
1,2,3,7,8-PeCDF	ND	1.08				13C-1,2,3,7,8-PeCDF	74.4	40 - 135	
2,3,4,7,8-PeCDF	ND	1.03				13C-2,3,4,7,8-PeCDF	74.7	40 - 135	
1,2,3,4,7,8-HxCDF	ND	0.606				13C-1,2,3,4,7,8-HxCDF	72.8	40 - 135	
1,2,3,6,7,8-HxCDF	ND	0.608				13C-1,2,3,6,7,8-HxCDF	72.2	40 - 135	
2,3,4,6,7,8-HxCDF	ND	0.675				13C-2,3,4,6,7,8-HxCDF	74.4	40 - 135	
1,2,3,7,8,9-HxCDF	ND	0.860				13C-1,2,3,7,8,9-HxCDF	75.4	40 - 135	
1,2,3,4,6,7,8-HpCDF	9.15			J		13C-1,2,3,4,6,7,8-HpCDF	78.7	40 - 135	
1,2,3,4,7,8,9-HpCDF	ND	0.692				13C-1,2,3,4,7,8,9-HpCDF	80.1	40 - 135	
OCDF	8.23			J		13C-OCDF	61.4	40 - 135	
					CRS	37Cl-2,3,7,8-TCDD	88.4	40 - 135	

Toxic Equivalent Quotient (TEQ) Data (pg/L)

TEQMinWHO2005Dioxin	0.168

TOTALS

Total TCDD	ND	0.761	
Total PeCDD	ND	1.01	
Total HxCDD	ND	1.05	
Total HpCDD	11.7		
Total TCDF	ND	0.443	
Total PeCDF	ND	1.06	
Total HxCDF	ND		1.62
Total HpCDF	16.3		

DL - Sample specifc estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL- Lower control limit - upper control limit

Min-The TEQ is calculated using zero for the concentration of congeners that are not detected.

Sample ID: OM-3	**EPA Method 8290**

Client Data		**Sample Data**		**Laboratory Data**			
Name:	Geocon Consultants, Inc.	Matrix:	Groundwater	Lab Sample:	1800154-03	Date Received:	19-Jan-2018 16:11
Project:	59850-03-13B	Sample Size:	0.983 L	QC Batch:	B8A0169	Date Extracted:	29-Jan-2018 7:47
Date Collected:	18-Jan-2018 12:35			Date Analyzed :	31-Jan-18 23:56	Column: ZB-5MS	

Analyte	Conc. (pg/L)	DL	EMPC	Qualifiers		Labeled Standard	%R	LCL-UCL	Qualifiers
2,3,7,8-TCDD	ND	0.604			IS	13C-2,3,7,8-TCDD	77.8	40 - 135	
1,2,3,7,8-PeCDD	ND	0.815				13C-1,2,3,7,8-PeCDD	76.4	40 - 135	
1,2,3,4,7,8-HxCDD	ND	1.00				13C-1,2,3,4,7,8-HxCDD	74.6	40 - 135	
1,2,3,6,7,8-HxCDD	ND	1.06				13C-1,2,3,6,7,8-HxCDD	74.9	40 - 135	
1,2,3,7,8,9-HxCDD	ND	1.03				13C-1,2,3,7,8,9-HxCDD	73.4	40 - 135	
1,2,3,4,6,7,8-HpCDD	11.5			J		13C-1,2,3,4,6,7,8-HpCDD	66.4	40 - 135	
OCDD	122					13C-OCDD	55.3	40 - 135	
2,3,7,8-TCDF	ND	0.424				13C-2,3,7,8-TCDF	76.0	40 - 135	
1,2,3,7,8-PeCDF	ND	1.01				13C-1,2,3,7,8-PeCDF	70.3	40 - 135	
2,3,4,7,8-PeCDF	ND	1.05				13C-2,3,4,7,8-PeCDF	71.7	40 - 135	
1,2,3,4,7,8-HxCDF	ND	0.544				13C-1,2,3,4,7,8-HxCDF	71.9	40 - 135	
1,2,3,6,7,8-HxCDF	ND	0.547				13C-1,2,3,6,7,8-HxCDF	70.4	40 - 135	
2,3,4,6,7,8-HxCDF	ND	0.579				13C-2,3,4,6,7,8-HxCDF	73.4	40 - 135	
1,2,3,7,8,9-HxCDF	ND	0.756				13C-1,2,3,7,8,9-HxCDF	73.4	40 - 135	
1,2,3,4,6,7,8-HpCDF	8.63			J		13C-1,2,3,4,6,7,8-HpCDF	70.8	40 - 135	
1,2,3,4,7,8,9-HpCDF	ND	0.631				13C-1,2,3,4,7,8,9-HpCDF	76.0	40 - 135	
OCDF	6.47			J		13C-OCDF	58.2	40 - 135	
					CRS	37Cl-2,3,7,8-TCDD	94.9	40 - 135	

			Toxic Equivalent Quotient (TEQ) Data (pg/L)	
			TEQMinWHO2005Dioxin	0.240
TOTALS				
Total TCDD	ND	0.604		
Total PeCDD	ND	0.815		
Total HxCDD	ND	1.03		
Total HpCDD	22.5			
Total TCDF	ND	0.424		
Total PeCDF	ND	1.03		
Total HxCDF	5.40			
Total HpCDF	14.7			

DL - Sample specifc estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL- Lower control limit - upper control limit

Min-The TEQ is calculated using zero for the concentration of congeners that are not detected.

Sample ID: OM-1

EPA Method 8290

Client Data		**Sample Data**		**Laboratory Data**			
Name:	Geocon Consultants, Inc.	Matrix:	Groundwater	Lab Sample:	1800154-04	Date Received:	19-Jan-2018 16:11
Project:	59850-03-13B	Sample Size:	1.00 L	QC Batch:	B8A0169	Date Extracted:	29-Jan-2018 7:47
Date Collected:	18-Jan-2018 12:55			Date Analyzed :	01-Feb-18 00:43	Column: ZB-5MS	

Analyte	Conc. (pg/L)	DL	EMPC	Qualifiers		Labeled Standard	%R	LCL-UCL	Qualifiers
2,3,7,8-TCDD	ND	0.580			IS	13C-2,3,7,8-TCDD	81.1	40 - 135	
1,2,3,7,8-PeCDD	ND	0.885				13C-1,2,3,7,8-PeCDD	82.8	40 - 135	
1,2,3,4,7,8-HxCDD	ND	1.71				13C-1,2,3,4,7,8-HxCDD	76.6	40 - 135	
1,2,3,6,7,8-HxCDD	ND	1.71				13C-1,2,3,6,7,8-HxCDD	74.3	40 - 135	
1,2,3,7,8,9-HxCDD	ND	1.83				13C-1,2,3,7,8,9-HxCDD	75.7	40 - 135	
1,2,3,4,6,7,8-HpCDD	32.3					13C-1,2,3,4,6,7,8-HpCDD	67.9	40 - 135	
OCDD	292					13C-OCDD	56.3	40 - 135	
2,3,7,8-TCDF	ND	0.409				13C-2,3,7,8-TCDF	76.0	40 - 135	
1,2,3,7,8-PeCDF	ND	0.877				13C-1,2,3,7,8-PeCDF	70.6	40 - 135	
2,3,4,7,8-PeCDF	ND	0.827				13C-2,3,4,7,8-PeCDF	70.5	40 - 135	
1,2,3,4,7,8-HxCDF	ND	1.30				13C-1,2,3,4,7,8-HxCDF	74.4	40 - 135	
1,2,3,6,7,8-HxCDF	ND	1.31				13C-1,2,3,6,7,8-HxCDF	73.7	40 - 135	
2,3,4,6,7,8-HxCDF	ND	1.43				13C-2,3,4,6,7,8-HxCDF	74.0	40 - 135	
1,2,3,7,8,9-HxCDF	ND	2.00				13C-1,2,3,7,8,9-HxCDF	74.1	40 - 135	
1,2,3,4,6,7,8-HpCDF	512					13C-1,2,3,4,6,7,8-HpCDF	74.9	40 - 135	
1,2,3,4,7,8,9-HpCDF	ND	1.92				13C-1,2,3,4,7,8,9-HpCDF	78.7	40 - 135	
OCDF	262					13C-OCDF	55.7	40 - 135	
					CRS	37Cl-2,3,7,8-TCDD	90.8	40 - 135	

Toxic Equivalent Quotient (TEQ) Data (pg/L)

TEQMinWHO2005Dioxin	5.61

TOTALS

Total TCDD	ND	0.580
Total PeCDD	ND	0.885
Total HxCDD	8.66	
Total HpCDD	66.2	
Total TCDF	ND	0.409
Total PeCDF	8.20	
Total HxCDF	120	
Total HpCDF	792	

DL - Sample specifc estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL- Lower control limit - upper control limit

Min-The TEQ is calculated using zero for the concentration of congeners that are not detected.

Sample ID: OM-5

EPA Method 8290

Client Data		**Sample Data**		**Laboratory Data**			
Name:	Geocon Consultants, Inc.	Matrix:	Groundwater	Lab Sample:	1800154-05	Date Received:	19-Jan-2018 16:11
Project:	59850-03-13B	Sample Size:	1.00 L	QC Batch:	B8A0169	Date Extracted:	29-Jan-2018 7:47
Date Collected:	18-Jan-2018 13:15			Date Analyzed :	01-Feb-18 01:31	Column: ZB-5MS	

Analyte	Conc. (pg/L)	DL	EMPC	Qualifiers		Labeled Standard	%R	LCL-UCL	Qualifiers
2,3,7,8-TCDD	ND	0.745			IS	13C-2,3,7,8-TCDD	64.9	40 - 135	
1,2,3,7,8-PeCDD	ND	1.79				13C-1,2,3,7,8-PeCDD	65.0	40 - 135	
1,2,3,4,7,8-HxCDD	ND	1.82				13C-1,2,3,4,7,8-HxCDD	60.9	40 - 135	
1,2,3,6,7,8-HxCDD	2.95			J		13C-1,2,3,6,7,8-HxCDD	62.5	40 - 135	
1,2,3,7,8,9-HxCDD	ND	1.94				13C-1,2,3,7,8,9-HxCDD	62.1	40 - 135	
1,2,3,4,6,7,8-HpCDD	86.5					13C-1,2,3,4,6,7,8-HpCDD	57.0	40 - 135	
OCDD	858					13C-OCDD	47.4	40 - 135	
2,3,7,8-TCDF	ND	0.529				13C-2,3,7,8-TCDF	52.2	40 - 135	
1,2,3,7,8-PeCDF	ND	1.12				13C-1,2,3,7,8-PeCDF	52.0	40 - 135	
2,3,4,7,8-PeCDF	ND	0.949				13C-2,3,4,7,8-PeCDF	54.1	40 - 135	
1,2,3,4,7,8-HxCDF	1.57			J		13C-1,2,3,4,7,8-HxCDF	60.4	40 - 135	
1,2,3,6,7,8-HxCDF	ND	0.941				13C-1,2,3,6,7,8-HxCDF	59.0	40 - 135	
2,3,4,6,7,8-HxCDF	2.48			J		13C-2,3,4,6,7,8-HxCDF	59.7	40 - 135	
1,2,3,7,8,9-HxCDF	ND	1.30				13C-1,2,3,7,8,9-HxCDF	58.8	40 - 135	
1,2,3,4,6,7,8-HpCDF	177					13C-1,2,3,4,6,7,8-HpCDF	62.3	40 - 135	
1,2,3,4,7,8,9-HpCDF	ND	1.53				13C-1,2,3,4,7,8,9-HpCDF	64.1	40 - 135	
OCDF	97.5					13C-OCDF	47.1	40 - 135	
					CRS	37Cl-2,3,7,8-TCDD	95.9	40 - 135	

Toxic Equivalent Quotient (TEQ) Data (pg/L)

TEQMinWHO2005Dioxin	3.62

TOTALS

Total TCDD	ND	0.745
Total PeCDD	3.83	
Total HxCDD	30.6	
Total HpCDD	193	
Total TCDF	ND	0.529
Total PeCDF	4.08	
Total HxCDF	66.6	
Total HpCDF	286	

DL - Sample specifc estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL- Lower control limit - upper control limit

Min-The TEQ is calculated using zero for the concentration of congeners that are not detected.

DATA QUALIFIERS & ABBREVIATIONS

B	**This compound was also detected in the method blank.**
D	**Dilution**
E	**The associated compound concentration exceeded the calibration range of the instrument.**
H	**Recovery and/or RPD was outside laboratory acceptance limits.**
I	**Chemical Interference**
J	**The amount detected is below the Reporting Limit/LOQ.**
M	**Estimated Maximum Possible Concentration. (CA Region 2 projects only)**
*****	**See Cover Letter**
Conc.	**Concentration**
NA	**Not applicable**
ND	**Not Detected**
TEQ	**Toxic Equivalency**
U	**Not Detected (specific projects only)**

Unless otherwise noted, solid sample results are reported in dry weight. Tissue samples are reported in wet weight.

CERTIFICATIONS

Accrediting Authority	Certificate Number
Alaska Department of Environmental Conservation	17-013
Arkansas Department of Environmental Quality	17-015-0
California Department of Health – ELAP	2892
DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005	3091.01
Florida Department of Health	E87777-18
Hawaii Department of Health	N/A
Louisiana Department of Environmental Quality	01977
Maine Department of Health	2016026
Minnesota Department of Health	1322288
New Hampshire Environmental Accreditation Program	207717
New Jersey Department of Environmental Protection	CA003
New York Department of Health	11411
Oregon Laboratory Accreditation Program	4042-008
Pennsylvania Department of Environmental Protection	014
Texas Commission on Environmental Quality	T104704189-17-8
Virginia Department of General Services	9077
Washington Department of Ecology	C584
Wisconsin Department of Natural Resources	998036160

Current certificates and lists of licensed parameters are located in the Quality Assurance office and are available upon request.

Submit by Email* *A printed COC must accompany all samples.

Print Form

Vista

CHAIN OF CUSTODY RECORD

FOR LABORATORY USE ONLY
Laboratory Project ID: 1800154
Storage ID: WR-2
Temp 0.0 °C
Storage Secured: Yes [X] No [ ]

TAT: (Check One)
Standard (X) 21 days
Rush (surcharge may apply)
◯ 14 days ◯ 7 days Specify: ___

Project I.D.: S9850-03-13B P.O. #: 745 Sampler: J. Esquivel (Name)

Invoice to: Name	Company	Address	City	State	Zip	Ph#	Fax #
Nicole Hastings	Geocon	3160 Gold Valley Dr #800	Rancho Cordova	CA	95742		916-852-9118

Relinquished by: (Printed Name and Signature)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Nicole Hastings	1.19.18	1611	Sydney Rongstad	01/19/18	1614
Relinquished by: (Printed Name and Signature)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

See "Sample Log-in Checklist" for additional sample information

SHIP TO: Vista Analytical Laboratory
1104 Windfield Way
El Dorado Hills, CA 95762
(916) 673-1520 Fax (916) 673-0106

ATTN: ___

Method of Shipment: ___

Tracking No.: ___

Add Analysis(es) Requested

Sample ID	Date	Time	Location/Sample Description	Container(s) Quantity	Container(s) Type	Matrix	EPA1613 2378-TCDD	EPA1613 2378-TCDD/TCDF	EPA1613 PCDD/PCDF	EPA8290 2378-TCDD	EPA8290 2378-TCDD/TCDF	EPA8290 PCDD/PCDF	EPA8280 2378-TCDD	EPA8280 2378-TCDD/TCDF	EPA8280 PCDD/PCDF	TOTALS	EPA1668 COPLANAR PCBs	EPA1668 209 CONGENERS	EPA1614 PBDE	CARB429 PAH	WHO-29	
OM-2	1/18/18	1150	OM-2	2	1	O						X										
OM-4	↓	1220	OM-4	↓	↓	↓						↓										
OM-3	↓	1235	OM-3	↓	↓	↓						↓										
OM-1	↓	1255	OM-1	↓	↓	↓						↓										
OM-5	↓	1315	OM-5	↓	↓	↓						↓										

Special Instructions/Comments: ___

SEND DOCUMENTATION AND RESULTS TO:
Name: Nicole Hastings
Company: Geocon
Address: see above
City: ___ State: ___ Zip: ___
Phone: 916 852 9118 Fax: ___
Email: hastings@geoconinc.com

Container Types: A = 1 Liter Amber, G = Glass Jar
P = PUF, T = MM5 Train, O = Other ___

*Bottle Preservative Type: [ ] T = Thiosulfate, [ ] O = Other ___

Matrix Types: DW = Drinking Water, EF = Effluent, PP = Pulp/Paper, SD = Sediment, SL = Sludge, SO = Soil, WW = Wastewater, B=Blood/Serum
O = Other groundwater

Vista Analytical Laboratory

Sample Log-in Checklist

Vista Work Order #: 1800154 **TAT** 21

Samples Arrival:	**Date/Time** 01/19/18 1611	**Initials:** SR	**Location:** WR-2 **Shelf/Rack:** N/A
Logged In:	**Date/Time** 01/20/18 1228	**Initials:** WJS	**Location:** WR-2 **Shelf/Rack:** C-2, C-5

Delivered By:	FedEx	UPS	On Trac	GSO	DHL	Hand Delivered	Other
Preservation:	Ice		Blue Ice		Dry Ice		None

Temp °C: 0.1 (uncorrected)	**Time:** 1612	**Thermometer ID:** IR-4
Temp °C: 0.0 (corrected)	**Probe used:** Yes☐ No☒	

	YES	NO	NA
Adequate Sample Volume Received?	✓		
Holding Time Acceptable?	✓		
Shipping Container(s) Intact?	✓		
Shipping Custody Seals Intact?			✓
Shipping Documentation Present?			✓
Airbill / Trk #			✓
Sample Container Intact?	✓		
Sample Custody Seals Intact?			✓
Chain of Custody / Sample Documentation Present?	✓		
COC Anomaly/Sample Acceptance Form completed?		✓	✓

If Chlorinated or Drinking Water Samples, Acceptable Preservation?						✓
Preservation Documented:	$Na_2S_2O_3$	Trizma	None	Yes	No	NA
Shipping Container	Vista	Client	Retain	Return	Dispose	

Comments:

ID.: LR – SLC *Rev No.: 0* *Rev Date: 05/18/2017* *Page: 1 of 1*

APPENDIX B

MONITORING WELL SAMPLING DATA

Project Name: The Landing – Old Mill	**Project Number:** S9850-03-13B
Well No.: OM-1	Date: 1/18/2018
Well Diameter: 2 in.	Field Personnel: JE
Casing Length: 16.85 feet	Screened Casing Length: 7 feet
Well Elevation: 3,511.04 feet MSL measured from top of casing	

PURGE CHARACTERISTICS	
Water Depth Before Purging: 5.10 ft.	2 in. = .1632 Gal/ft. 4 in. = .6528 Gal/ft.
Calculated Water Column Volume: 1.92 Gal.	Volumes Purged: 3.13
Start Purging Time: 1121	End Purging Time: 1125
Total Time: 4 min.	Flow Gauge:
Total Volume Purged: 6 Gal.	Avg. Flow Rate: 1.5 gpm
Water Depth After Purging:	Time:
Dissolved Oxygen:	Free Product: (Y/N); No

SAMPLING CHARACTERISTICS

Purging Method: submersible pump | Sampling Method: disposable bailer

Laboratory Analysis: DRO, ORO, metals, dioxins

TIME	TEMPERATURE (°C)	CONDUCTIVITY (umhos/cm)	pH	Gallons Purged
1122	11.4	80	7.58	2
1123	12.5	75	7.45	4
1125	12.6	74	7.30	6
1255				Sample

comments: Turbid, Silty; no odor

Project Name: The Landing – Old Mill	**Project Number:** S9850-03-13B
Well No.: OM-2	Date: 1/18/2018
Well Diameter: 2 in.	Field Personnel: JE
Casing Length: 21.98 feet	Screened Casing Length: 10 feet
Well Elevation: 3,509.07 feet MSL measured from top of casing	

PURGE CHARACTERISTICS	
Water Depth Before Purging: 8.88 ft.	2 in. = .1632 Gal/ft. 4 in. = .6528 Gal/ft.
Calculated Water Column Volume: 2.14 Gal.	Volumes Purged: 3.04
Start Purging Time: 1005	End Purging Time: 1009
Total Time: 4 min.	Flow Gauge:
Total Volume Purged: 6.5 Gal.	Avg. Flow Rate: 1.6 gpm
Water Depth After Purging:	Time:
Dissolved Oxygen:	Free Product: (Y/N); No

SAMPLING CHARACTERISTICS	
Purging Method: submersible pump	Sampling Method: disposable bailer
Laboratory Analysis: DRO, ORO, metals, dioxins	

TIME	TEMPERATURE (°C)	CONDUCTIVITY (umhos/cm)	pH	Gallons Purged
1006	11.1	151	7.96	2
1007	10.8	96	7.65	4
1009	9.9	80	7.35	6.5
1150				Sample

comments: Slightly turbid; no odor
Well was going dry near end of 3rd purged volume.

Project Name: The Landing – Old Mill	**Project Number:** S9850-03-13B
Well No.: OM-3	Date: 1/18/2018
Well Diameter: 2 in.	Field Personnel: JE
Casing Length: 25.60 feet	Screened Casing Length: 15 feet
Well Elevation: 3,503.29 feet MSL measured from top of casing	

PURGE CHARACTERISTICS	
Water Depth Before Purging: 9.62 ft.	2 in. = .1632 Gal/ft. 4 in. = .6528 Gal/ft.
Calculated Water Column Volume: 2.61 Gal.	Volumes Purged: 2.3
Start Purging Time: 1045	End Purging Time: 1053
Total Time: 8 min.	Flow Gauge:
Total Volume Purged: 6 Gal.	Avg. Flow Rate: 1.3 gpm
Water Depth After Purging:	Time:
Dissolved Oxygen:	Free Product: (Y/N); No

SAMPLING CHARACTERISTICS	
Purging Method: submersible pump	Sampling Method: disposable bailer
Laboratory Analysis: DRO, ORO, metals, dioxins	

TIME	TEMPERATURE (°C)	CONDUCTIVITY (umhos/cm)	pH	Gallons Purged
1047	9.7	131	6.82	3
1048	9.6	151	6.74	5
1053	10.2	134	6.60	6
1235				Sample

comments: Turbid, silty; no odor
Dry at 6 gallons.

Project Name: The Landing – Old Mill	**Project Number:** S9850-03-13B
Well No.: OM-4	Date: 1/18/2018
Well Diameter: 2 in.	Field Personnel: JE
Casing Length: 30.38 feet	Screened Casing Length: 15 feet
Well Elevation: 3490.79 feet MSL measured from top of casing	

PURGE CHARACTERISTICS	
Water Depth Before Purging: 6.24 ft.	2 in. = .1632 Gal/ft. 4 in. = .6528 Gal/ft.
Calculated Water Column Volume: 3.94 Gal.	Volumes Purged: 2.5
Start Purging Time: 1025	End Purging Time: 1031
Total Time: 6 min.	Flow Gauge:
Total Volume Purged: 10 Gal.	Avg. Flow Rate: 1.7 gpm
Water Depth After Purging:	Time:
Dissolved Oxygen:	Free Product: (Y/N); No

SAMPLING CHARACTERISTICS	
Purging Method: submersible pump	Sampling Method: disposable bailer
Laboratory Analysis: DRO, ORO, metals, dioxins	

TIME	TEMPERATURE (°C)	CONDUCTIVITY (umhos/cm)	pH	Gallons Purged
1027	10.3	89	7.86	4
1029	11.2	136	7.18	8
1031	10.7	137	7.01	10
1220				Sample

comments: Turbid and silty; no odor
Well went dry at 10 gallons.

Project Name: The Landing – Old Mill	**Project Number:** S9850-03-13B
Well No.: OM-5	Date: 1/18/2018
Well Diameter: 2 in.	Field Personnel: JE
Casing Length: 32.83 feet	Screened Casing Length: 15 feet
Well Elevation: 3,503.14 feet MSL measured from top of casing	

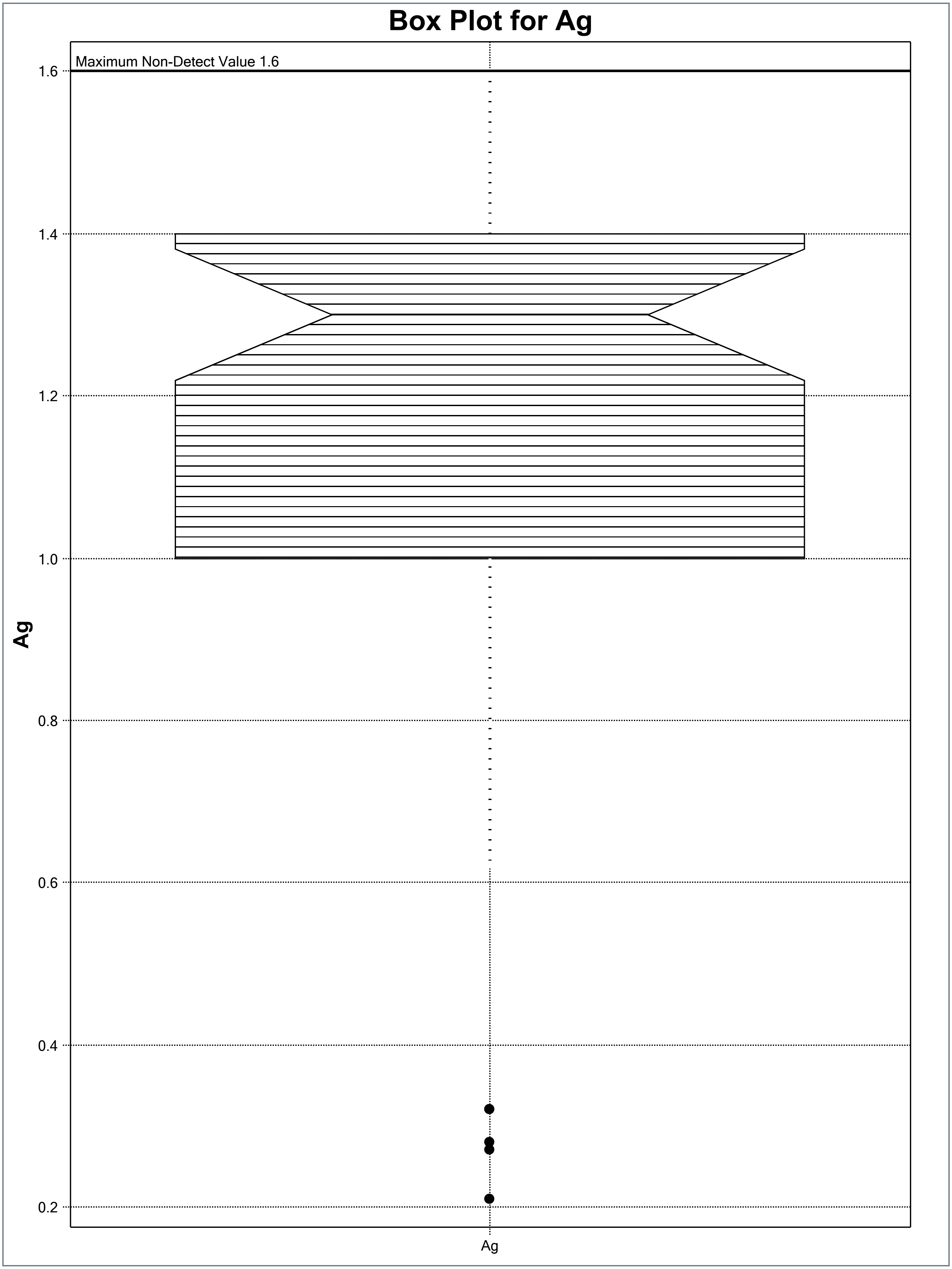
PURGE CHARACTERISTICS	
Water Depth Before Purging: 20.31 ft.	2 in. = .1632 Gal/ft. 4 in. = .6528 Gal/ft.
Calculated Water Column Volume: 2.04 Gal.	Volumes Purged: 3.2
Start Purging Time: 1107	End Purging Time: 1110
Total Time: 3 min.	Flow Gauge:
Total Volume Purged: 6.5 Gal.	Avg. Flow Rate: 2.2 gpm
Water Depth After Purging:	Time:
Dissolved Oxygen:	Free Product: (Y/N); No

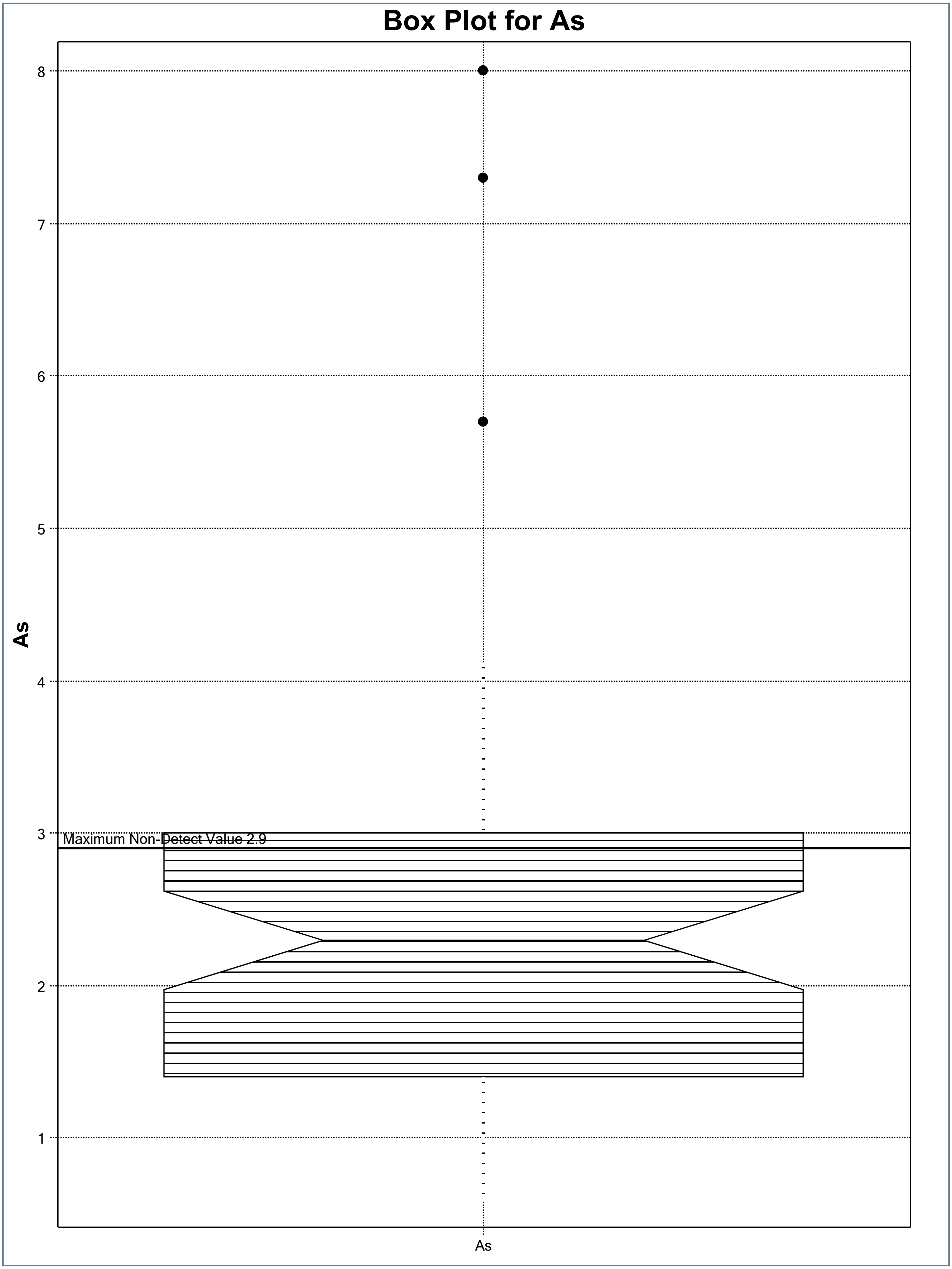
SAMPLING CHARACTERISTICS	
Purging Method: submersible pump	Sampling Method: disposable bailer
Laboratory Analysis: DRO, ORO, metals, dioxins	

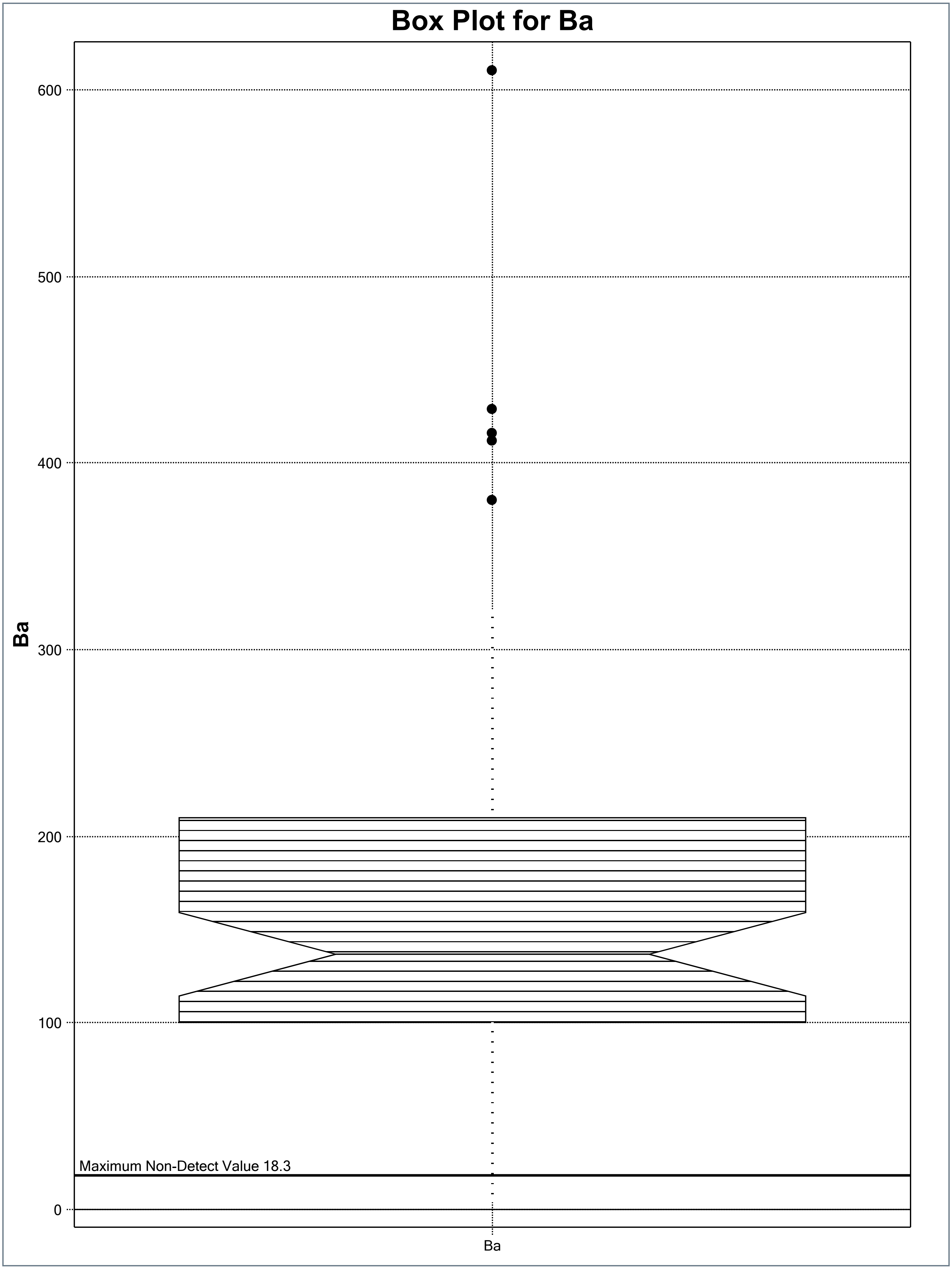
TIME	TEMPERATURE (°C)	CONDUCTIVITY (umhos/cm)	pH	Gallons Purged
1108	11.3	198	7.40	2
1109	12.1	202	7.02	4
1110	12.3	242	6.78	6.5
1315				Sample

comments: Turbid, grayish, no odor; 2nd volume had a slight odor

APPENDIX C

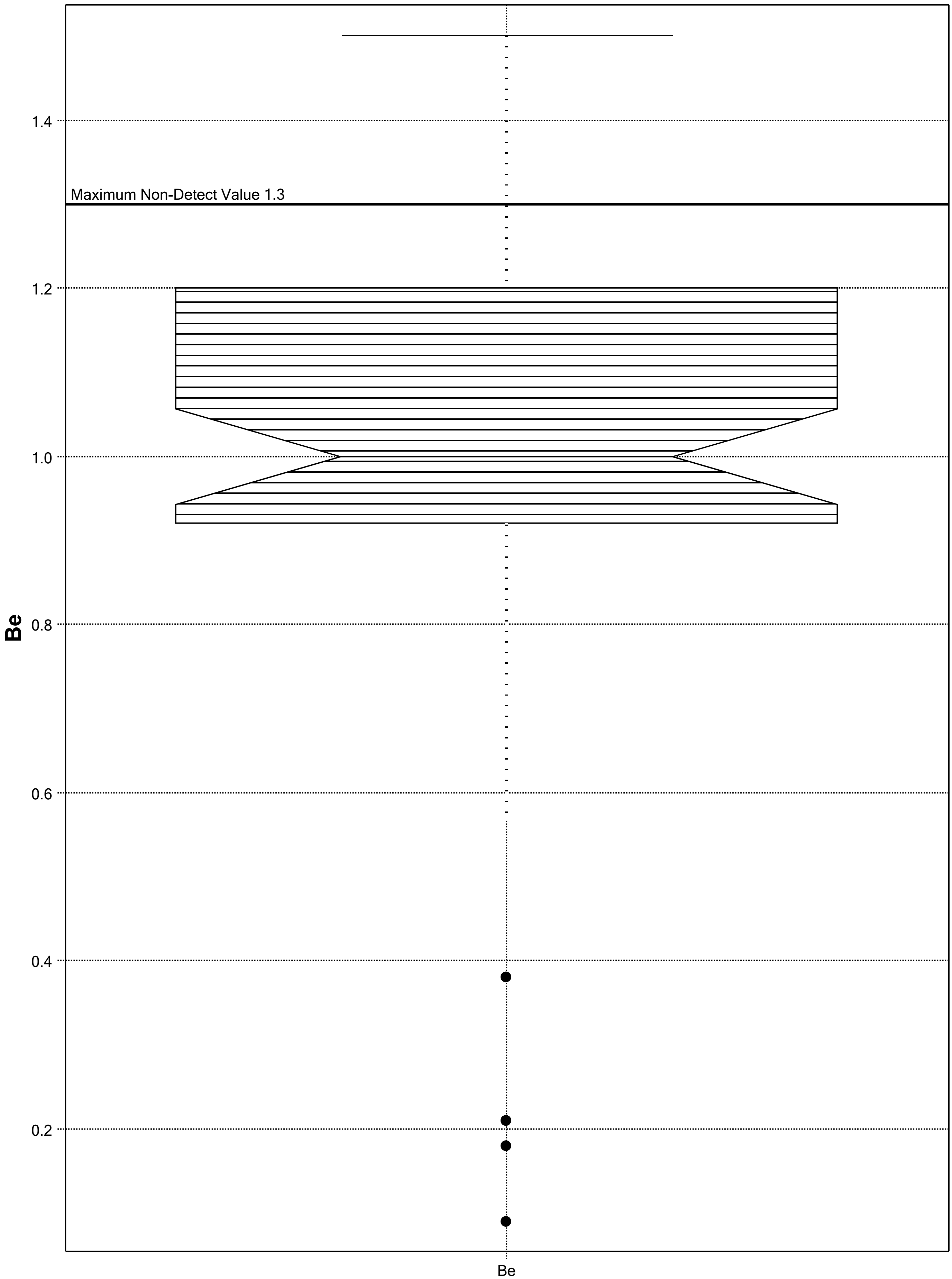

Box Plot for Ag
Maximum Non-Detect Value 1.6
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
Ag
Ag

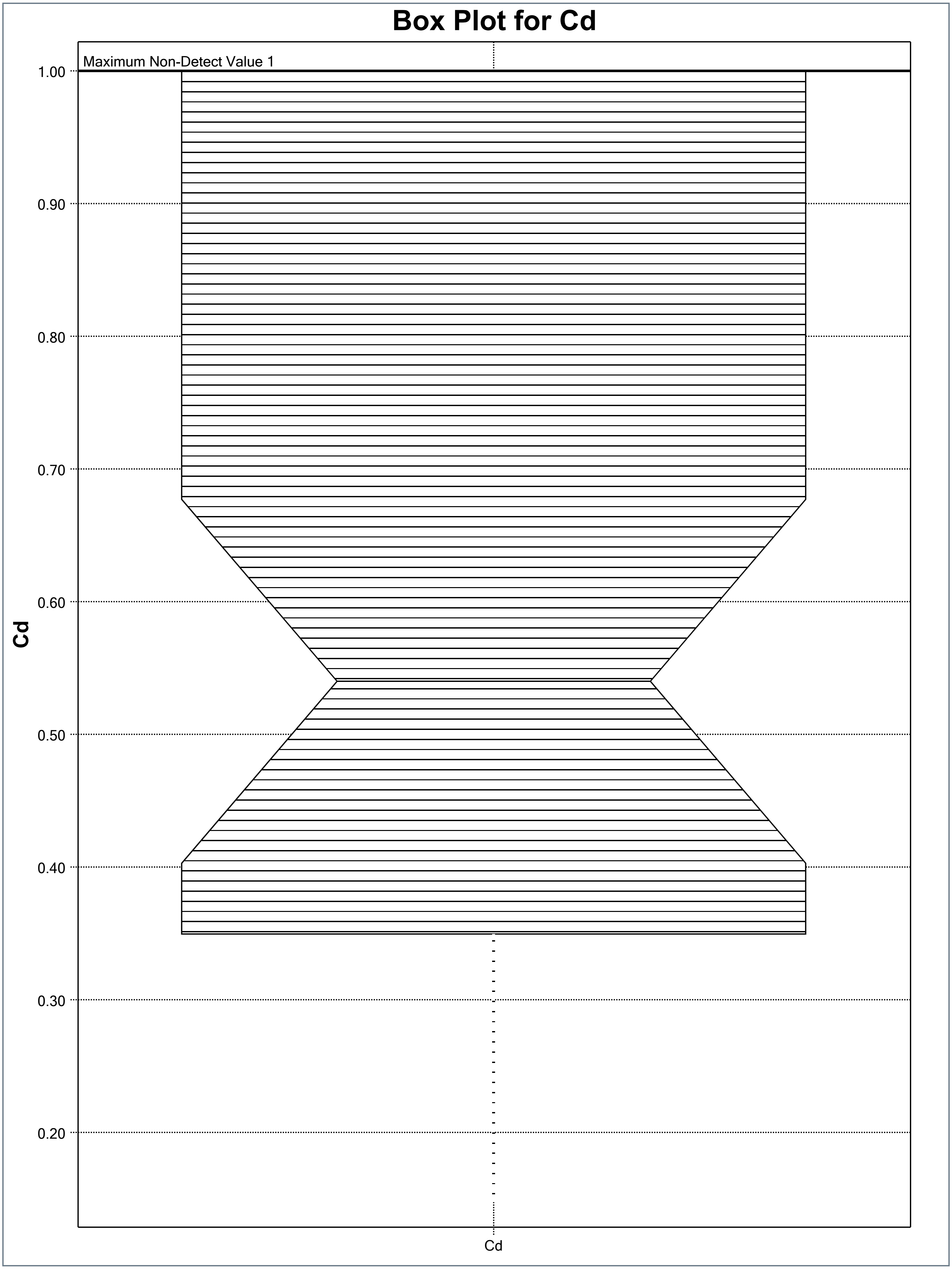

Box Plot for As
As
8
7
6
5
4
3
2
1
Maximum Non-Detect Value 2.9
As



Box Plot for Ba
Ba
600
500
400
300
200
100
0
Maximum Non-Detect Value 18.3
Ba

Box Plot for Be

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Maximum Non-Detect Value 1
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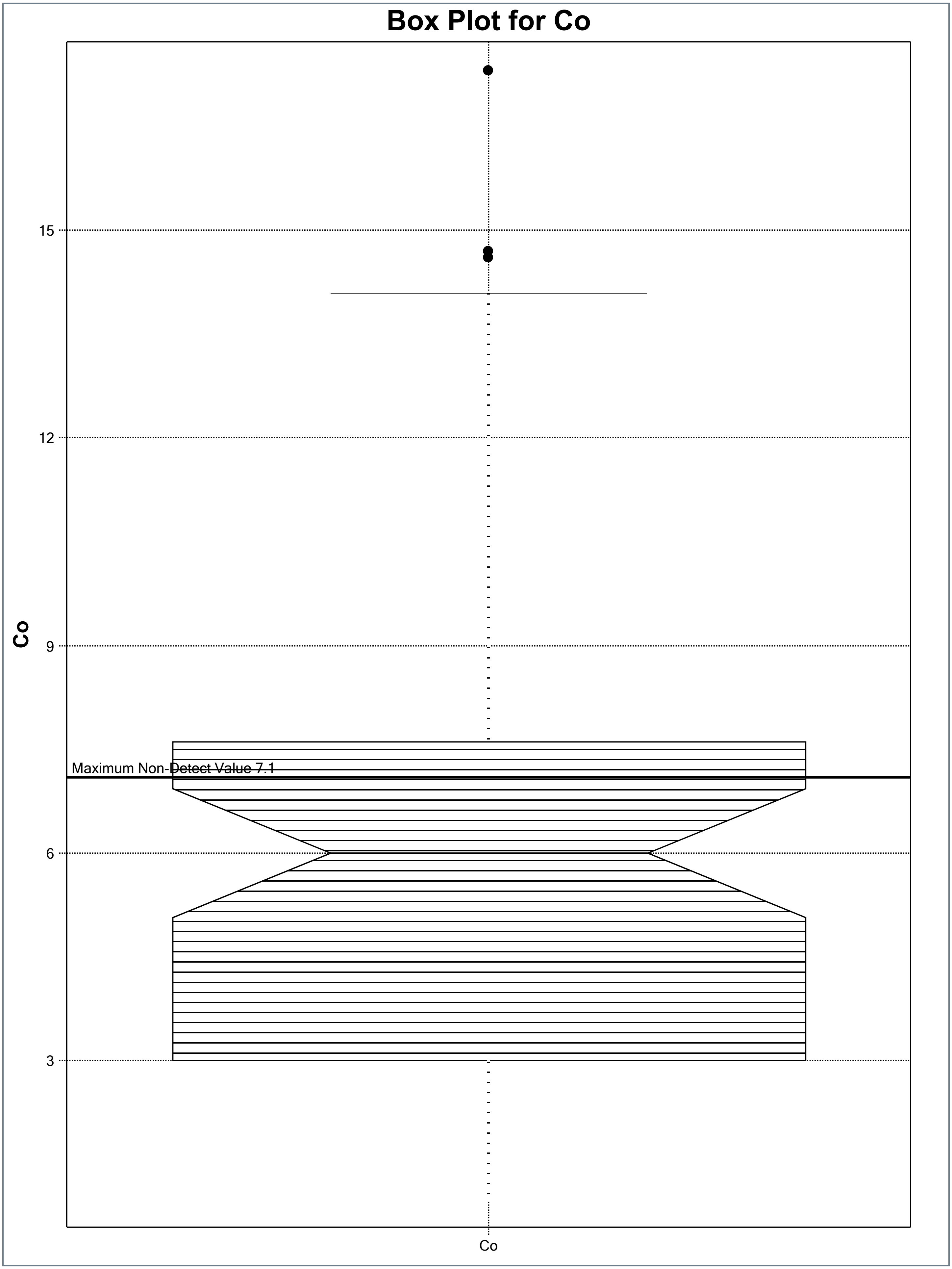
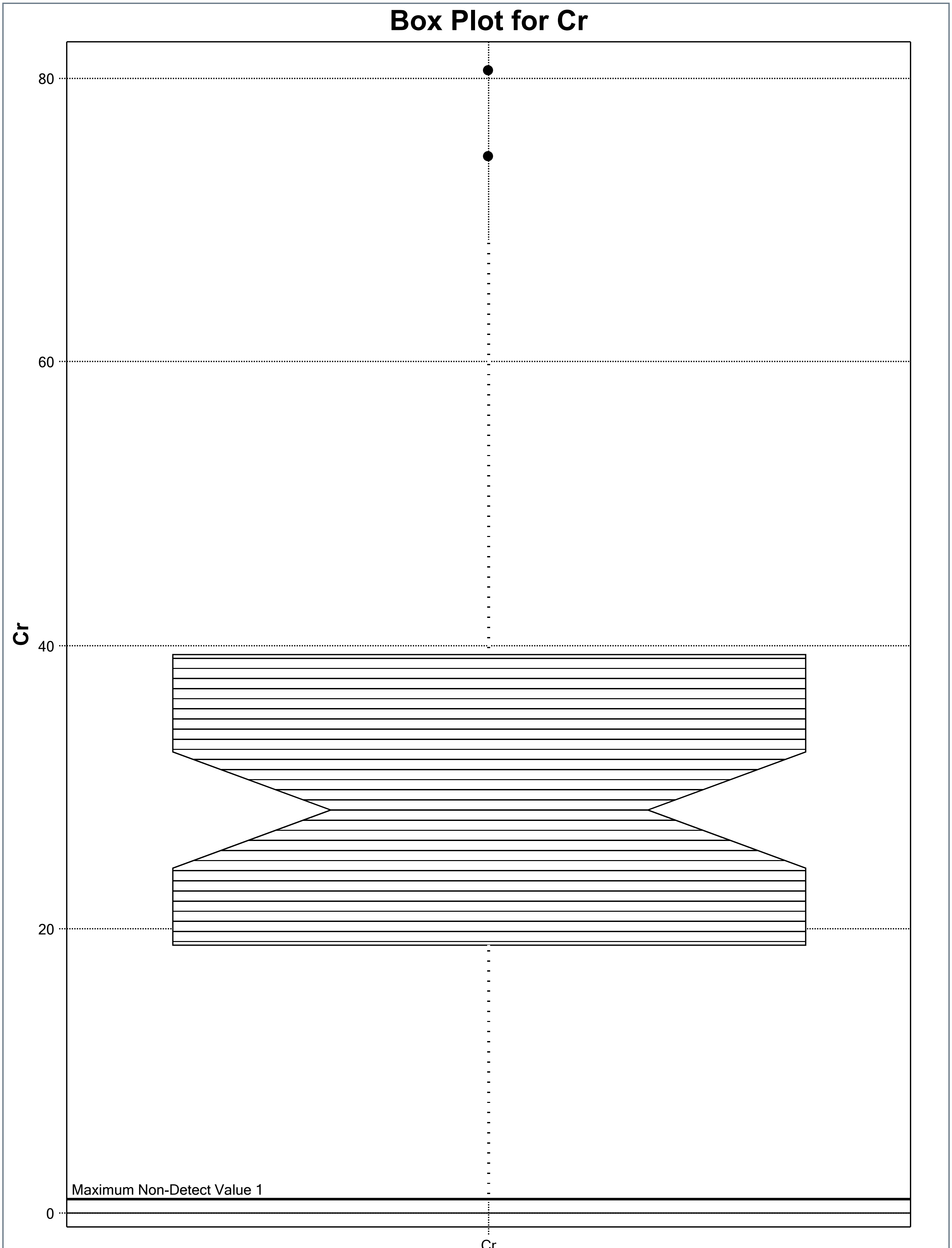
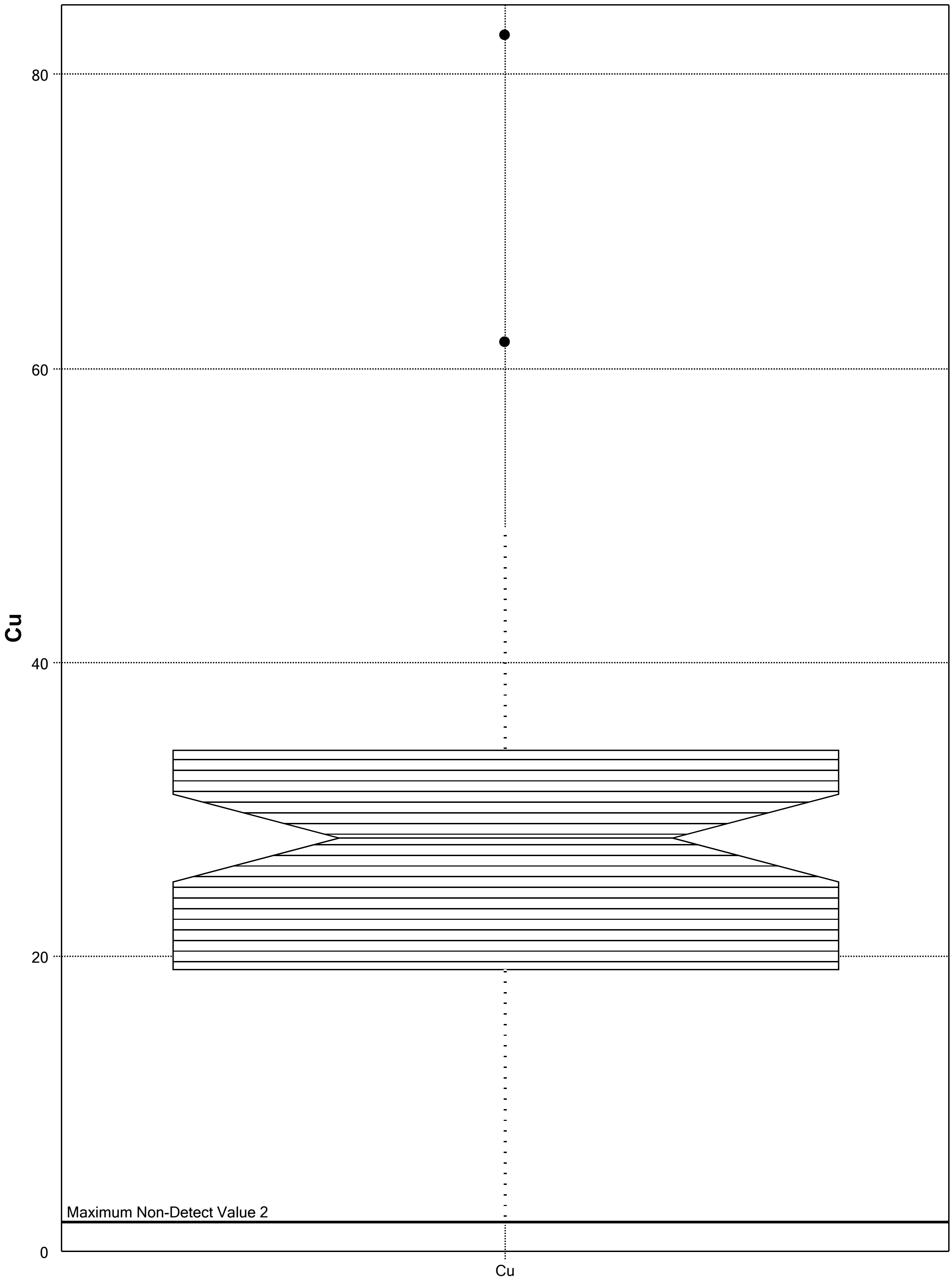
0.80
0.70
0.60
0.50
0.40
0.30
0.20
Cd
Cd


Box Plot for Co
Co
15
12
9
6
3
Maximum Non-Detect Value 7.1
Co

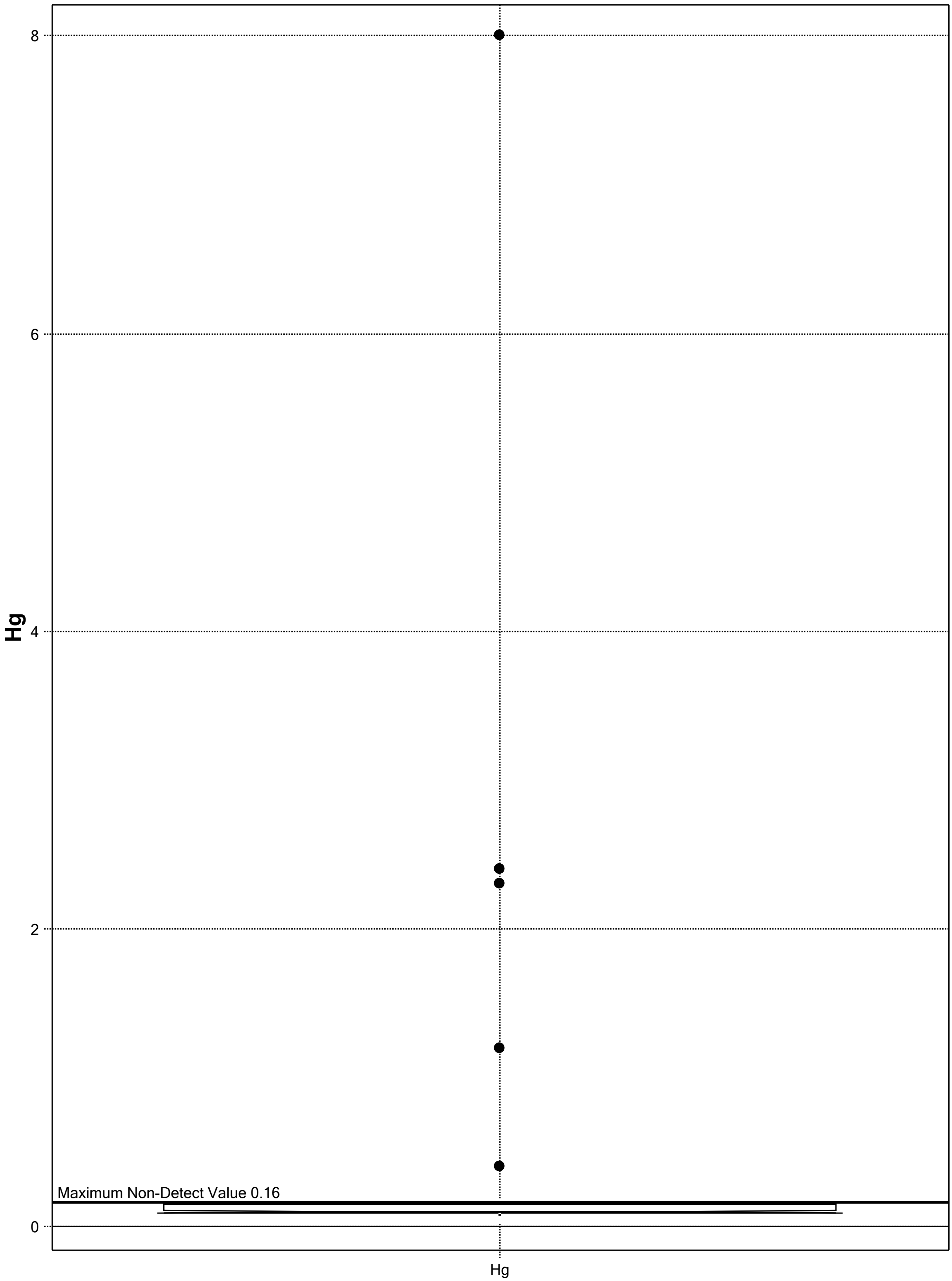


Box Plot for Cr
Cr
80
60
40
20
0
Maximum Non-Detect Value 1
Cr

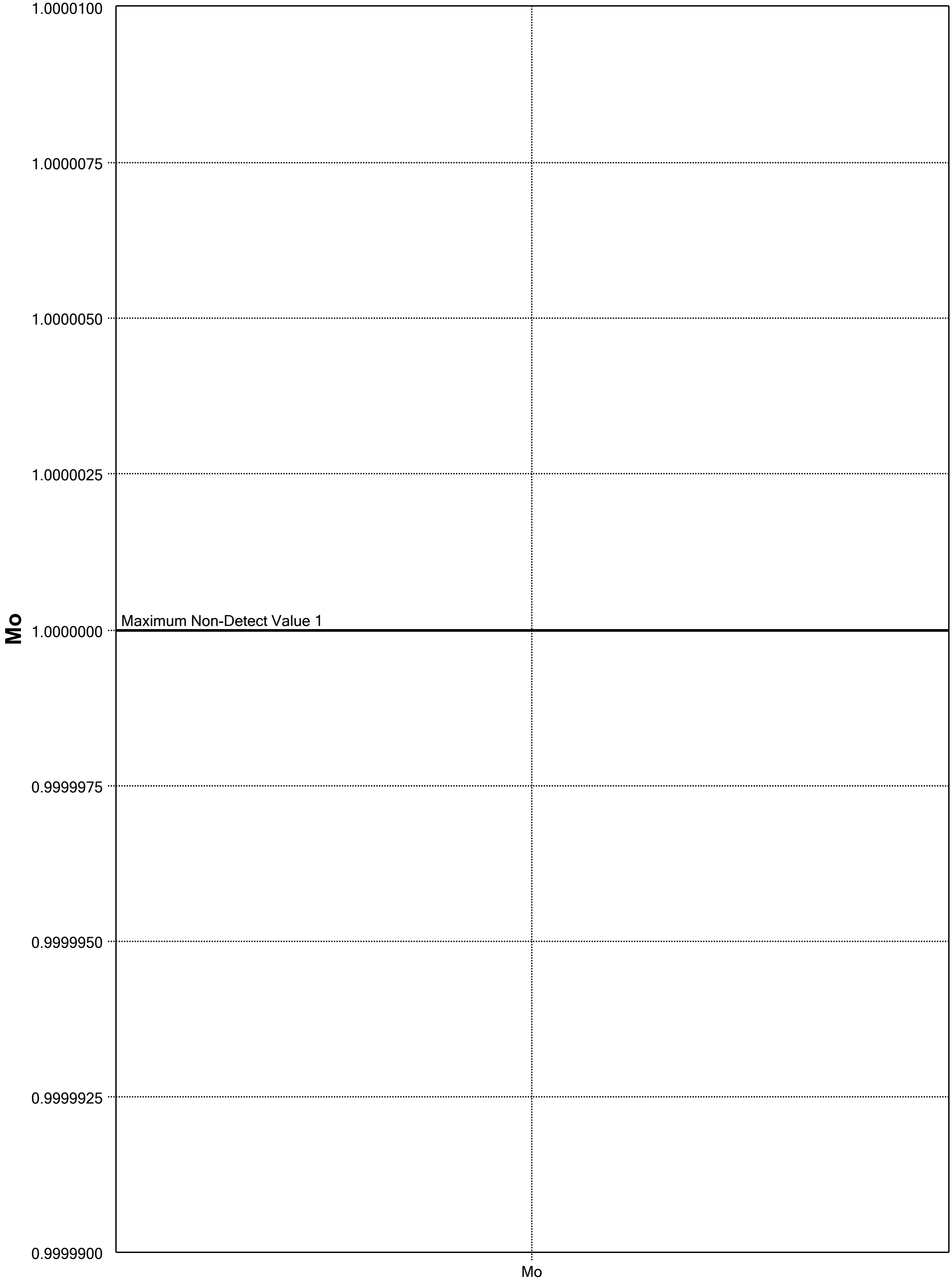
Box Plot for Cu

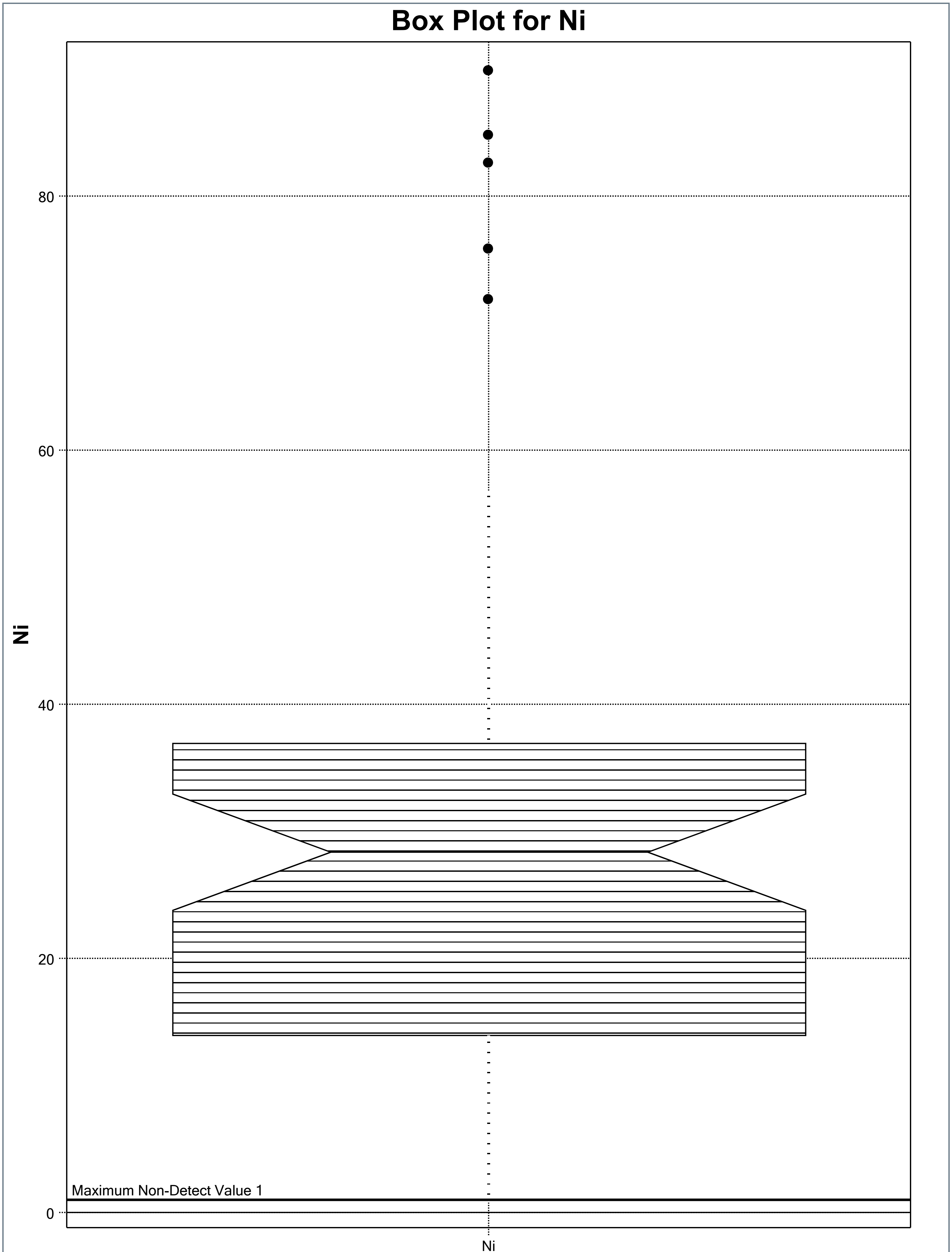


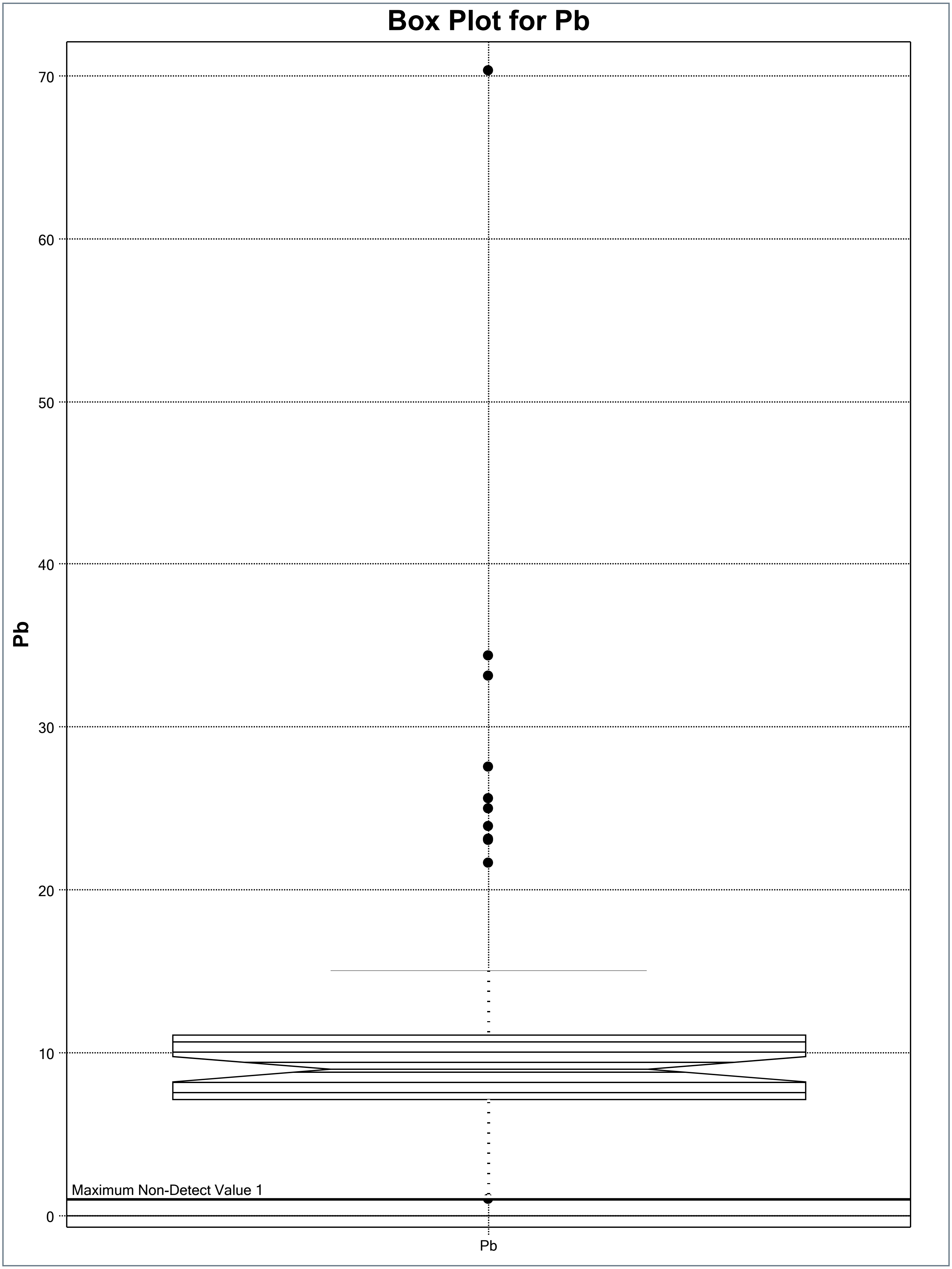
Box Plot for Hg



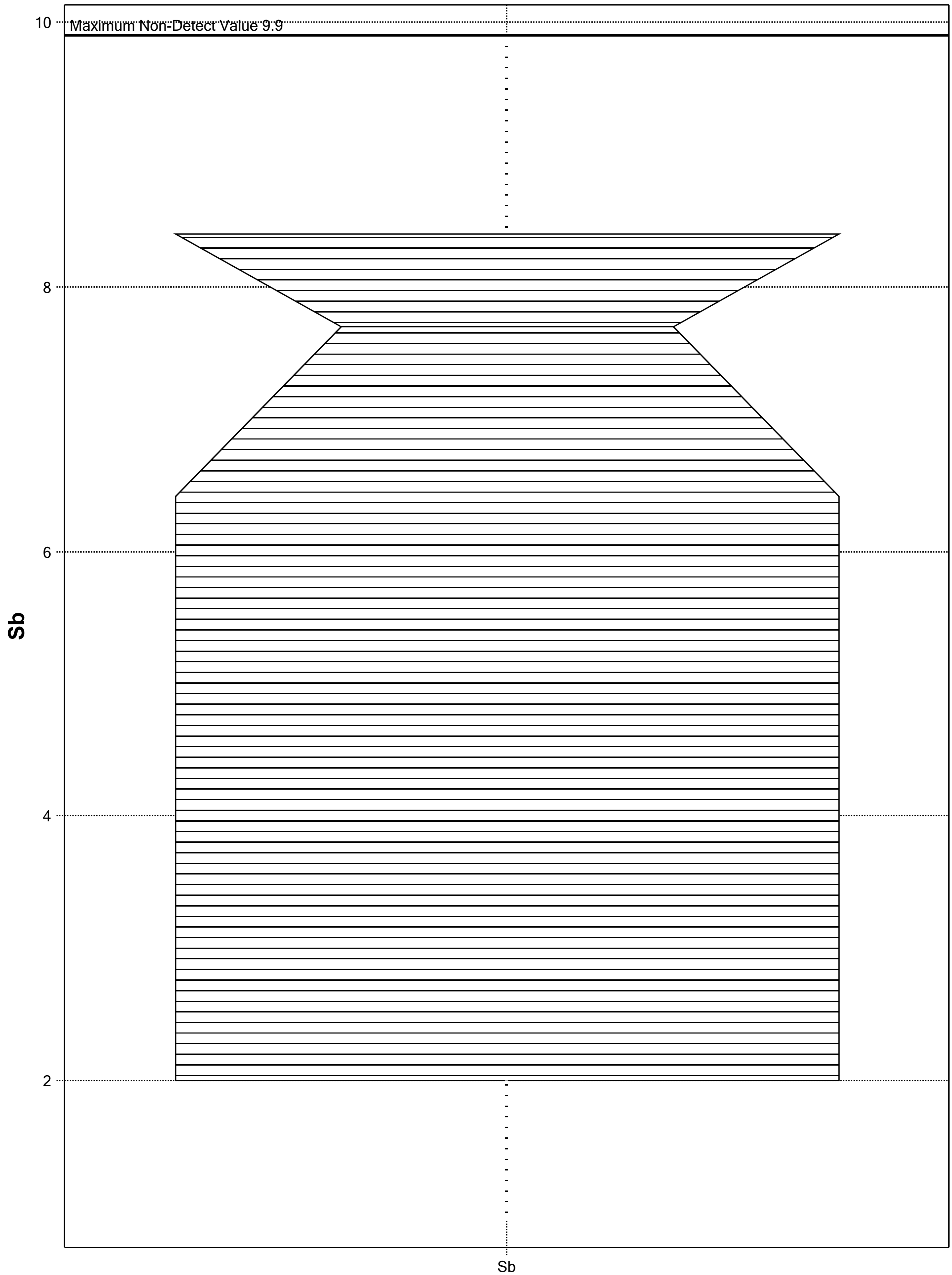
Box Plot for Mo



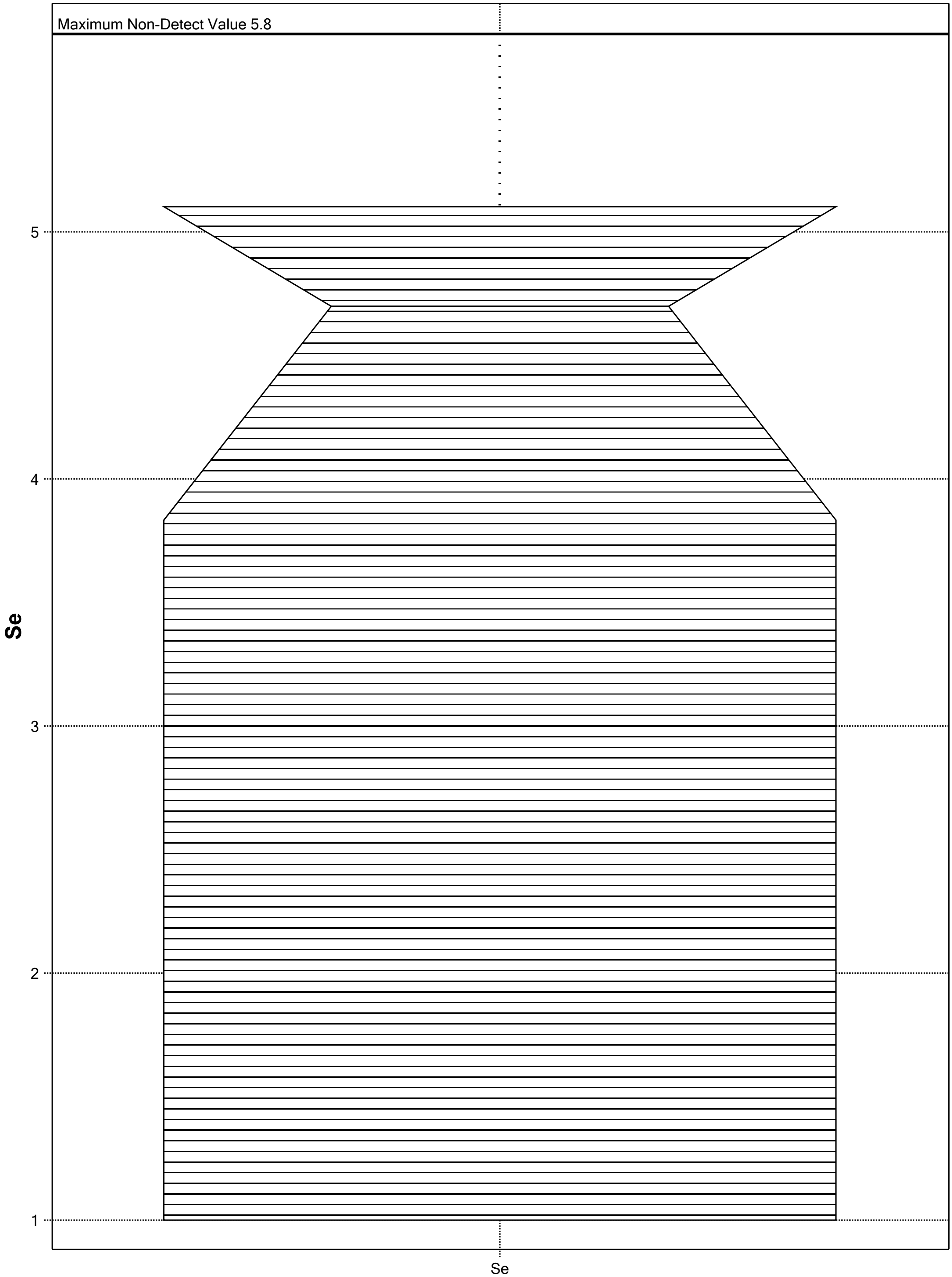

Box Plot for Ni
Ni
80
60
40
20
0
Maximum Non-Detect Value 1
Ni

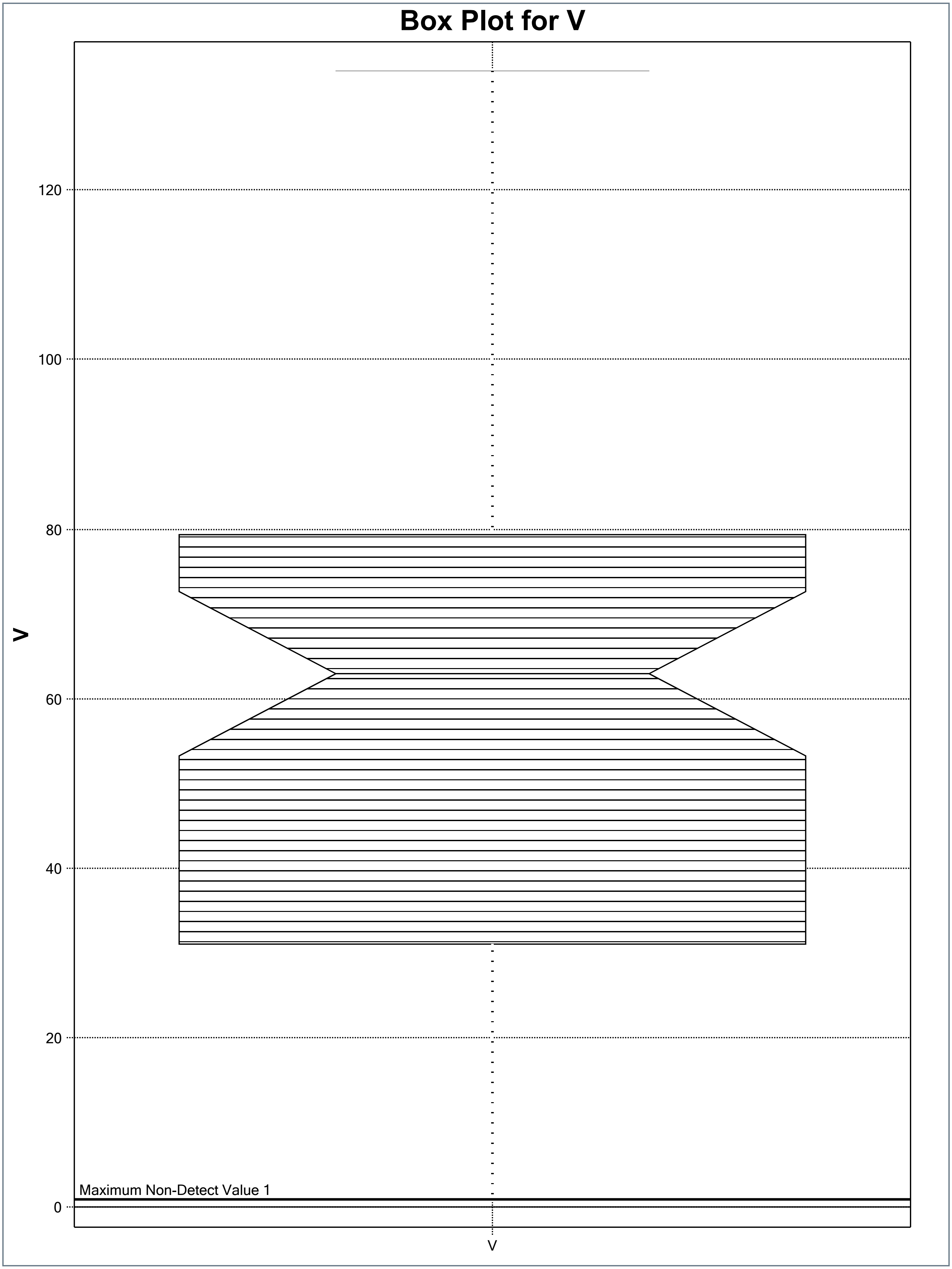

Box Plot for Pb
70
60
50
40
30
20
10
0
Pb
Maximum Non-Detect Value 1
Pb

Box Plot for Sb

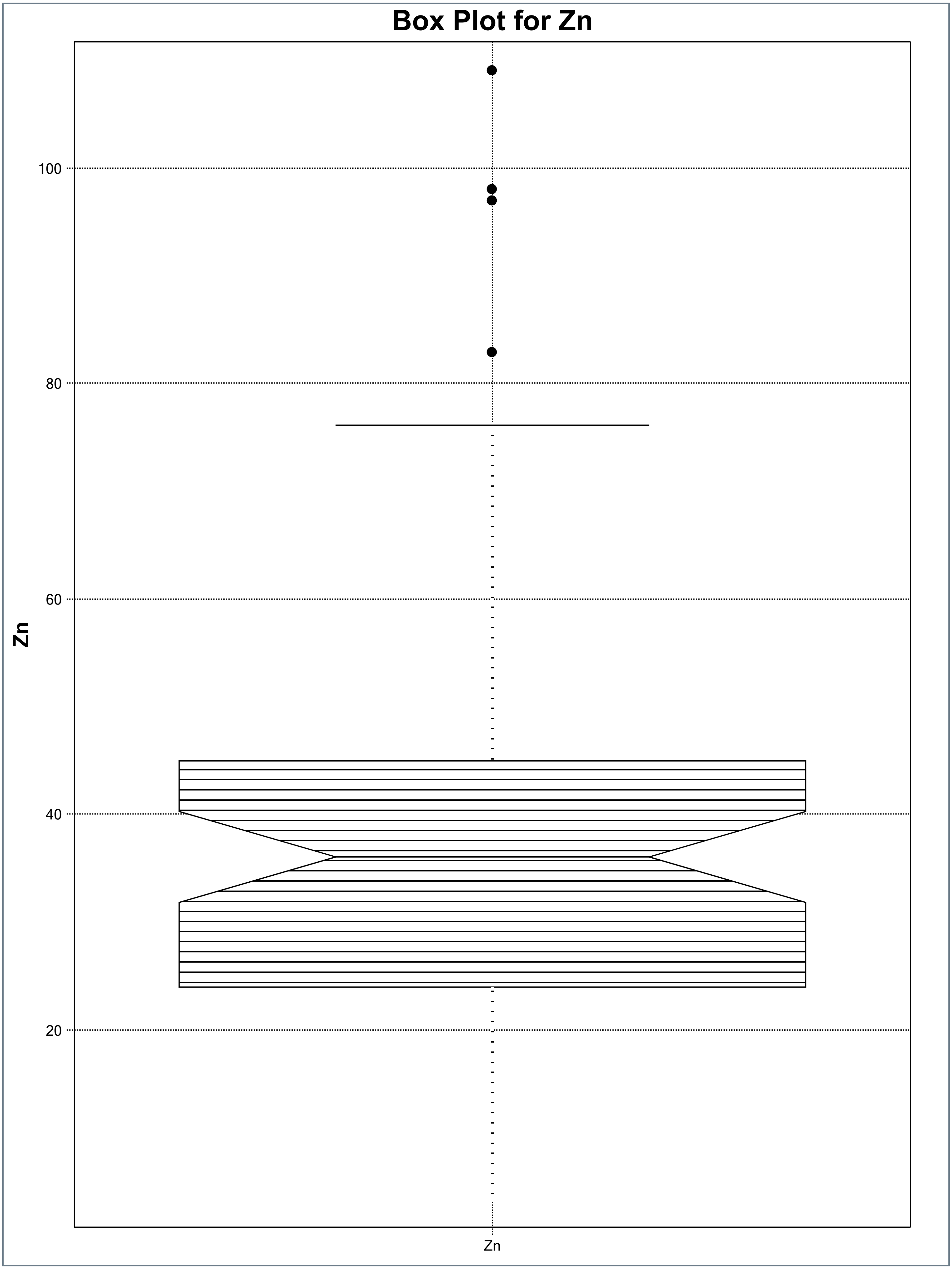


Box Plot for Se

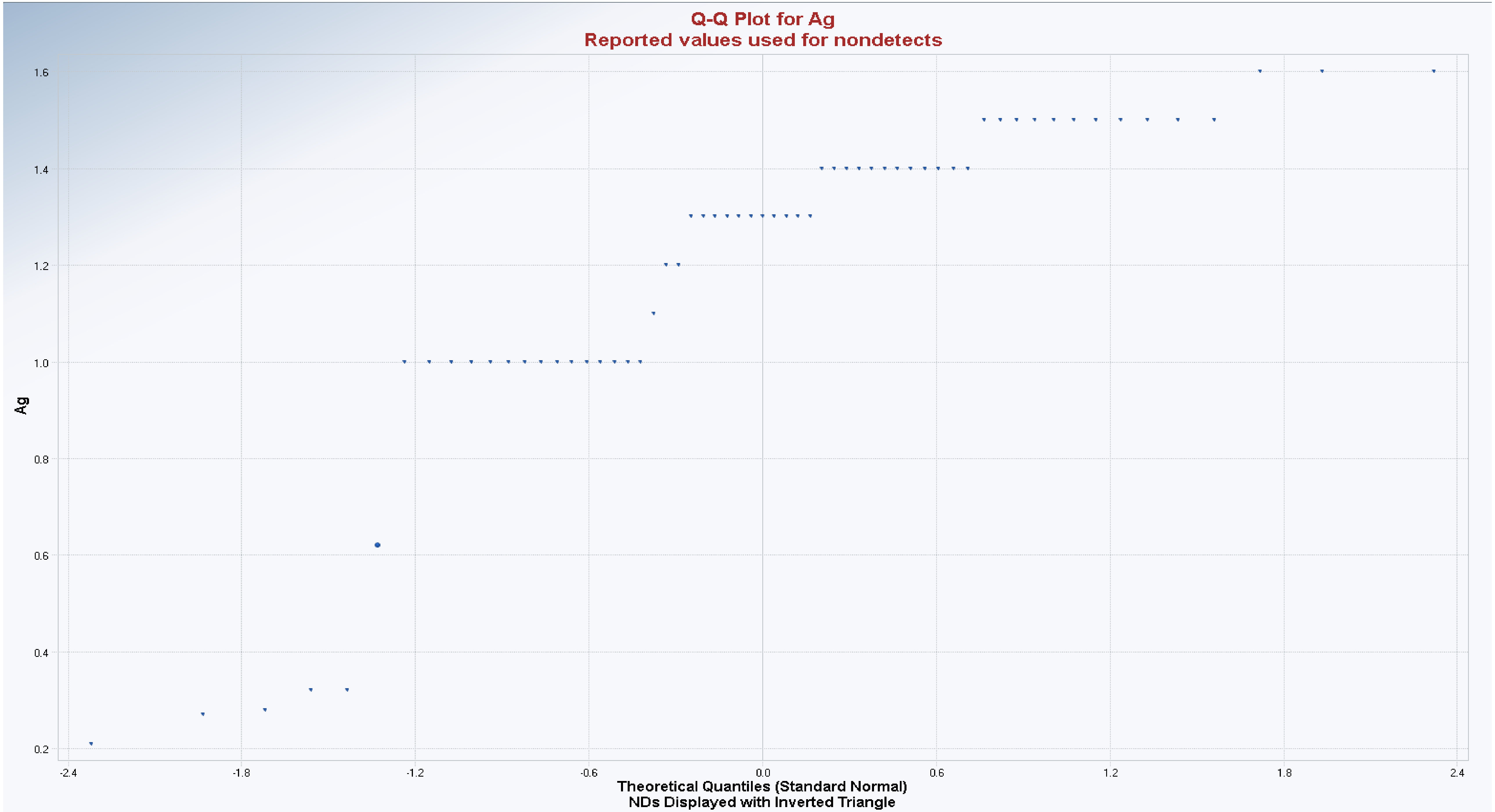


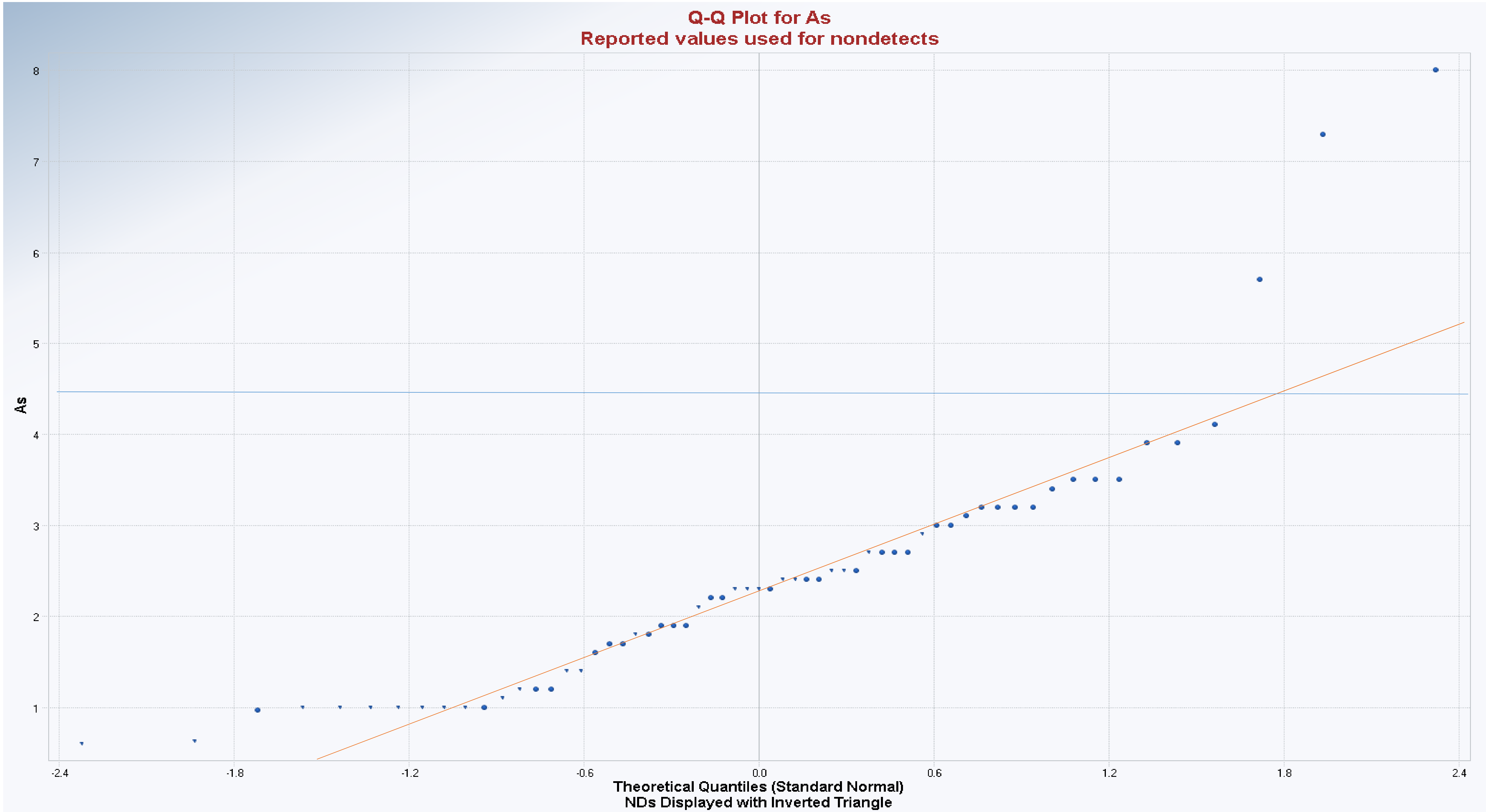


Box Plot for V
V
120
100
80
60
40
20
0
Maximum Non-Detect Value 1
V

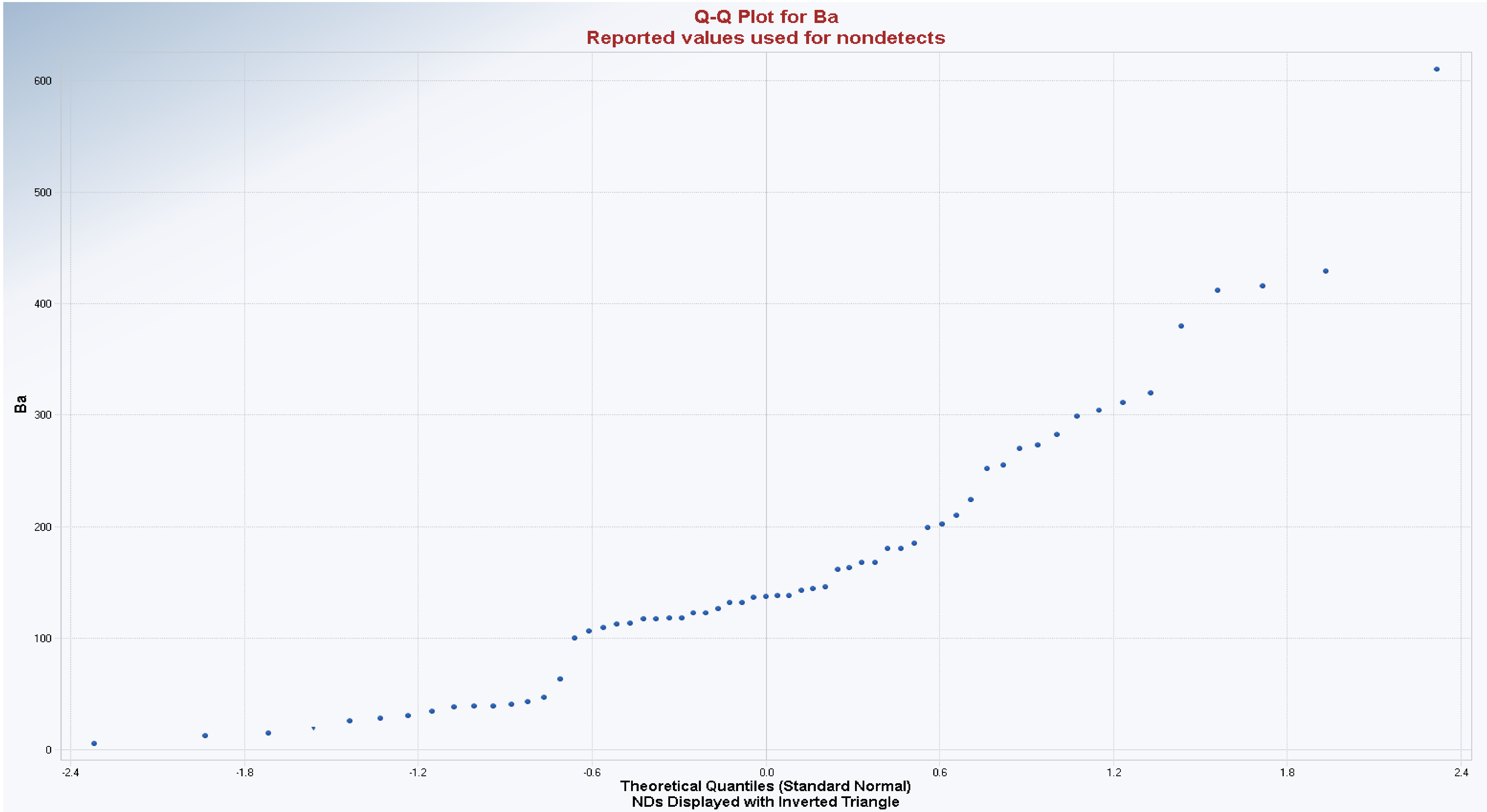


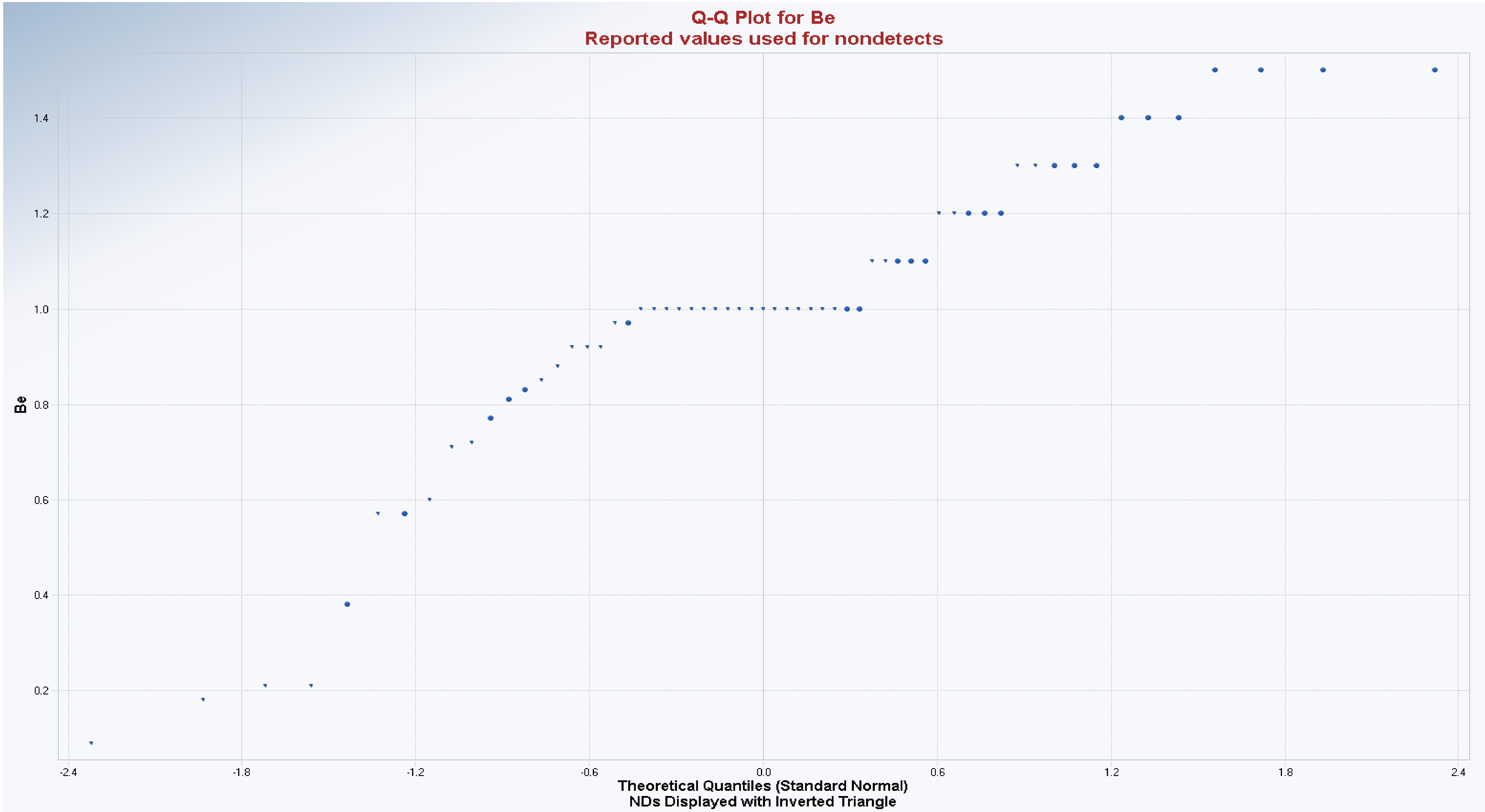
Box Plot for Zn
Zn
100
80
60
40
20
Zn

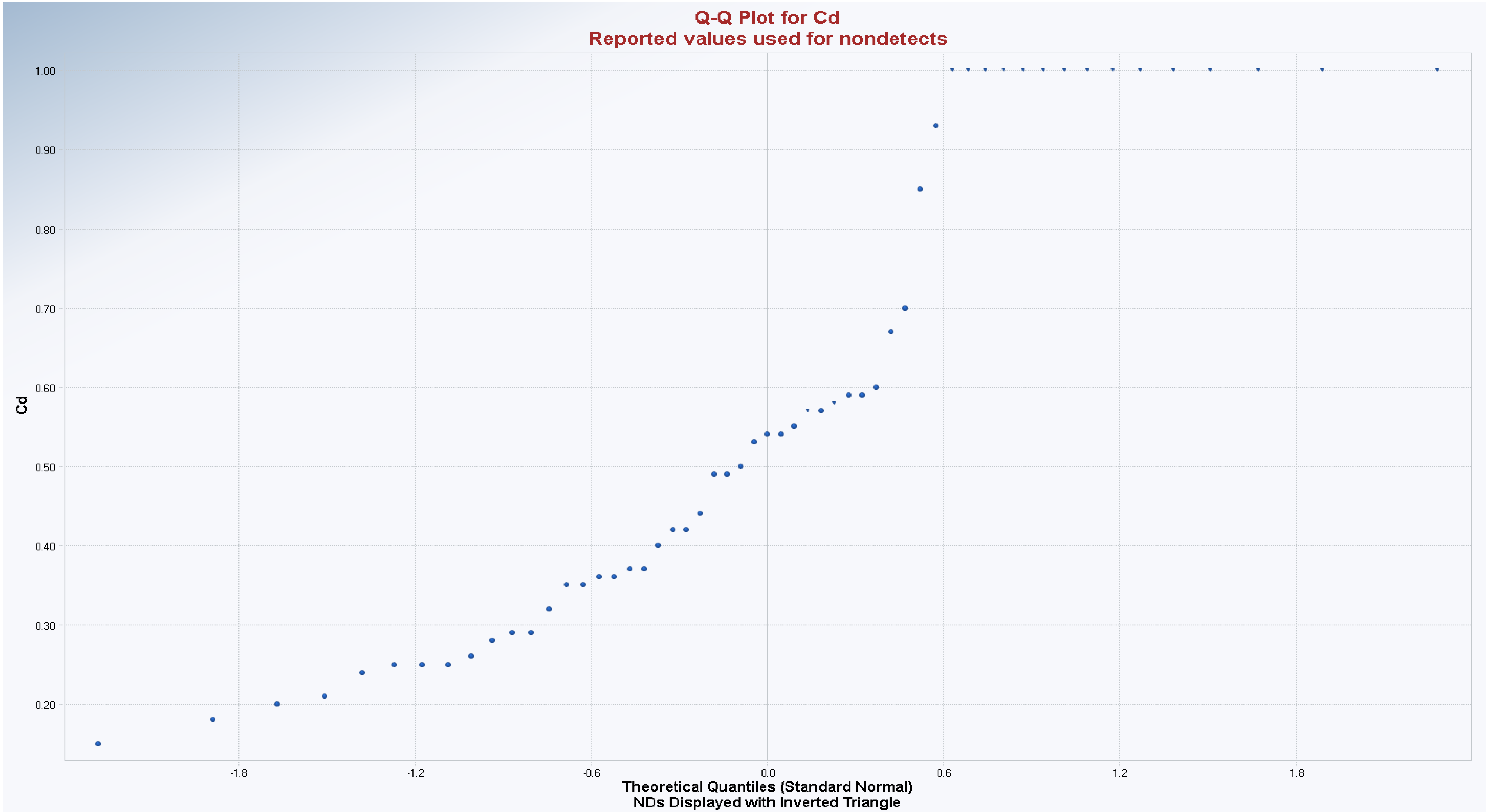

Q-Q Plot for Ag
Reported values used for nondetects
Ag
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle

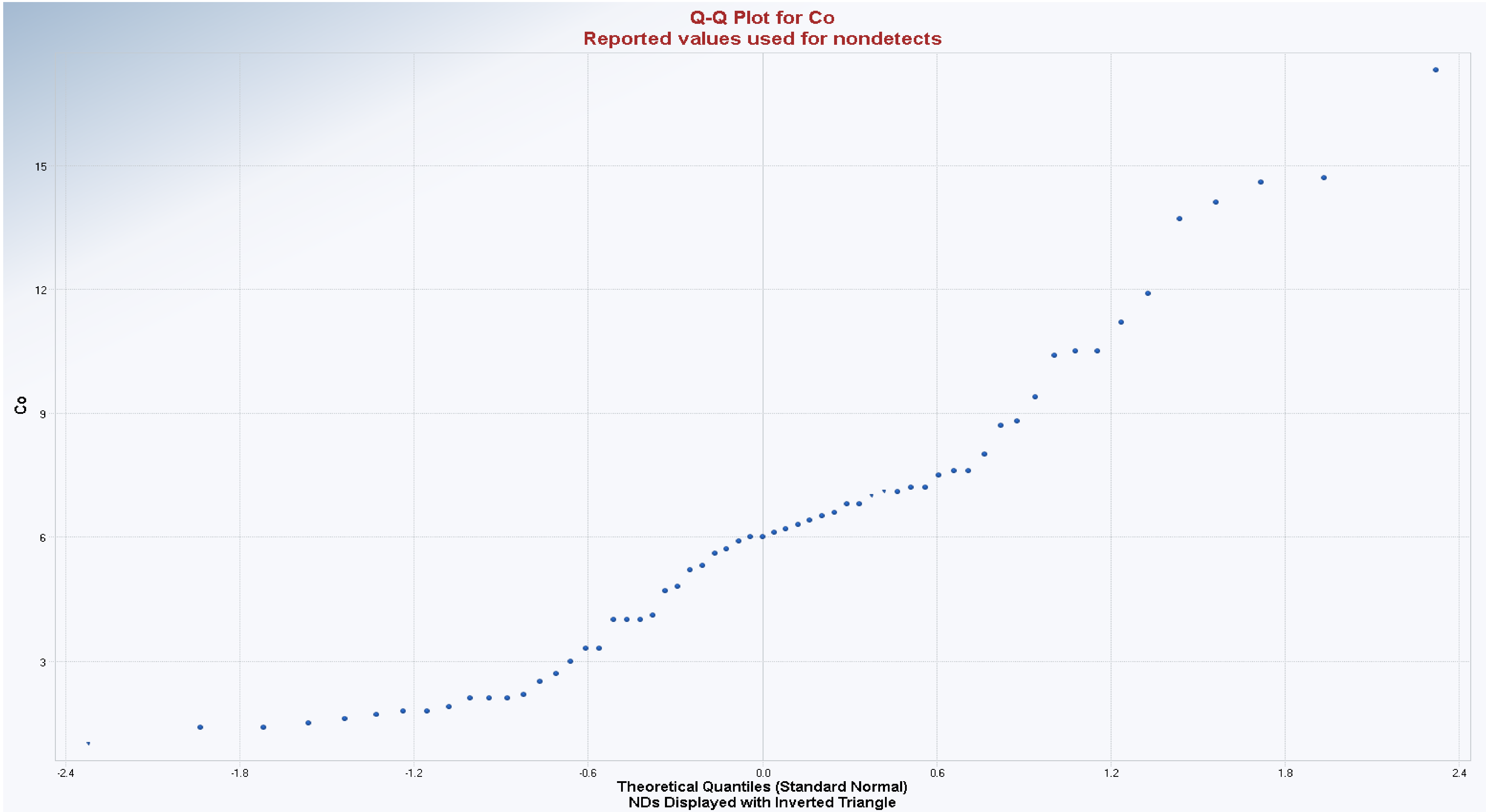


Q-Q Plot for As
Reported values used for nondetects
As
8
7
6
5
4
3
2
1
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle

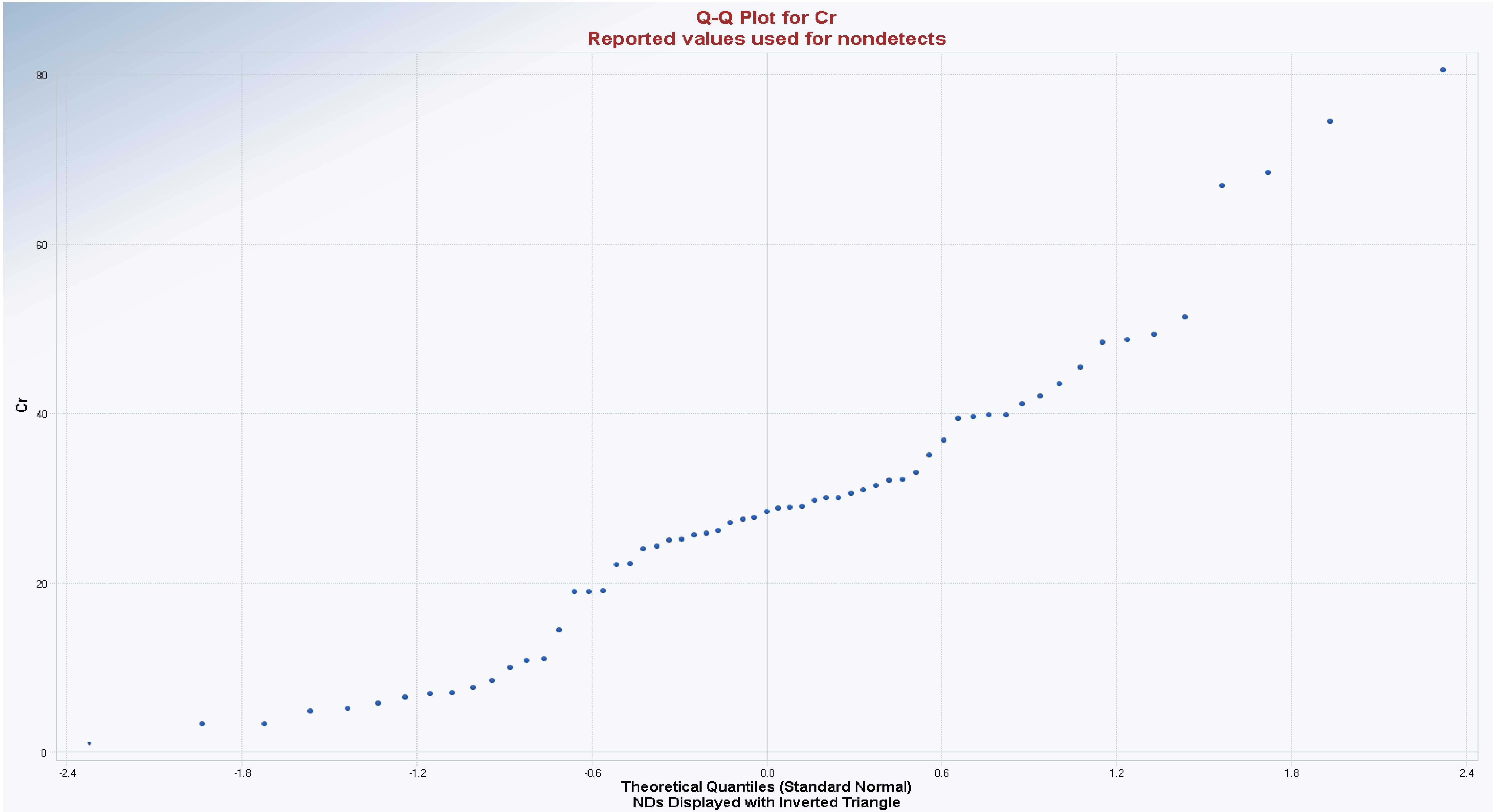

Q-Q Plot for Ba
Reported values used for nondetects
Ba
0
100
200
300
400
500
600
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle


Q-Q Plot for Be
Reported values used for nondetects
Be
1.4
1.2
1.0
0.8
0.6
0.4
0.2
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle

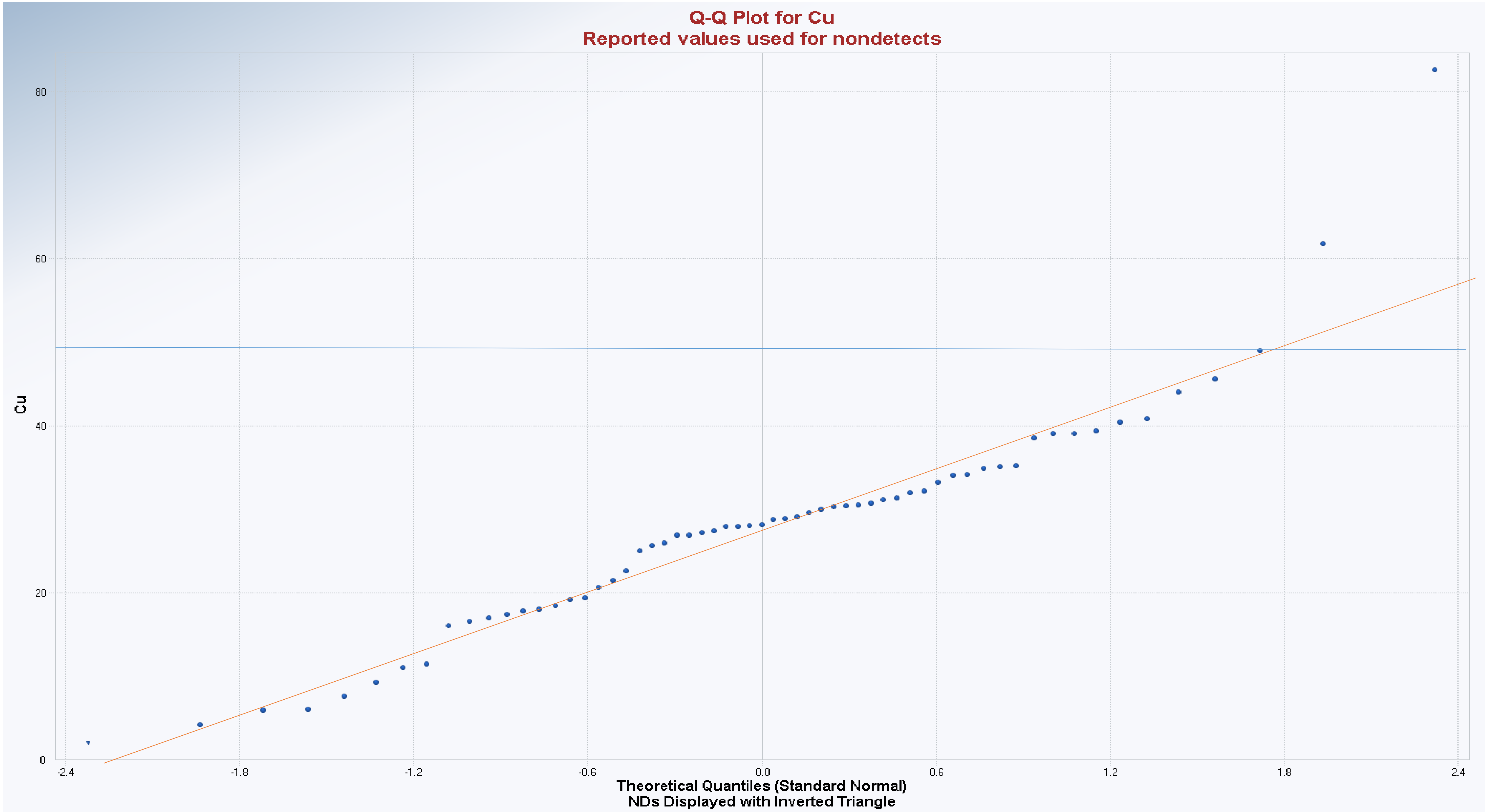

Q-Q Plot for Cd
Reported values used for nondetects
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
Cd
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle

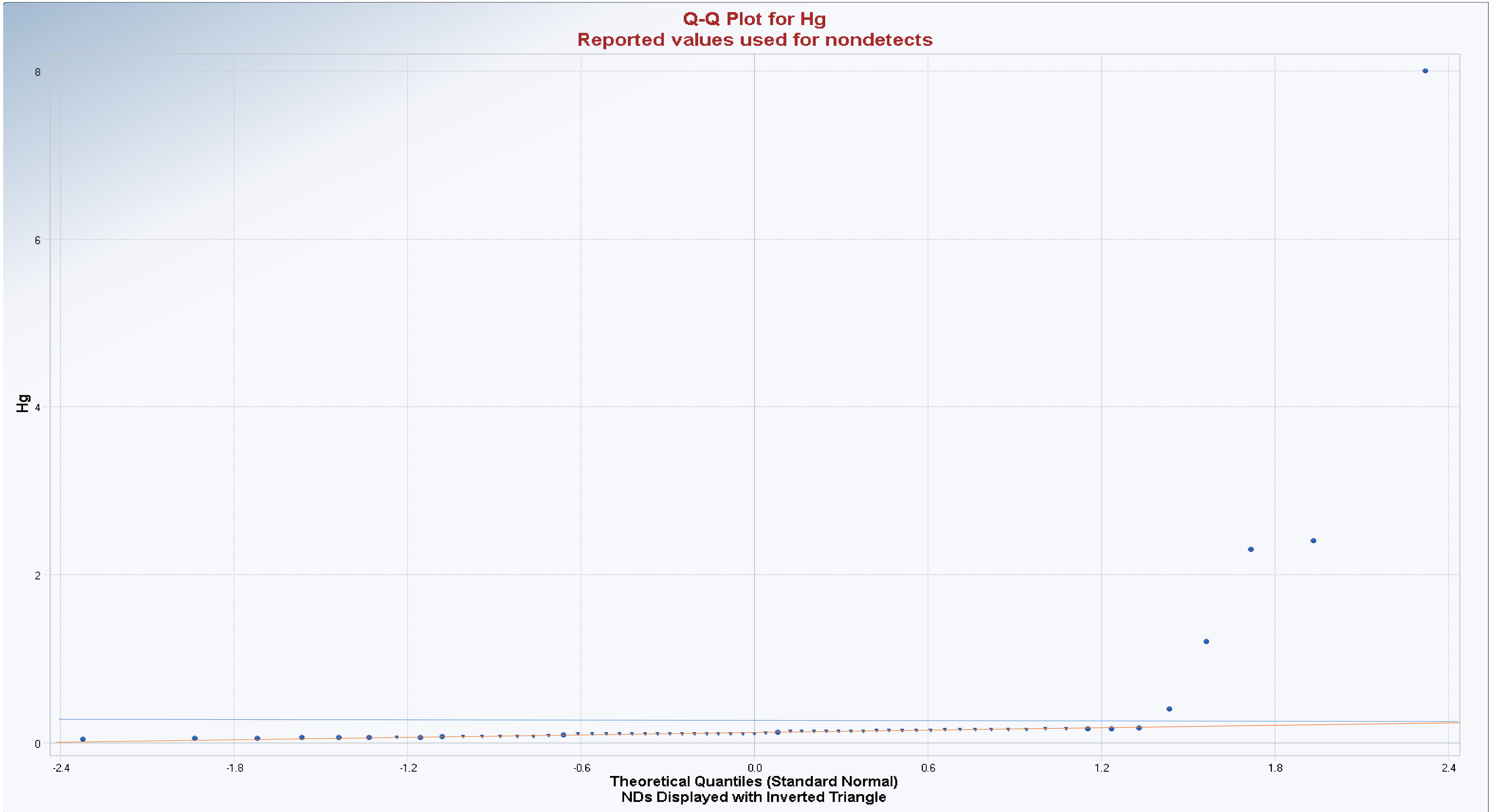


Q-Q Plot for Co
Reported values used for nondetects
Co
15
12
9
6
3
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle

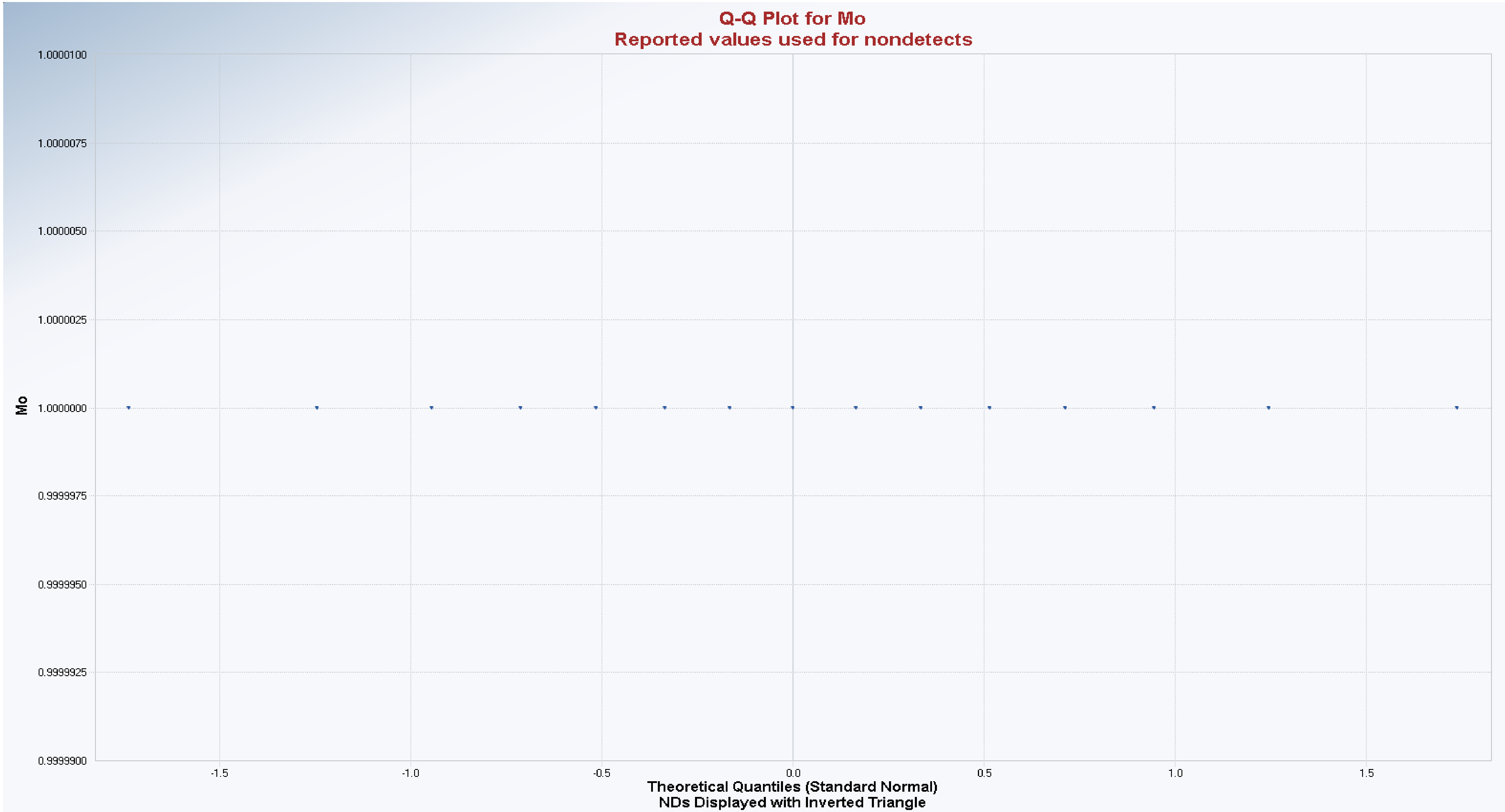


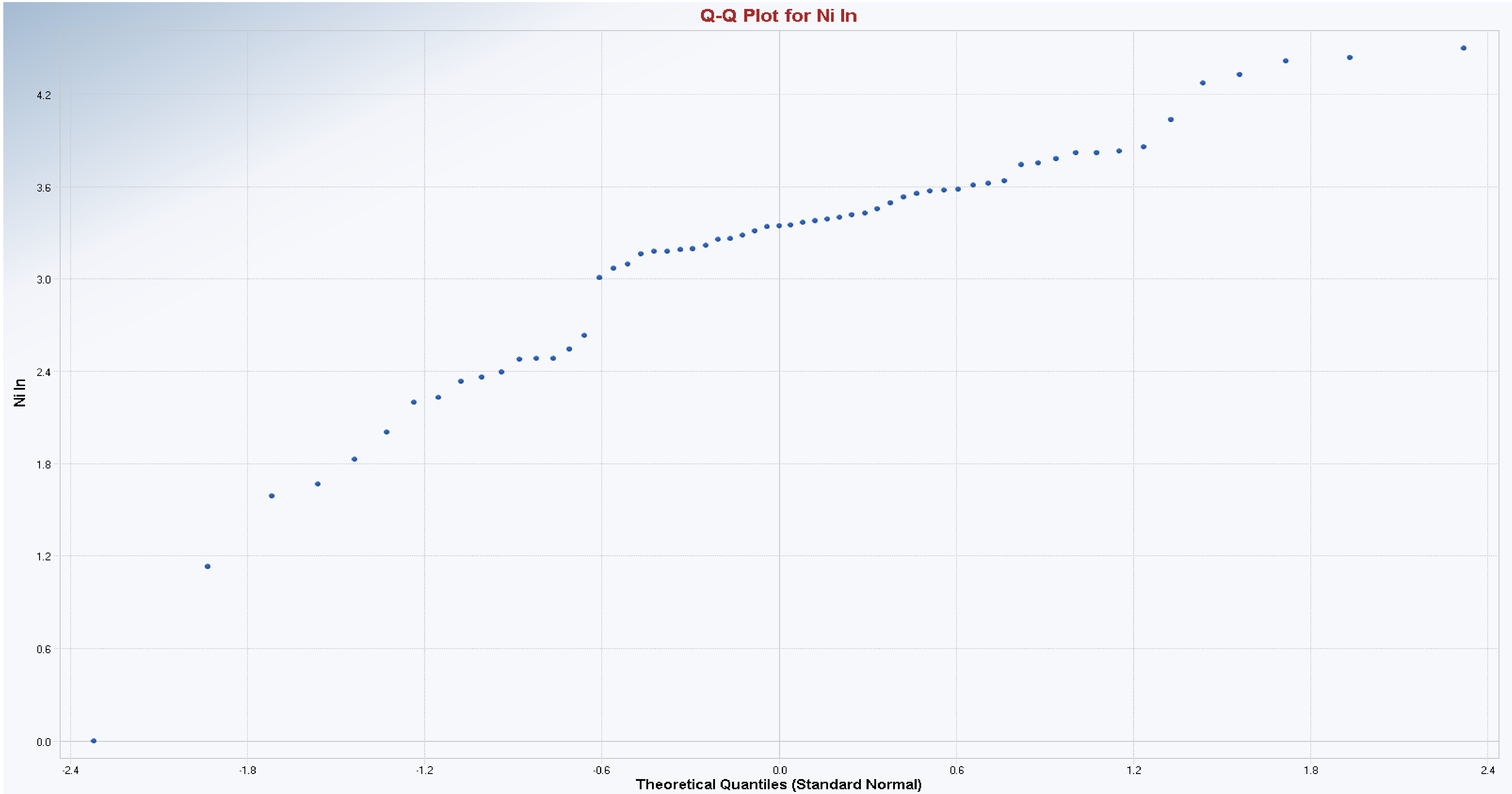
Q-Q Plot for Cr
Reported values used for nondetects
Cr
80
60
40
20
0
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle

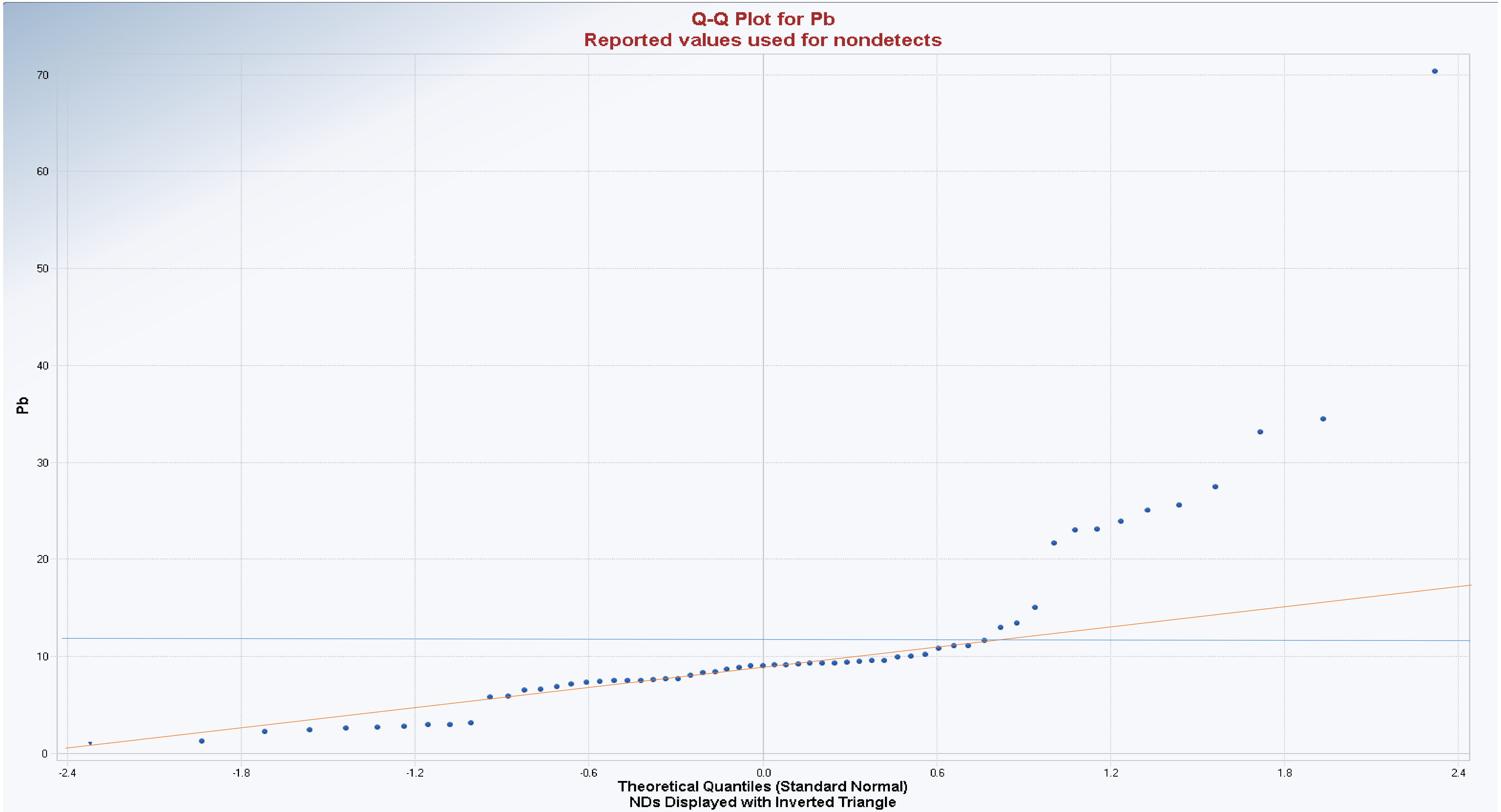

Q-Q Plot for Cu
Reported values used for nondetects
Cu
80
60
40
20
0
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle



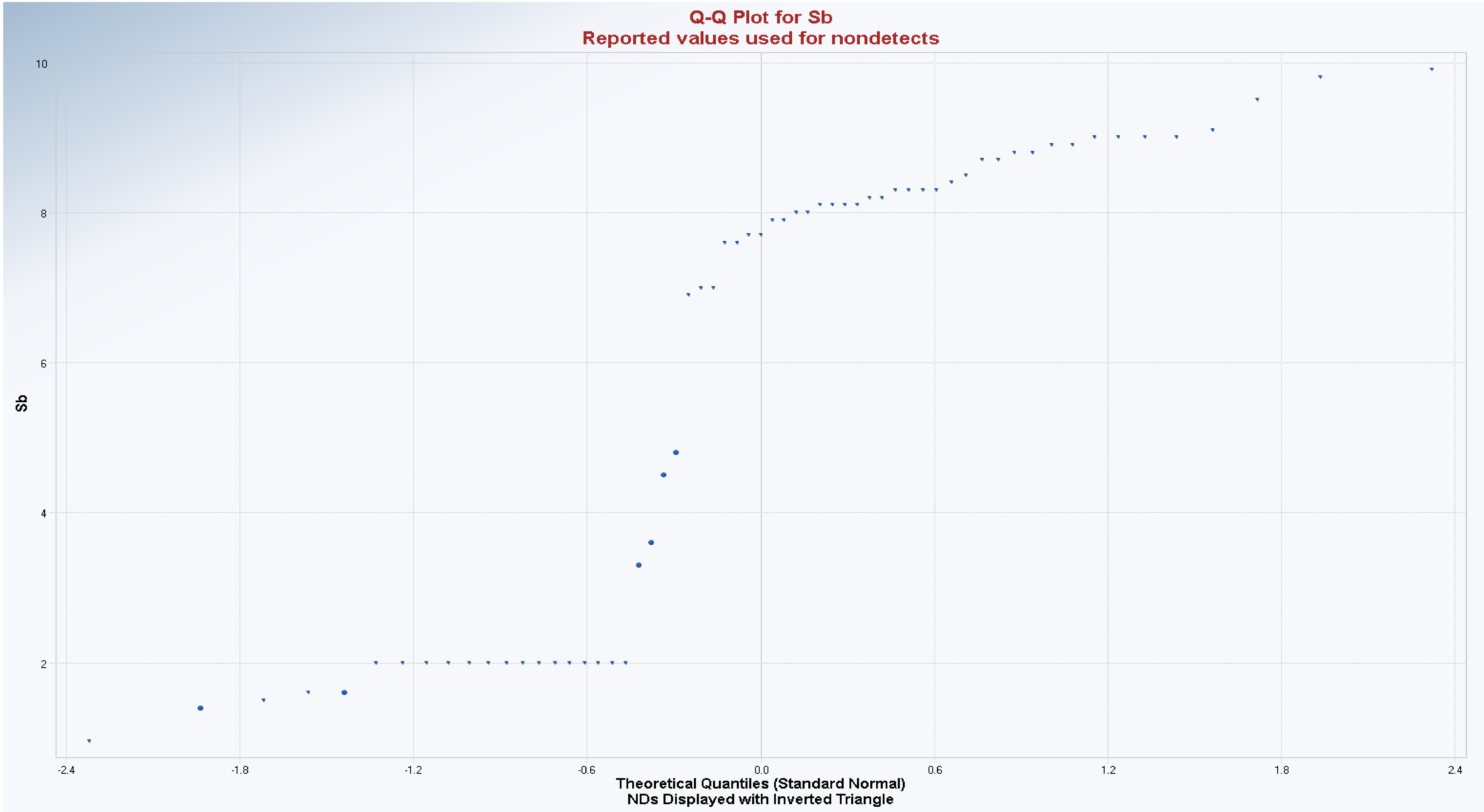
Q-Q Plot for Hg
Reported values used for nondetects
Hg
0
2
4
6
8
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle

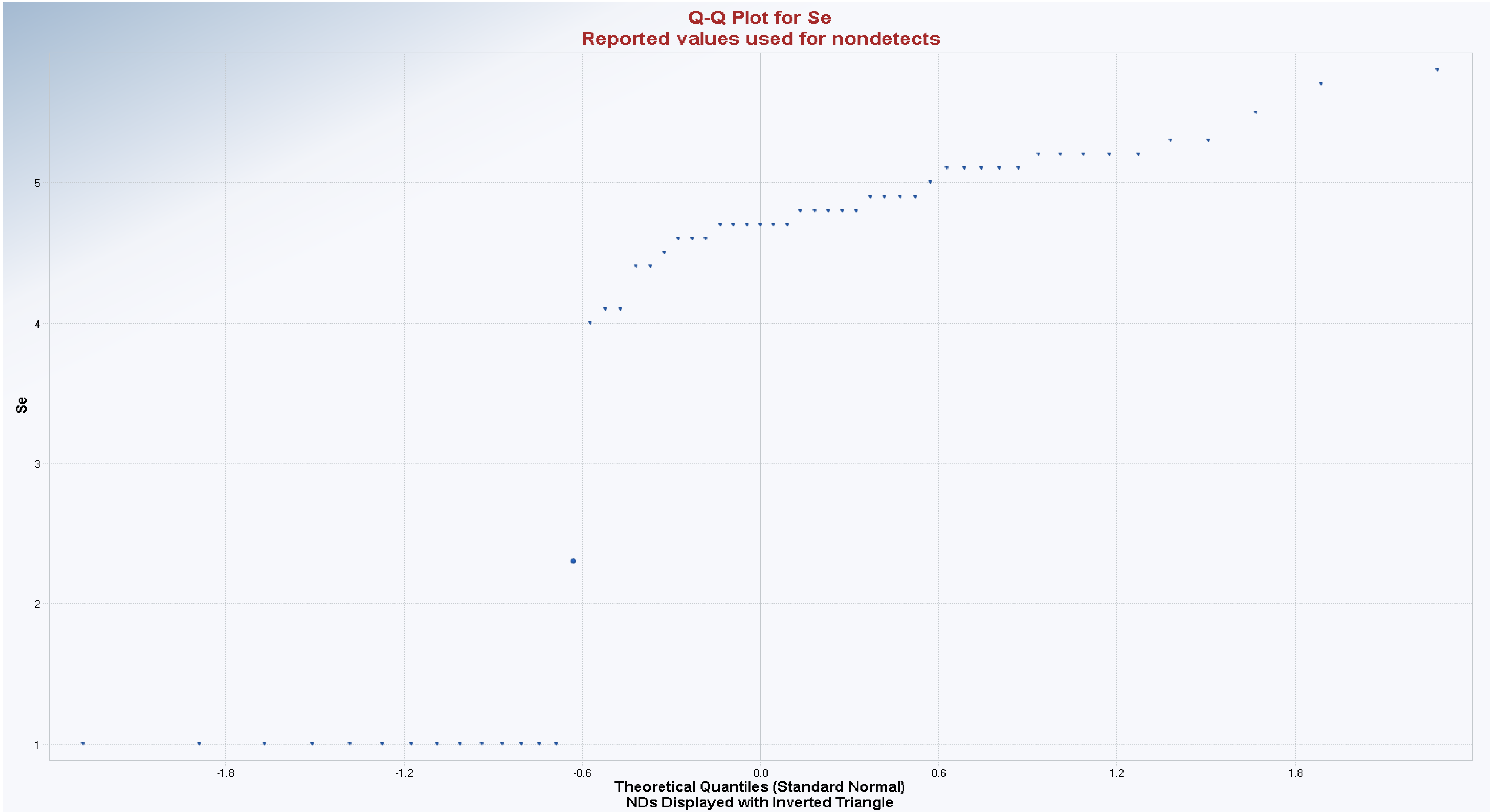

Q-Q Plot for Mo
Reported values used for nondetects
1.0000100
1.0000075
1.0000050
1.0000025
1.0000000
0.9999975
0.9999950
0.9999925
0.9999900
Mo
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle

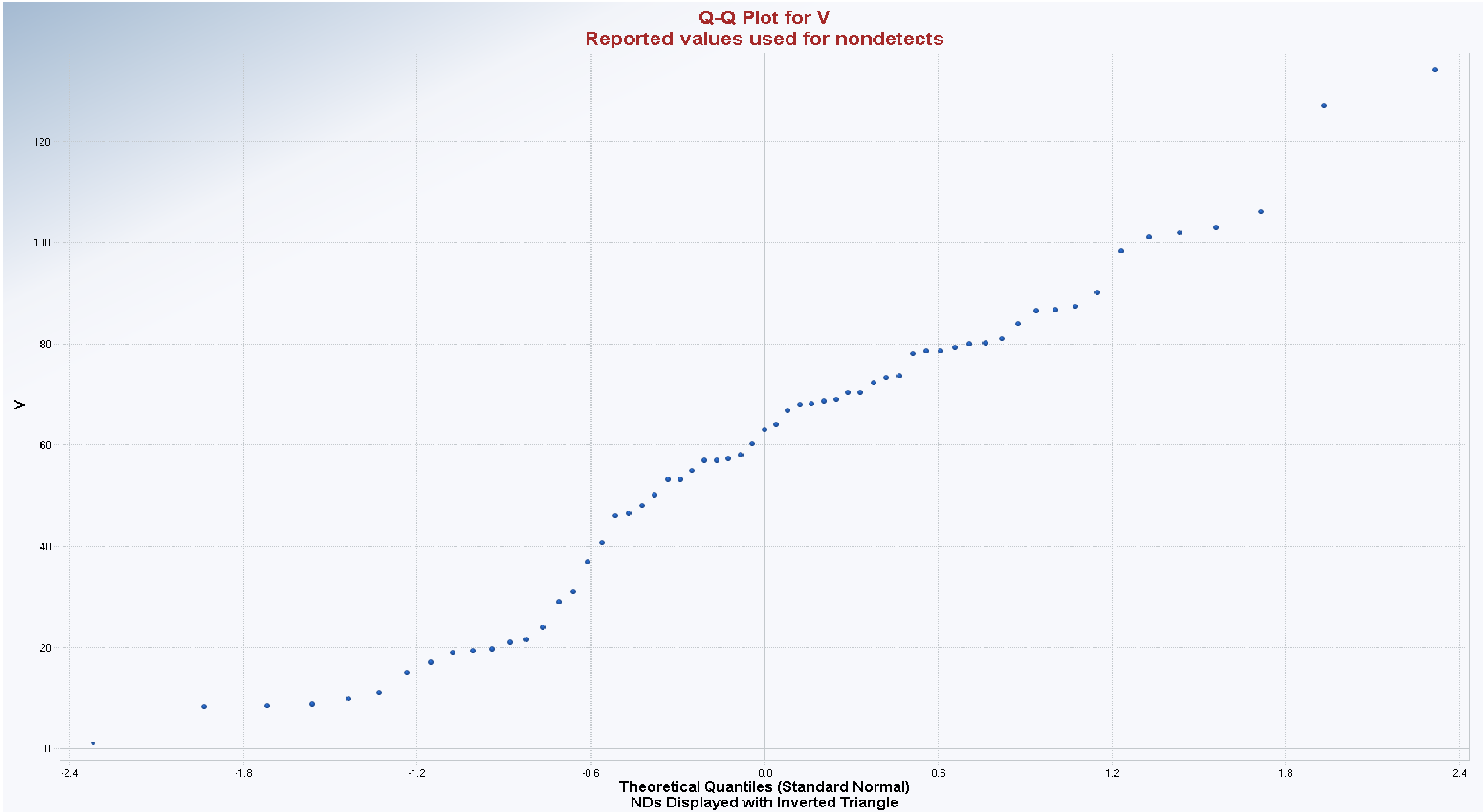

Q-Q Plot for Ni ln
Ni ln
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0.0
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)

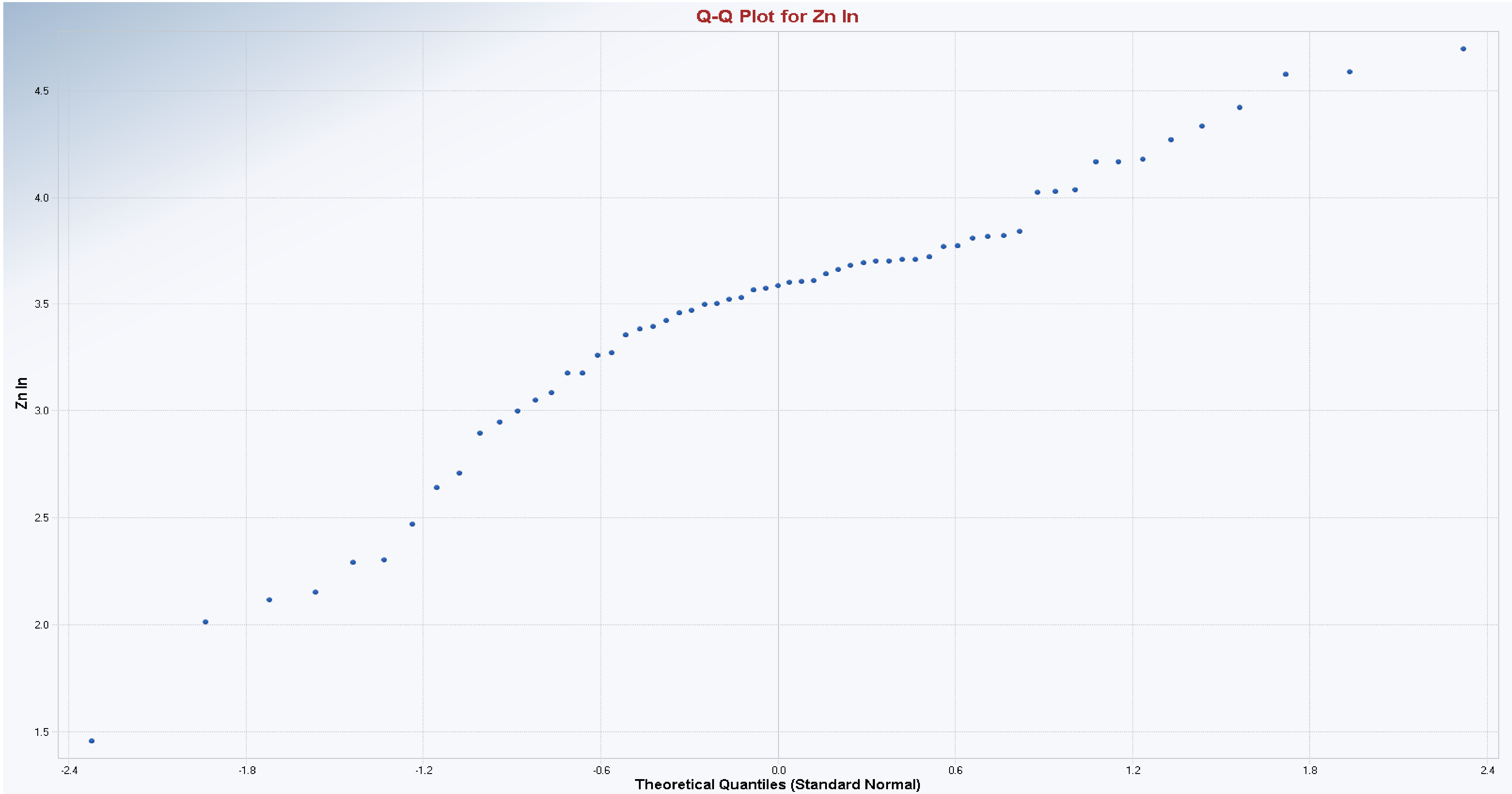


Q-Q Plot for Pb
Reported values used for nondetects
Pb
70
60
50
40
30
20
10
0
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle


Q-Q Plot for Sb
Reported values used for nondetects
Sb
10
8
6
4
2
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle


Q-Q Plot for Se
Reported values used for nondetects
Se
5
4
3
2
1
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle


Q-Q Plot for V
Reported values used for nondetects
V
0
20
40
60
80
100
120
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle


Q-Q Plot for Zn ln
Zn ln
4.5
4.0
3.5
3.0
2.5
2.0
1.5
-2.4
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
2.4
Theoretical Quantiles (Standard Normal)

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.12/28/2018 10:00:40 AM								
5	From File			5034.01 Metals Data.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	Sb											
11												
12	General Statistics											
13	Total Number of Observations					61	Number of Distinct Observations					28
14	Number of Detects					6	Number of Non-Detects					55
15	Number of Distinct Detects					6	Number of Distinct Non-Detects					23
16	Minimum Detect					1.4	Minimum Non-Detect					0.96
17	Maximum Detect					4.8	Maximum Non-Detect					9.9
18	Variance Detects					2.044	Percent Non-Detects					90.16%
19	Mean Detects					3.2	SD Detects					1.43
20	Median Detects					3.45	CV Detects					0.447
21	Skewness Detects					-0.366	Kurtosis Detects					-1.812
22	Mean of Logged Detects					1.059	SD of Logged Detects					0.528
23												
24	Normal GOF Test on Detects Only											
25	Shapiro Wilk Test Statistic					0.896	Shapiro Wilk GOF Test					
26	5% Shapiro Wilk Critical Value					0.788	Detected Data appear Normal at 5% Significance Level					
27	Lilliefors Test Statistic					0.202	Lilliefors GOF Test					
28	5% Lilliefors Critical Value					0.325	Detected Data appear Normal at 5% Significance Level					
29	Detected Data appear Normal at 5% Significance Level											
30												
31	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
32	KM Mean					1.728	KM Standard Error of Mean					0.273
33	KM SD					1.094	95% KM (BCA) UCL					2.229
34	95% KM (t) UCL					2.185	95% KM (Percentile Bootstrap) UCL					2.224
35	95% KM (z) UCL					2.178	95% KM Bootstrap t UCL					2.105
36	90% KM Chebyshev UCL					2.548	95% KM Chebyshev UCL					2.92
37	97.5% KM Chebyshev UCL					3.435	99% KM Chebyshev UCL					4.448
38												
39	Gamma GOF Tests on Detected Observations Only											
40	A-D Test Statistic					0.476	Anderson-Darling GOF Test					
41	5% A-D Critical Value					0.698	Detected data appear Gamma Distributed at 5% Significance Level					
42	K-S Test Statistic					0.253	Kolmogorov-Smirnov GOF					
43	5% K-S Critical Value					0.333	Detected data appear Gamma Distributed at 5% Significance Level					
44	Detected data appear Gamma Distributed at 5% Significance Level											
45												
46	Gamma Statistics on Detected Data Only											
47	k hat (MLE)					4.962	k star (bias corrected MLE)					2.592
48	Theta hat (MLE)					0.645	Theta star (bias corrected MLE)					1.235
49	nu hat (MLE)					59.54	nu star (bias corrected)					31.1
50	Mean (detects)					3.2						
51												
52	Gamma ROS Statistics using Imputed Non-Detects											

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	1.234
Maximum	4.8	Median	1.066
SD	1.072	CV	0.868
k hat (MLE)	0.798	k star (bias corrected MLE)	0.77
Theta hat (MLE)	1.545	Theta star (bias corrected MLE)	1.602
nu hat (MLE)	97.4	nu star (bias corrected)	93.95
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (93.95, α)	72.59	Adjusted Chi Square Value (93.95, β)	72.14
95% Gamma Approximate UCL (use when n>=50)	1.597	95% Gamma Adjusted UCL (use when n<50)	1.607
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	1.728	SD (KM)	1.094
Variance (KM)	1.198	SE of Mean (KM)	0.273
k hat (KM)	2.494	k star (KM)	2.383
nu hat (KM)	304.3	nu star (KM)	290.7
theta hat (KM)	0.693	theta star (KM)	0.725
80% gamma percentile (KM)	2.534	90% gamma percentile (KM)	3.228
95% gamma percentile (KM)	3.883	99% gamma percentile (KM)	5.321
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (290.68, α)	252.2	Adjusted Chi Square Value (290.68, β)	251.3
95% Gamma Approximate KM-UCL (use when n>=50)	1.992	95% Gamma Adjusted KM-UCL (use when n<50)	1.999
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.267	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	1.456	Mean in Log Scale	0.239
SD in Original Scale	0.866	SD in Log Scale	0.515
95% t UCL (assumes normality of ROS data)	1.642	95% Percentile Bootstrap UCL	1.644
95% BCA Bootstrap UCL	1.665	95% Bootstrap t UCL	1.69
95% H-UCL (Log ROS)	1.642		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	0.408	KM Geo Mean	1.504
KM SD (logged)	0.483	95% Critical H Value (KM-Log)	1.85
KM Standard Error of Mean (logged)	0.148	95% H-UCL (KM -Log)	1.896
KM SD (logged)	0.483	95% Critical H Value (KM-Log)	1.85
KM Standard Error of Mean (logged)	0.148		
DL/2 Statistics			
DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.129	Mean in Log Scale	0.949

SD in Original Scale	1.537	SD in Log Scale	0.7
95% t UCL (Assumes normality)	3.458	95% H-Stat UCL	3.957
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Normal Distributed at 5% Significance Level			
Suggested UCL to Use			
95% KM (t) UCL	2.185		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
As			
General Statistics			
Total Number of Observations	61	Number of Distinct Observations	28
Number of Detects	37	Number of Non-Detects	24
Number of Distinct Detects	22	Number of Distinct Non-Detects	13
Minimum Detect	0.97	Minimum Non-Detect	0.6
Maximum Detect	8	Maximum Non-Detect	2.9
Variance Detects	2.289	Percent Non-Detects	39.34%
Mean Detects	2.91	SD Detects	1.513
Median Detects	2.7	CV Detects	0.52
Skewness Detects	1.754	Kurtosis Detects	4.028
Mean of Logged Detects	0.955	SD of Logged Detects	0.479
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.842	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.936	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.186	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.144	Detected Data Not Normal at 5% Significance Level	
Detected Data Not Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	2.135	KM Standard Error of Mean	0.205
KM SD	1.539	95% KM (BCA) UCL	2.487
95% KM (t) UCL	2.477	95% KM (Percentile Bootstrap) UCL	2.485
95% KM (z) UCL	2.472	95% KM Bootstrap t UCL	2.522
90% KM Chebyshev UCL	2.75	95% KM Chebyshev UCL	3.029
97.5% KM Chebyshev UCL	3.416	99% KM Chebyshev UCL	4.176
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.519	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.751	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.125	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.145	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			

k hat (MLE)	4.584	k star (bias corrected MLE)	4.23
Theta hat (MLE)	0.635	Theta star (bias corrected MLE)	0.688
nu hat (MLE)	339.2	nu star (bias corrected)	313
Mean (detects)	2.91		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	1.992
Maximum	8	Median	1.7
SD	1.667	CV	0.837
k hat (MLE)	0.944	k star (bias corrected MLE)	0.909
Theta hat (MLE)	2.11	Theta star (bias corrected MLE)	2.192
nu hat (MLE)	115.2	nu star (bias corrected)	110.9
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (110.86, α)	87.56	Adjusted Chi Square Value (110.86, β)	87.06
95% Gamma Approximate UCL (use when n>=50)	2.522	95% Gamma Adjusted UCL (use when n<50)	2.537
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	2.135	SD (KM)	1.539
Variance (KM)	2.369	SE of Mean (KM)	0.205
k hat (KM)	1.923	k star (KM)	1.84
nu hat (KM)	234.7	nu star (KM)	224.5
theta hat (KM)	1.11	theta star (KM)	1.16
80% gamma percentile (KM)	3.227	90% gamma percentile (KM)	4.234
95% gamma percentile (KM)	5.2	99% gamma percentile (KM)	7.352
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (224.46, α)	190.8	Adjusted Chi Square Value (224.46, β)	190
95% Gamma Approximate KM-UCL (use when n>=50)	2.511	95% Gamma Adjusted KM-UCL (use when n<50)	2.521
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.936	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.105	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.144	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	2.177	Mean in Log Scale	0.583
SD in Original Scale	1.499	SD in Log Scale	0.621
95% t UCL (assumes normality of ROS data)	2.497	95% Percentile Bootstrap UCL	2.496
95% BCA Bootstrap UCL	2.542	95% Bootstrap t UCL	2.574
95% H-UCL (Log ROS)	2.537		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	0.514	KM Geo Mean	1.673
KM SD (logged)	0.712	95% Critical H Value (KM-Log)	2.014
KM Standard Error of Mean (logged)	0.104	95% H-UCL (KM -Log)	2.593

	A	B	C	D	E	F	G	H	I	J	K	L
209					KM SD (logged)	0.712					95% Critical H Value (KM-Log)	2.014
210					KM Standard Error of Mean (logged)	0.104						
211												
212						DL/2 Statistics						
213				DL/2 Normal					DL/2 Log-Transformed			
214					Mean in Original Scale	2.089					Mean in Log Scale	0.462
215					SD in Original Scale	1.575					SD in Log Scale	0.78
216					95% t UCL (Assumes normality)	2.426					95% H-Stat UCL	2.649
217						DL/2 is not a recommended method, provided for comparisons and historical reasons						
218												
219						Nonparametric Distribution Free UCL Statistics						
220						Detected Data appear Gamma Distributed at 5% Significance Level						
221												
222						Suggested UCL to Use						
223					95% KM Approximate Gamma UCL	2.511					95% GROS Approximate Gamma UCL	2.522
224												
225						Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
226						Recommendations are based upon data size, data distribution, and skewness.						
227						These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).						
228						However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.						
229												
230	Ba											
231												
232						General Statistics						
233					Total Number of Observations	61					Number of Distinct Observations	54
234					Number of Detects	60					Number of Non-Detects	1
235					Number of Distinct Detects	53					Number of Distinct Non-Detects	1
236					Minimum Detect	5.5					Minimum Non-Detect	18.3
237					Maximum Detect	610					Maximum Non-Detect	18.3
238					Variance Detects	14692					Percent Non-Detects	1.639%
239					Mean Detects	165.6					SD Detects	121.2
240					Median Detects	137.5					CV Detects	0.732
241					Skewness Detects	1.261					Kurtosis Detects	2.109
242					Mean of Logged Detects	4.779					SD of Logged Detects	0.945
243												
244						Normal GOF Test on Detects Only						
245					Shapiro Wilk Test Statistic	0.901			Normal GOF Test on Detected Observations Only			
246					5% Shapiro Wilk P Value	4.4060E-5			Detected Data Not Normal at 5% Significance Level			
247					Lilliefors Test Statistic	0.148			Lilliefors GOF Test			
248					5% Lilliefors Critical Value	0.114			Detected Data Not Normal at 5% Significance Level			
249						Detected Data Not Normal at 5% Significance Level						
250												
251						Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs						
252					KM Mean	163.1					KM Standard Error of Mean	15.6
253					KM SD	120.8					95% KM (BCA) UCL	189
254					95% KM (t) UCL	189.1					95% KM (Percentile Bootstrap) UCL	188.6
255					95% KM (z) UCL	188.7					95% KM Bootstrap t UCL	191.6
256					90% KM Chebyshev UCL	209.9					95% KM Chebyshev UCL	231.1
257					97.5% KM Chebyshev UCL	260.5					99% KM Chebyshev UCL	318.3
258												
259						Gamma GOF Tests on Detected Observations Only						
260					A-D Test Statistic	0.79			Anderson-Darling GOF Test			

	A	B	C	D	E	F	G	H	I	J	K	L
261					5% A-D Critical Value	0.767	Detected Data Not Gamma Distributed at 5% Significance Level					
262					K-S Test Statistic	0.145	**Kolmogorov-Smirnov GOF**					
263					5% K-S Critical Value	0.117	Detected Data Not Gamma Distributed at 5% Significance Level					
264	**Detected Data Not Gamma Distributed at 5% Significance Level**											
265												
266	**Gamma Statistics on Detected Data Only**											
267					k hat (MLE)	1.658					k star (bias corrected MLE)	1.586
268					Theta hat (MLE)	99.9					Theta star (bias corrected MLE)	104.4
269					nu hat (MLE)	198.9					nu star (bias corrected)	190.3
270					Mean (detects)	165.6						
271												
272	**Gamma ROS Statistics using Imputed Non-Detects**											
273	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
274	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
275	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
276	This is especially true when the sample size is small.											
277	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
278					Minimum	5.5					Mean	163.1
279					Maximum	610					Median	137
280					SD	121.7					CV	0.746
281					k hat (MLE)	1.578					k star (bias corrected MLE)	1.511
282					Theta hat (MLE)	103.4					Theta star (bias corrected MLE)	108
283					nu hat (MLE)	192.5					nu star (bias corrected)	184.3
284					Adjusted Level of Significance (β)	0.0461						
285					Approximate Chi Square Value (184.33, α)	153.9					Adjusted Chi Square Value (184.33, β)	153.3
286					95% Gamma Approximate UCL (use when n>=50)	195.4					95% Gamma Adjusted UCL (use when n<50)	196.2
287												
288	**Estimates of Gamma Parameters using KM Estimates**											
289					Mean (KM)	163.1					SD (KM)	120.8
290					Variance (KM)	14598					SE of Mean (KM)	15.6
291					k hat (KM)	1.821					k star (KM)	1.743
292					nu hat (KM)	222.2					nu star (KM)	212.6
293					theta hat (KM)	89.52					theta star (KM)	93.56
294					80% gamma percentile (KM)	248.1					90% gamma percentile (KM)	327.7
295					95% gamma percentile (KM)	404.2					99% gamma percentile (KM)	575.5
296												
297	**Gamma Kaplan-Meier (KM) Statistics**											
298					Approximate Chi Square Value (212.62, α)	179.9					Adjusted Chi Square Value (212.62, β)	179.2
299					95% Gamma Approximate KM-UCL (use when n>=50)	192.7					95% Gamma Adjusted KM-UCL (use when n<50)	193.5
300												
301	**Lognormal GOF Test on Detected Observations Only**											
302					Shapiro Wilk Approximate Test Statistic	0.918	**Shapiro Wilk GOF Test**					
303					5% Shapiro Wilk P Value	4.6544E-4	Detected Data Not Lognormal at 5% Significance Level					
304					Lilliefors Test Statistic	0.201	**Lilliefors GOF Test**					
305					5% Lilliefors Critical Value	0.114	Detected Data Not Lognormal at 5% Significance Level					
306	**Detected Data Not Lognormal at 5% Significance Level**											
307												
308	**Lognormal ROS Statistics Using Imputed Non-Detects**											
309					Mean in Original Scale	163.2					Mean in Log Scale	4.749
310					SD in Original Scale	121.6					SD in Log Scale	0.965
311					95% t UCL (assumes normality of ROS data)	189.2					95% Percentile Bootstrap UCL	190.5
312					95% BCA Bootstrap UCL	192.7					95% Bootstrap t UCL	193.5

	A–E	F	G–K	L
313	95% H-UCL (Log ROS)	242.7		
314				
315	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
316	KM Mean (logged)	4.738	KM Geo Mean	114.2
317	KM SD (logged)	0.983	95% Critical H Value (KM-Log)	2.24
318	KM Standard Error of Mean (logged)	0.127	95% H-UCL (KM -Log)	245.9
319	KM SD (logged)	0.983	95% Critical H Value (KM-Log)	2.24
320	KM Standard Error of Mean (logged)	0.127		
321				
322	DL/2 Statistics			
323	DL/2 Normal		DL/2 Log-Transformed	
324	Mean in Original Scale	163	Mean in Log Scale	4.737
325	SD in Original Scale	121.9	SD in Log Scale	0.993
326	95% t UCL (Assumes normality)	189.1	95% H-Stat UCL	248.9
327	DL/2 is not a recommended method, provided for comparisons and historical reasons			
328				
329	Nonparametric Distribution Free UCL Statistics			
330	Data do not follow a Discernible Distribution at 5% Significance Level			
331				
332	Suggested UCL to Use			
333	95% KM (Chebyshev) UCL	231.1		
334				
335	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
336	Recommendations are based upon data size, data distribution, and skewness.			
337	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
338	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
339				
340	Be			
341				
342	General Statistics			
343	Total Number of Observations	61	Number of Distinct Observations	21
344	Number of Detects	24	Number of Non-Detects	37
345	Number of Distinct Detects	12	Number of Distinct Non-Detects	15
346	Minimum Detect	0.38	Minimum Non-Detect	0.09
347	Maximum Detect	1.5	Maximum Non-Detect	1.3
348	Variance Detects	0.0924	Percent Non-Detects	60.66%
349	Mean Detects	1.139	SD Detects	0.304
350	Median Detects	1.2	CV Detects	0.267
351	Skewness Detects	-0.828	Kurtosis Detects	0.273
352	Mean of Logged Detects	0.0847	SD of Logged Detects	0.334
353				
354	Normal GOF Test on Detects Only			
355	Shapiro Wilk Test Statistic	0.926	Shapiro Wilk GOF Test	
356	5% Shapiro Wilk Critical Value	0.916	Detected Data appear Normal at 5% Significance Level	
357	Lilliefors Test Statistic	0.121	Lilliefors GOF Test	
358	5% Lilliefors Critical Value	0.177	Detected Data appear Normal at 5% Significance Level	
359	Detected Data appear Normal at 5% Significance Level			
360				
361	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
362	KM Mean	0.65	KM Standard Error of Mean	0.0847
363	KM SD	0.5	95% KM (BCA) UCL	0.818
364	95% KM (t) UCL	0.792	95% KM (Percentile Bootstrap) UCL	0.8

95% KM (z) UCL	0.79	95% KM Bootstrap t UCL	0.785
90% KM Chebyshev UCL	0.904	95% KM Chebyshev UCL	1.02
97.5% KM Chebyshev UCL	1.179	99% KM Chebyshev UCL	1.493

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.885	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.744	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.161	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.178	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	11.22	k star (bias corrected MLE)	9.843
Theta hat (MLE)	0.102	Theta star (bias corrected MLE)	0.116
nu hat (MLE)	538.4	nu star (bias corrected)	472.5
Mean (detects)	1.139		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.185	Mean	0.794
Maximum	1.5	Median	0.738
SD	0.362	CV	0.457
k hat (MLE)	4.844	k star (bias corrected MLE)	4.617
Theta hat (MLE)	0.164	Theta star (bias corrected MLE)	0.172
nu hat (MLE)	591	nu star (bias corrected)	563.3
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (563.29, α)	509.2	Adjusted Chi Square Value (563.29, β)	508
95% Gamma Approximate UCL (use when n>=50)	0.878	95% Gamma Adjusted UCL (use when n<50)	0.88

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.65	SD (KM)	0.5
Variance (KM)	0.25	SE of Mean (KM)	0.0847
k hat (KM)	1.694	k star (KM)	1.621
nu hat (KM)	206.6	nu star (KM)	197.8
theta hat (KM)	0.384	theta star (KM)	0.401
80% gamma percentile (KM)	0.998	90% gamma percentile (KM)	1.33
95% gamma percentile (KM)	1.651	99% gamma percentile (KM)	2.373

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (197.78, α)	166.2	Adjusted Chi Square Value (197.78, β)	165.5
95% Gamma Approximate KM-UCL (use when n>=50)	0.774	95% Gamma Adjusted KM-UCL (use when n<50)	0.777

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.835	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.916	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.179	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.177	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.791	Mean in Log Scale	-0.329
SD in Original Scale	0.355	SD in Log Scale	0.436
95% t UCL (assumes normality of ROS data)	0.867	95% Percentile Bootstrap UCL	0.864
95% BCA Bootstrap UCL	0.868	95% Bootstrap t UCL	0.874
95% H-UCL (Log ROS)	0.877		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.926	KM Geo Mean	0.396
KM SD (logged)	1.137	95% Critical H Value (KM-Log)	2.293
KM Standard Error of Mean (logged)	0.235	95% H-UCL (KM -Log)	1.058
KM SD (logged)	1.137	95% Critical H Value (KM-Log)	2.293
KM Standard Error of Mean (logged)	0.235		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.718	Mean in Log Scale	-0.526
SD in Original Scale	0.406	SD in Log Scale	0.708
95% t UCL (Assumes normality)	0.805	95% H-Stat UCL	0.912

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.792

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cd

General Statistics

Total Number of Observations	55	Number of Distinct Observations	30
Number of Detects	38	Number of Non-Detects	17
Number of Distinct Detects	28	Number of Distinct Non-Detects	3
Minimum Detect	0.15	Minimum Non-Detect	0.57
Maximum Detect	0.93	Maximum Non-Detect	1
Variance Detects	0.0331	Percent Non-Detects	30.91%
Mean Detects	0.425	SD Detects	0.182
Median Detects	0.385	CV Detects	0.428
Skewness Detects	0.809	Kurtosis Detects	0.528
Mean of Logged Detects	-0.945	SD of Logged Detects	0.434

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.938	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.119	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.142	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level			

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.422	KM Standard Error of Mean	0.0288
KM SD	0.178	95% KM (BCA) UCL	0.465
95% KM (t) UCL	0.47	95% KM (Percentile Bootstrap) UCL	0.469
95% KM (z) UCL	0.469	95% KM Bootstrap t UCL	0.475
90% KM Chebyshev UCL	0.508	95% KM Chebyshev UCL	0.547
97.5% KM Chebyshev UCL	0.601	99% KM Chebyshev UCL	0.708

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.234	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0818	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.143	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	5.755	k star (bias corrected MLE)	5.318
Theta hat (MLE)	0.0739	Theta star (bias corrected MLE)	0.0799
nu hat (MLE)	437.4	nu star (bias corrected)	404.2
Mean (detects)	0.425		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.15	Mean	0.42
Maximum	0.93	Median	0.37
SD	0.172	CV	0.41
k hat (MLE)	6.233	k star (bias corrected MLE)	5.905
Theta hat (MLE)	0.0674	Theta star (bias corrected MLE)	0.0711
nu hat (MLE)	685.6	nu star (bias corrected)	649.5
Adjusted Level of Significance (β)	0.0456		
Approximate Chi Square Value (649.52, α)	591.4	Adjusted Chi Square Value (649.52, β)	589.9
95% Gamma Approximate UCL (use when n>=50)	0.461	95% Gamma Adjusted UCL (use when n<50)	0.462

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.422	SD (KM)	0.178
Variance (KM)	0.0315	SE of Mean (KM)	0.0288
k hat (KM)	5.637	k star (KM)	5.341
nu hat (KM)	620	nu star (KM)	587.6
theta hat (KM)	0.0748	theta star (KM)	0.0789
80% gamma percentile (KM)	0.563	90% gamma percentile (KM)	0.666
95% gamma percentile (KM)	0.76	99% gamma percentile (KM)	0.957

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (587.56, α)	532.3	Adjusted Chi Square Value (587.56, β)	530.9
95% Gamma Approximate KM-UCL (use when n>=50)	0.465	95% Gamma Adjusted KM-UCL (use when n<50)	0.467

	A–E	F	G–K	L
521	Lognormal GOF Test on Detected Observations Only			
522	Shapiro Wilk Test Statistic	0.981	Shapiro Wilk GOF Test	
523	5% Shapiro Wilk Critical Value	0.938	Detected Data appear Lognormal at 5% Significance Level	
524	Lilliefors Test Statistic	0.0978	Lilliefors GOF Test	
525	5% Lilliefors Critical Value	0.142	Detected Data appear Lognormal at 5% Significance Level	
526	Detected Data appear Lognormal at 5% Significance Level			
527				
528	Lognormal ROS Statistics Using Imputed Non-Detects			
529	Mean in Original Scale	0.419	Mean in Log Scale	-0.952
530	SD in Original Scale	0.173	SD in Log Scale	0.412
531	95% t UCL (assumes normality of ROS data)	0.458	95% Percentile Bootstrap UCL	0.458
532	95% BCA Bootstrap UCL	0.462	95% Bootstrap t UCL	0.462
533	95% H-UCL (Log ROS)	0.465		
534				
535	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
536	KM Mean (logged)	-0.952	KM Geo Mean	0.386
537	KM SD (logged)	0.426	95% Critical H Value (KM-Log)	1.839
538	KM Standard Error of Mean (logged)	0.0695	95% H-UCL (KM -Log)	0.47
539	KM SD (logged)	0.426	95% Critical H Value (KM-Log)	1.839
540	KM Standard Error of Mean (logged)	0.0695		
541				
542	DL/2 Statistics			
543	DL/2 Normal		DL/2 Log-Transformed	
544	Mean in Original Scale	0.44	Mean in Log Scale	-0.887
545	SD in Original Scale	0.157	SD in Log Scale	0.383
546	95% t UCL (Assumes normality)	0.476	95% H-Stat UCL	0.486
547	DL/2 is not a recommended method, provided for comparisons and historical reasons			
548				
549	Nonparametric Distribution Free UCL Statistics			
550	Detected Data appear Normal Distributed at 5% Significance Level			
551				
552	Suggested UCL to Use			
553	95% KM (t) UCL	0.47		
554				
555	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
556	Recommendations are based upon data size, data distribution, and skewness.			
557	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
558	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
559				
560	Cr			
561				
562	General Statistics			
563	Total Number of Observations	61	Number of Distinct Observations	57
564	Number of Detects	60	Number of Non-Detects	1
565	Number of Distinct Detects	56	Number of Distinct Non-Detects	1
566	Minimum Detect	3.3	Minimum Non-Detect	1
567	Maximum Detect	80.5	Maximum Non-Detect	1
568	Variance Detects	303.3	Percent Non-Detects	1.639%
569	Mean Detects	29.17	SD Detects	17.41
570	Median Detects	28.6	CV Detects	0.597
571	Skewness Detects	0.79	Kurtosis Detects	0.908
572	Mean of Logged Detects	3.143	SD of Logged Detects	0.768

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.93	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0.00229	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.114	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.114	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	28.7	KM Standard Error of Mean	2.259
KM SD	17.5	95% KM (BCA) UCL	32.77
95% KM (t) UCL	32.48	95% KM (Percentile Bootstrap) UCL	32.43
95% KM (z) UCL	32.42	95% KM Bootstrap t UCL	32.77
90% KM Chebyshev UCL	35.48	95% KM Chebyshev UCL	38.55
97.5% KM Chebyshev UCL	42.81	99% KM Chebyshev UCL	51.18

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.34	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.761	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.158	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.116	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.328	k star (bias corrected MLE)	2.223
Theta hat (MLE)	12.53	Theta star (bias corrected MLE)	13.12
nu hat (MLE)	279.3	nu star (bias corrected)	266.7
Mean (detects)	29.17		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	3.3	Mean	28.74
Maximum	80.5	Median	28.4
SD	17.58	CV	0.612
k hat (MLE)	2.176	k star (bias corrected MLE)	2.08
Theta hat (MLE)	13.21	Theta star (bias corrected MLE)	13.82
nu hat (MLE)	265.5	nu star (bias corrected)	253.7
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (253.73, α)	217.8	Adjusted Chi Square Value (253.73, β)	217
95% Gamma Approximate UCL (use when n>=50)	33.48	95% Gamma Adjusted UCL (use when n<50)	33.6

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	28.7	SD (KM)	17.5
Variance (KM)	306.1	SE of Mean (KM)	2.259
k hat (KM)	2.692	k star (KM)	2.57
nu hat (KM)	328.4	nu star (KM)	313.6
theta hat (KM)	10.66	theta star (KM)	11.17
80% gamma percentile (KM)	41.71	90% gamma percentile (KM)	52.7

95% gamma percentile (KM)	63.03	99% gamma percentile (KM)	85.62
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (313.58, α)	273.6	Adjusted Chi Square Value (313.58, β)	272.7
95% Gamma Approximate KM-UCL (use when n>=50)	32.9	95% Gamma Adjusted KM-UCL (use when n<50)	33.01
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Approximate Test Statistic	0.895	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	1.9899E-5	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.201	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.114	Detected Data Not Lognormal at 5% Significance Level	
Detected Data Not Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	28.74	Mean in Log Scale	3.111
SD in Original Scale	17.58	SD in Log Scale	0.801
95% t UCL (assumes normality of ROS data)	32.5	95% Percentile Bootstrap UCL	32.5
95% BCA Bootstrap UCL	32.8	95% Bootstrap t UCL	32.7
95% H-UCL (Log ROS)	38.4		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	3.092	KM Geo Mean	22.01
KM SD (logged)	0.854	95% Critical H Value (KM-Log)	2.136
KM Standard Error of Mean (logged)	0.11	95% H-UCL (KM -Log)	40.13
KM SD (logged)	0.854	95% Critical H Value (KM-Log)	2.136
KM Standard Error of Mean (logged)	0.11		
DL/2 Statistics			
DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	28.7	Mean in Log Scale	3.08
SD in Original Scale	17.65	SD in Log Scale	0.906
95% t UCL (Assumes normality)	32.47	95% H-Stat UCL	42.37
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution at 5% Significance Level			
Suggested UCL to Use			
95% KM (Chebyshev) UCL	38.55		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Co			
General Statistics			
Total Number of Observations	61	Number of Distinct Observations	48
Number of Detects	58	Number of Non-Detects	3
Number of Distinct Detects	46	Number of Distinct Non-Detects	3
Minimum Detect	1.4	Minimum Non-Detect	1

Maximum Detect	17.3	Maximum Non-Detect	7.1
Variance Detects	14.82	Percent Non-Detects	4.918%
Mean Detects	6.231	SD Detects	3.849
Median Detects	6	CV Detects	0.618
Skewness Detects	0.885	Kurtosis Detects	0.41
Mean of Logged Detects	1.623	SD of Logged Detects	0.683
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.914	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	3.4813E-4	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.12	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.116	Detected Data Not Normal at 5% Significance Level	
Detected Data Not Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	6.071	KM Standard Error of Mean	0.495
KM SD	3.816	95% KM (BCA) UCL	6.755
95% KM (t) UCL	6.898	95% KM (Percentile Bootstrap) UCL	6.914
95% KM (z) UCL	6.885	95% KM Bootstrap t UCL	6.961
90% KM Chebyshev UCL	7.556	95% KM Chebyshev UCL	8.228
97.5% KM Chebyshev UCL	9.162	99% KM Chebyshev UCL	11
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.595	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.76	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.092	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.118	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	2.571	k star (bias corrected MLE)	2.449
Theta hat (MLE)	2.424	Theta star (bias corrected MLE)	2.544
nu hat (MLE)	298.2	nu star (bias corrected)	284.1
Mean (detects)	6.231		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.317	Mean	6.056
Maximum	17.3	Median	5.9
SD	3.849	CV	0.636
k hat (MLE)	2.3	k star (bias corrected MLE)	2.198
Theta hat (MLE)	2.633	Theta star (bias corrected MLE)	2.755
nu hat (MLE)	280.6	nu star (bias corrected)	268.2
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (268.18, α)	231.3	Adjusted Chi Square Value (268.18, β)	230.4
95% Gamma Approximate UCL (use when n>=50)	7.023	95% Gamma Adjusted UCL (use when n<50)	7.049
Estimates of Gamma Parameters using KM Estimates			

	A–E	F	G–K	L
729	Mean (KM)	6.071	SD (KM)	3.816
730	Variance (KM)	14.56	SE of Mean (KM)	0.495
731	k hat (KM)	2.531	k star (KM)	2.418
732	nu hat (KM)	308.8	nu star (KM)	295
733	theta hat (KM)	2.398	theta star (KM)	2.511
734	80% gamma percentile (KM)	8.886	90% gamma percentile (KM)	11.3
735	95% gamma percentile (KM)	13.58	99% gamma percentile (KM)	18.57
736				
737	**Gamma Kaplan-Meier (KM) Statistics**			
738	Approximate Chi Square Value (294.96, α)	256.2	Adjusted Chi Square Value (294.96, β)	255.3
739	95% Gamma Approximate KM-UCL (use when n>=50)	6.99	95% Gamma Adjusted KM-UCL (use when n<50)	7.014
740				
741	**Lognormal GOF Test on Detected Observations Only**			
742	Shapiro Wilk Approximate Test Statistic	0.938	**Shapiro Wilk GOF Test**	
743	5% Shapiro Wilk P Value	0.00765	Detected Data Not Lognormal at 5% Significance Level	
744	Lilliefors Test Statistic	0.127	**Lilliefors GOF Test**	
745	5% Lilliefors Critical Value	0.116	Detected Data Not Lognormal at 5% Significance Level	
746	**Detected Data Not Lognormal at 5% Significance Level**			
747				
748	**Lognormal ROS Statistics Using Imputed Non-Detects**			
749	Mean in Original Scale	6.056	Mean in Log Scale	1.582
750	SD in Original Scale	3.842	SD in Log Scale	0.705
751	95% t UCL (assumes normality of ROS data)	6.878	95% Percentile Bootstrap UCL	6.834
752	95% BCA Bootstrap UCL	6.906	95% Bootstrap t UCL	6.974
753	95% H-UCL (Log ROS)	7.489		
754				
755	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**			
756	KM Mean (logged)	1.583	KM Geo Mean	4.871
757	KM SD (logged)	0.702	95% Critical H Value (KM-Log)	2.006
758	KM Standard Error of Mean (logged)	0.0916	95% H-UCL (KM -Log)	7.472
759	KM SD (logged)	0.702	95% Critical H Value (KM-Log)	2.006
760	KM Standard Error of Mean (logged)	0.0916		
761				
762	**DL/2 Statistics**			
763	**DL/2 Normal**		**DL/2 Log-Transformed**	
764	Mean in Original Scale	6.048	Mean in Log Scale	1.573
765	SD in Original Scale	3.852	SD in Log Scale	0.731
766	95% t UCL (Assumes normality)	6.872	95% H-Stat UCL	7.622
767	**DL/2 is not a recommended method, provided for comparisons and historical reasons**			
768				
769	**Nonparametric Distribution Free UCL Statistics**			
770	**Detected Data appear Gamma Distributed at 5% Significance Level**			
771				
772	**Suggested UCL to Use**			
773	95% KM Approximate Gamma UCL	6.99	95% GROS Approximate Gamma UCL	7.023
774				
775	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
776	Recommendations are based upon data size, data distribution, and skewness.			
777	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
778	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
779				
780	Cu			

General Statistics

Total Number of Observations	61	Number of Distinct Observations	58
Number of Detects	60	Number of Non-Detects	1
Number of Distinct Detects	57	Number of Distinct Non-Detects	1
Minimum Detect	4.2	Minimum Non-Detect	2
Maximum Detect	82.6	Maximum Non-Detect	2
Variance Detects	173.6	Percent Non-Detects	1.639%
Mean Detects	28.28	SD Detects	13.17
Median Detects	28.4	CV Detects	0.466
Skewness Detects	1.168	Kurtosis Detects	4.225
Mean of Logged Detects	3.218	SD of Logged Detects	0.552

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.924	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0.00104	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.116	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.114	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	27.85	KM Standard Error of Mean	1.727
KM SD	13.38	95% KM (BCA) UCL	30.92
95% KM (t) UCL	30.74	95% KM (Percentile Bootstrap) UCL	30.7
95% KM (z) UCL	30.69	95% KM Bootstrap t UCL	30.83
90% KM Chebyshev UCL	33.03	95% KM Chebyshev UCL	35.38
97.5% KM Chebyshev UCL	38.64	99% KM Chebyshev UCL	45.04

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.444	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.754	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.156	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.115	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.172	k star (bias corrected MLE)	3.975
Theta hat (MLE)	6.779	Theta star (bias corrected MLE)	7.116
nu hat (MLE)	500.7	nu star (bias corrected)	477
Mean (detects)	28.28		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	4.2	Mean	27.92
Maximum	82.6	Median	28.1
SD	13.37	CV	0.479
k hat (MLE)	3.859	k star (bias corrected MLE)	3.68
Theta hat (MLE)	7.235	Theta star (bias corrected MLE)	7.586

nu hat (MLE)	470.8	nu star (bias corrected)	448.9
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (448.94, α)	400.8	Adjusted Chi Square Value (448.94, β)	399.7
95% Gamma Approximate UCL (use when n>=50)	31.27	95% Gamma Adjusted UCL (use when n<50)	31.35

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	27.85	SD (KM)	13.38
Variance (KM)	179	SE of Mean (KM)	1.727
k hat (KM)	4.334	k star (KM)	4.132
nu hat (KM)	528.7	nu star (KM)	504.1
theta hat (KM)	6.427	theta star (KM)	6.741
80% gamma percentile (KM)	38.26	90% gamma percentile (KM)	46.22
95% gamma percentile (KM)	53.53	99% gamma percentile (KM)	69.13

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (504.06, α)	453	Adjusted Chi Square Value (504.06, β)	451.8
95% Gamma Approximate KM-UCL (use when n>=50)	30.99	95% Gamma Adjusted KM-UCL (use when n<50)	31.07

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.898	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	3.2385E-5	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.114	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	27.92	Mean in Log Scale	3.195
SD in Original Scale	13.36	SD in Log Scale	0.575
95% t UCL (assumes normality of ROS data)	30.78	95% Percentile Bootstrap UCL	30.74
95% BCA Bootstrap UCL	31.13	95% Bootstrap t UCL	30.98
95% H-UCL (Log ROS)	33.2		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.176	KM Geo Mean	23.96
KM SD (logged)	0.631	95% Critical H Value (KM-Log)	1.952
KM Standard Error of Mean (logged)	0.0814	95% H-UCL (KM -Log)	34.27
KM SD (logged)	0.631	95% Critical H Value (KM-Log)	1.952
KM Standard Error of Mean (logged)	0.0814		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	27.84	Mean in Log Scale	3.165
SD in Original Scale	13.52	SD in Log Scale	0.685
95% t UCL (Assumes normality)	30.73	95% H-Stat UCL	35.74

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	35.38

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	61	Number of Distinct Observations	51
Number of Detects	60	Number of Non-Detects	1
Number of Distinct Detects	50	Number of Distinct Non-Detects	1
Minimum Detect	1.2	Minimum Non-Detect	1
Maximum Detect	70.3	Maximum Non-Detect	1
Variance Detects	114.3	Percent Non-Detects	1.639%
Mean Detects	11.65	SD Detects	10.69
Median Detects	9.05	CV Detects	0.918
Skewness Detects	3.294	Kurtosis Detects	14.91
Mean of Logged Detects	2.18	SD of Logged Detects	0.739

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.677	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	1.110E-16	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.287	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.114	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	11.48	KM Standard Error of Mean	1.369
KM SD	10.6	95% KM (BCA) UCL	13.96
95% KM (t) UCL	13.76	95% KM (Percentile Bootstrap) UCL	13.82
95% KM (z) UCL	13.73	95% KM Bootstrap t UCL	15
90% KM Chebyshev UCL	15.58	95% KM Chebyshev UCL	17.44
97.5% KM Chebyshev UCL	20.02	99% KM Chebyshev UCL	25.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.433	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.763	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.198	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.116	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.97	k star (bias corrected MLE)	1.882
Theta hat (MLE)	5.914	Theta star (bias corrected MLE)	6.189
nu hat (MLE)	236.4	nu star (bias corrected)	225.9
Mean (detects)	11.65		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

937	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
938	Minimum	0.01	Mean	11.46
939	Maximum	70.3	Median	9
940	SD	10.71	CV	0.934
941	k hat (MLE)	1.498	k star (bias corrected MLE)	1.435
942	Theta hat (MLE)	7.65	Theta star (bias corrected MLE)	7.985
943	nu hat (MLE)	182.7	nu star (bias corrected)	175.1
944	Adjusted Level of Significance (β)	0.0461		
945	Approximate Chi Square Value (175.09, α)	145.5	Adjusted Chi Square Value (175.09, β)	144.8
946	95% Gamma Approximate UCL (use when n>=50)	13.79	95% Gamma Adjusted UCL (use when n<50)	13.85
947				
948	**Estimates of Gamma Parameters using KM Estimates**			
949	Mean (KM)	11.48	SD (KM)	10.6
950	Variance (KM)	112.4	SE of Mean (KM)	1.369
951	k hat (KM)	1.172	k star (KM)	1.125
952	nu hat (KM)	142.9	nu star (KM)	137.2
953	theta hat (KM)	9.795	theta star (KM)	10.2
954	80% gamma percentile (KM)	18.28	90% gamma percentile (KM)	25.67
955	95% gamma percentile (KM)	32.99	99% gamma percentile (KM)	49.84
956				
957	**Gamma Kaplan-Meier (KM) Statistics**			
958	Approximate Chi Square Value (137.23, α)	111.2	Adjusted Chi Square Value (137.23, β)	110.6
959	95% Gamma Approximate KM-UCL (use when n>=50)	14.17	95% Gamma Adjusted KM-UCL (use when n<50)	14.24
960				
961	**Lognormal GOF Test on Detected Observations Only**			
962	Shapiro Wilk Approximate Test Statistic	0.941	**Shapiro Wilk GOF Test**	
963	5% Shapiro Wilk P Value	0.01	Detected Data Not Lognormal at 5% Significance Level	
964	Lilliefors Test Statistic	0.155	**Lilliefors GOF Test**	
965	5% Lilliefors Critical Value	0.114	Detected Data Not Lognormal at 5% Significance Level	
966	**Detected Data Not Lognormal at 5% Significance Level**			
967				
968	**Lognormal ROS Statistics Using Imputed Non-Detects**			
969	Mean in Original Scale	11.48	Mean in Log Scale	2.15
970	SD in Original Scale	10.68	SD in Log Scale	0.771
971	95% t UCL (assumes normality of ROS data)	13.77	95% Percentile Bootstrap UCL	13.83
972	95% BCA Bootstrap UCL	14.58	95% Bootstrap t UCL	14.94
973	95% H-UCL (Log ROS)	14.19		
974				
975	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**			
976	KM Mean (logged)	2.145	KM Geo Mean	8.54
977	KM SD (logged)	0.778	95% Critical H Value (KM-Log)	2.069
978	KM Standard Error of Mean (logged)	0.1	95% H-UCL (KM -Log)	14.22
979	KM SD (logged)	0.778	95% Critical H Value (KM-Log)	2.069
980	KM Standard Error of Mean (logged)	0.1		
981				
982	**DL/2 Statistics**			
983	**DL/2 Normal**		**DL/2 Log-Transformed**	
984	Mean in Original Scale	11.47	Mean in Log Scale	2.133
985	SD in Original Scale	10.7	SD in Log Scale	0.82
986	95% t UCL (Assumes normality)	13.76	95% H-Stat UCL	14.76
987	**DL/2 is not a recommended method, provided for comparisons and historical reasons**			
988				

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	17.44

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mo

General Statistics

Total Number of Observations	15	Number of Distinct Observations	1
Number of Detects	0	Number of Non-Detects	15
Number of Distinct Detects	0	Number of Distinct Non-Detects	1

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Mo was not processed!

Ni

General Statistics

Total Number of Observations	61	Number of Distinct Observations	60
Number of Detects	60	Number of Non-Detects	1
Number of Distinct Detects	59	Number of Distinct Non-Detects	1
Minimum Detect	3.1	Minimum Non-Detect	1
Maximum Detect	89.8	Maximum Non-Detect	1
Variance Detects	386.3	Percent Non-Detects	1.639%
Mean Detects	30.8	SD Detects	19.66
Median Detects	28.45	CV Detects	0.638
Skewness Detects	1.241	Kurtosis Detects	1.766
Mean of Logged Detects	3.207	SD of Logged Detects	0.725

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.883	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	4.3491E-6	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.14	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.114	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	30.31	KM Standard Error of Mean	2.543
KM SD	19.7	95% KM (BCA) UCL	34.09
95% KM (t) UCL	34.56	95% KM (Percentile Bootstrap) UCL	34.64
95% KM (z) UCL	34.49	95% KM Bootstrap t UCL	35.12
90% KM Chebyshev UCL	37.94	95% KM Chebyshev UCL	41.39

	A–E	F	G–K	L
1041	97.5% KM Chebyshev UCL	46.19	99% KM Chebyshev UCL	55.61
1042				
1043	**Gamma GOF Tests on Detected Observations Only**			
1044	A-D Test Statistic	0.847	**Anderson-Darling GOF Test**	
1045	5% A-D Critical Value	0.761	Detected Data Not Gamma Distributed at 5% Significance Level	
1046	K-S Test Statistic	0.13	**Kolmogorov-Smirnov GOF**	
1047	5% K-S Critical Value	0.116	Detected Data Not Gamma Distributed at 5% Significance Level	
1048	**Detected Data Not Gamma Distributed at 5% Significance Level**			
1049				
1050	**Gamma Statistics on Detected Data Only**			
1051	k hat (MLE)	2.422	k star (bias corrected MLE)	2.312
1052	Theta hat (MLE)	12.72	Theta star (bias corrected MLE)	13.32
1053	nu hat (MLE)	290.6	nu star (bias corrected)	277.4
1054	Mean (detects)	30.8		
1055				
1056	**Gamma ROS Statistics using Imputed Non-Detects**			
1057	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
1058	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
1059	For such situations, GROS method may yield incorrect values of UCLs and BTVs			
1060	This is especially true when the sample size is small.			
1061	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
1062	Minimum	1.372	Mean	30.31
1063	Maximum	89.8	Median	28.3
1064	SD	19.85	CV	0.655
1065	k hat (MLE)	2.135	k star (bias corrected MLE)	2.041
1066	Theta hat (MLE)	14.2	Theta star (bias corrected MLE)	14.85
1067	nu hat (MLE)	260.5	nu star (bias corrected)	249
1068	Adjusted Level of Significance (β)	0.0461		
1069	Approximate Chi Square Value (249.05, α)	213.5	Adjusted Chi Square Value (249.05, β)	212.7
1070	95% Gamma Approximate UCL (use when n>=50)	35.36	95% Gamma Adjusted UCL (use when n<50)	35.49
1071				
1072	**Estimates of Gamma Parameters using KM Estimates**			
1073	Mean (KM)	30.31	SD (KM)	19.7
1074	Variance (KM)	388	SE of Mean (KM)	2.543
1075	k hat (KM)	2.368	k star (KM)	2.262
1076	nu hat (KM)	288.9	nu star (KM)	276
1077	theta hat (KM)	12.8	theta star (KM)	13.4
1078	80% gamma percentile (KM)	44.72	90% gamma percentile (KM)	57.28
1079	95% gamma percentile (KM)	69.18	99% gamma percentile (KM)	95.38
1080				
1081	**Gamma Kaplan-Meier (KM) Statistics**			
1082	Approximate Chi Square Value (275.98, α)	238.5	Adjusted Chi Square Value (275.98, β)	237.7
1083	95% Gamma Approximate KM-UCL (use when n>=50)	35.07	95% Gamma Adjusted KM-UCL (use when n<50)	35.19
1084				
1085	**Lognormal GOF Test on Detected Observations Only**			
1086	Shapiro Wilk Approximate Test Statistic	0.938	**Shapiro Wilk GOF Test**	
1087	5% Shapiro Wilk P Value	0.00671	Detected Data Not Lognormal at 5% Significance Level	
1088	Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**	
1089	5% Lilliefors Critical Value	0.114	Detected Data Not Lognormal at 5% Significance Level	
1090	**Detected Data Not Lognormal at 5% Significance Level**			
1091				
1092	**Lognormal ROS Statistics Using Imputed Non-Detects**			

Mean in Original Scale	30.35	Mean in Log Scale	3.176
SD in Original Scale	19.79	SD in Log Scale	0.757
95% t UCL (assumes normality of ROS data)	34.59	95% Percentile Bootstrap UCL	34.57
95% BCA Bootstrap UCL	34.87	95% Bootstrap t UCL	35.06
95% H-UCL (Log ROS)	39.01		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.154	KM Geo Mean	23.44
KM SD (logged)	0.821	95% Critical H Value (KM-Log)	2.106
KM Standard Error of Mean (logged)	0.106	95% H-UCL (KM -Log)	41.05
KM SD (logged)	0.821	95% Critical H Value (KM-Log)	2.106
KM Standard Error of Mean (logged)	0.106		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	30.3	Mean in Log Scale	3.143
SD in Original Scale	19.87	SD in Log Scale	0.875
95% t UCL (Assumes normality)	34.55	95% H-Stat UCL	43.36

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	41.39		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Se

General Statistics

Total Number of Observations	55	Number of Distinct Observations	17
Number of Detects	1	Number of Non-Detects	54
Number of Distinct Detects	1	Number of Distinct Non-Detects	16

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Se was not processed!

Ag

General Statistics

Total Number of Observations	61	Number of Distinct Observations	12
Number of Detects	1	Number of Non-Detects	60
Number of Distinct Detects	1	Number of Distinct Non-Detects	11

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Ag was not processed!

V

General Statistics

Total Number of Observations	61	Number of Distinct Observations	59
Number of Detects	60	Number of Non-Detects	1
Number of Distinct Detects	58	Number of Distinct Non-Detects	1
Minimum Detect	8.4	Minimum Non-Detect	1
Maximum Detect	134	Maximum Non-Detect	1
Variance Detects	943.2	Percent Non-Detects	1.639%
Mean Detects	59.51	SD Detects	30.71
Median Detects	63.45	CV Detects	0.516
Skewness Detects	0.0346	Kurtosis Detects	-0.477
Mean of Logged Detects	3.888	SD of Logged Detects	0.725

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.954	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0.0535	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.0928	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.114	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	58.55	KM Standard Error of Mean	4.016
KM SD	31.1	95% KM (BCA) UCL	64.99
95% KM (t) UCL	65.26	95% KM (Percentile Bootstrap) UCL	65.22
95% KM (z) UCL	65.15	95% KM Bootstrap t UCL	65.57
90% KM Chebyshev UCL	70.6	95% KM Chebyshev UCL	76.05
97.5% KM Chebyshev UCL	83.63	99% KM Chebyshev UCL	98.51

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.023	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.76	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.161	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.116	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.673	k star (bias corrected MLE)	2.551
Theta hat (MLE)	22.26	Theta star (bias corrected MLE)	23.33
nu hat (MLE)	320.8	nu star (bias corrected)	306.1
Mean (detects)	59.51		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

1197	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
1198	Minimum	8.4	Mean	58.74
1199	Maximum	134	Median	62.9
1200	SD	31.03	CV	0.528
1201	k hat (MLE)	2.567	k star (bias corrected MLE)	2.451
1202	Theta hat (MLE)	22.89	Theta star (bias corrected MLE)	23.97
1203	nu hat (MLE)	313.1	nu star (bias corrected)	299.1
1204	Adjusted Level of Significance (β)	0.0461		
1205	Approximate Chi Square Value (299.05, α)	260	Adjusted Chi Square Value (299.05, β)	259.1
1206	95% Gamma Approximate UCL (use when n>=50)	67.57	95% Gamma Adjusted UCL (use when n<50)	67.8
1207				
1208	**Estimates of Gamma Parameters using KM Estimates**			
1209	Mean (KM)	58.55	SD (KM)	31.1
1210	Variance (KM)	967.5	SE of Mean (KM)	4.016
1211	k hat (KM)	3.543	k star (KM)	3.38
1212	nu hat (KM)	432.2	nu star (KM)	412.3
1213	theta hat (KM)	16.53	theta star (KM)	17.32
1214	80% gamma percentile (KM)	82.33	90% gamma percentile (KM)	101.3
1215	95% gamma percentile (KM)	118.8	99% gamma percentile (KM)	156.6
1216				
1217	**Gamma Kaplan-Meier (KM) Statistics**			
1218	Approximate Chi Square Value (412.31, α)	366.2	Adjusted Chi Square Value (412.31, β)	365.2
1219	95% Gamma Approximate KM-UCL (use when n>=50)	65.91	95% Gamma Adjusted KM-UCL (use when n<50)	66.1
1220				
1221	**Lognormal GOF Test on Detected Observations Only**			
1222	Shapiro Wilk Approximate Test Statistic	0.857	**Shapiro Wilk GOF Test**	
1223	5% Shapiro Wilk P Value	1.3512E-7	Detected Data Not Lognormal at 5% Significance Level	
1224	Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**	
1225	5% Lilliefors Critical Value	0.114	Detected Data Not Lognormal at 5% Significance Level	
1226	**Detected Data Not Lognormal at 5% Significance Level**			
1227				
1228	**Lognormal ROS Statistics Using Imputed Non-Detects**			
1229	Mean in Original Scale	58.66	Mean in Log Scale	3.858
1230	SD in Original Scale	31.16	SD in Log Scale	0.754
1231	95% t UCL (assumes normality of ROS data)	65.33	95% Percentile Bootstrap UCL	65.17
1232	95% BCA Bootstrap UCL	65.12	95% Bootstrap t UCL	65.81
1233	95% H-UCL (Log ROS)	76.9		
1234				
1235	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**			
1236	KM Mean (logged)	3.824	KM Geo Mean	45.78
1237	KM SD (logged)	0.867	95% Critical H Value (KM-Log)	2.148
1238	KM Standard Error of Mean (logged)	0.112	95% H-UCL (KM -Log)	84.8
1239	KM SD (logged)	0.867	95% Critical H Value (KM-Log)	2.148
1240	KM Standard Error of Mean (logged)	0.112		
1241				
1242	**DL/2 Statistics**			
1243	**DL/2 Normal**		**DL/2 Log-Transformed**	
1244	Mean in Original Scale	58.54	Mean in Log Scale	3.812
1245	SD in Original Scale	31.38	SD in Log Scale	0.928
1246	95% t UCL (Assumes normality)	65.25	95% H-Stat UCL	90.59
1247	**DL/2 is not a recommended method, provided for comparisons and historical reasons**			
1248				

1249	Nonparametric Distribution Free UCL Statistics			
1250	Detected Data appear Normal Distributed at 5% Significance Level			
1251				
1252	**Suggested UCL to Use**			
1253	95% KM (t) UCL	65.26		
1254				
1255	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
1256	Recommendations are based upon data size, data distribution, and skewness.			
1257	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
1258	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
1259				
1260				
1261	Zn			
1262				
1263	**General Statistics**			
1264	Total Number of Observations	61	Number of Distinct Observations	59
1265			Number of Missing Observations	0
1266	Minimum	4.3	Mean	38.53
1267	Maximum	109	Median	36.1
1268	SD	22.39	Std. Error of Mean	2.866
1269	Coefficient of Variation	0.581	Skewness	1.142
1270				
1271	**Normal GOF Test**			
1272	Shapiro Wilk Test Statistic	0.908	**Shapiro Wilk GOF Test**	
1273	5% Shapiro Wilk P Value	1.0600E-4	Data Not Normal at 5% Significance Level	
1274	Lilliefors Test Statistic	0.166	**Lilliefors GOF Test**	
1275	5% Lilliefors Critical Value	0.113	Data Not Normal at 5% Significance Level	
1276	**Data Not Normal at 5% Significance Level**			
1277				
1278	**Assuming Normal Distribution**			
1279	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
1280	95% Student's-t UCL	43.32	95% Adjusted-CLT UCL (Chen-1995)	43.69
1281			95% Modified-t UCL (Johnson-1978)	43.39
1282				
1283	**Gamma GOF Test**			
1284	A-D Test Statistic	0.716	**Anderson-Darling Gamma GOF Test**	
1285	5% A-D Critical Value	0.759	Detected data appear Gamma Distributed at 5% Significance Level	
1286	K-S Test Statistic	0.105	**Kolmogorov-Smirnov Gamma GOF Test**	
1287	5% K-S Critical Value	0.115	Detected data appear Gamma Distributed at 5% Significance Level	
1288	**Detected data appear Gamma Distributed at 5% Significance Level**			
1289				
1290	**Gamma Statistics**			
1291	k hat (MLE)	2.888	k star (bias corrected MLE)	2.757
1292	Theta hat (MLE)	13.34	Theta star (bias corrected MLE)	13.98
1293	nu hat (MLE)	352.3	nu star (bias corrected)	336.3
1294	MLE Mean (bias corrected)	38.53	MLE Sd (bias corrected)	23.2
1295			Approximate Chi Square Value (0.05)	294.8
1296	Adjusted Level of Significance	0.0461	Adjusted Chi Square Value	293.9
1297				
1298	**Assuming Gamma Distribution**			
1299	95% Approximate Gamma UCL (use when n>=50)	43.95	95% Adjusted Gamma UCL (use when n<50)	44.09
1300				

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk P Value	0.0102	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.138	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.113	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.459	Mean of logged Data	3.468
Maximum of Logged Data	4.691	SD of logged Data	0.659

Assuming Lognormal Distribution

95% H-UCL	47.14	90% Chebyshev (MVUE) UCL	50.61
95% Chebyshev (MVUE) UCL	55.55	97.5% Chebyshev (MVUE) UCL	62.42
99% Chebyshev (MVUE) UCL	75.91		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	43.24	95% Jackknife UCL	43.32
95% Standard Bootstrap UCL	43.08	95% Bootstrap-t UCL	43.87
95% Hall's Bootstrap UCL	43.83	95% Percentile Bootstrap UCL	43.32
95% BCA Bootstrap UCL	43.23		
90% Chebyshev(Mean, Sd) UCL	47.13	95% Chebyshev(Mean, Sd) UCL	51.02
97.5% Chebyshev(Mean, Sd) UCL	56.43	99% Chebyshev(Mean, Sd) UCL	67.05

Suggested UCL to Use

95% Approximate Gamma UCL	43.95		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Hg

General Statistics

Total Number of Observations	61	Number of Distinct Observations	26
Number of Detects	18	Number of Non-Detects	43
Number of Distinct Detects	17	Number of Distinct Non-Detects	10
Minimum Detect	0.04	Minimum Non-Detect	0.06
Maximum Detect	8	Maximum Non-Detect	0.16
Variance Detects	3.739	Percent Non-Detects	70.49%
Mean Detects	0.857	SD Detects	1.934
Median Detects	0.106	CV Detects	2.256
Skewness Detects	3.342	Kurtosis Detects	12.09
Mean of Logged Detects	-1.693	SD of Logged Detects	1.624

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.484	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Normal at 5% Significance Level	

Lilliefors Test Statistic	0.371	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.202	Detected Data Not Normal at 5% Significance Level	
Detected Data Not Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	0.292	KM Standard Error of Mean	0.143
KM SD	1.084	95% KM (BCA) UCL	0.552
95% KM (t) UCL	0.531	95% KM (Percentile Bootstrap) UCL	0.547
95% KM (z) UCL	0.527	95% KM Bootstrap t UCL	1.015
90% KM Chebyshev UCL	0.721	95% KM Chebyshev UCL	0.915
97.5% KM Chebyshev UCL	1.184	99% KM Chebyshev UCL	1.714
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	2.148	Anderson-Darling GOF Test	
5% A-D Critical Value	0.816	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.337	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.217	Detected Data Not Gamma Distributed at 5% Significance Level	
Detected Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	0.424	k star (bias corrected MLE)	0.39
Theta hat (MLE)	2.023	Theta star (bias corrected MLE)	2.197
nu hat (MLE)	15.25	nu star (bias corrected)	14.04
Mean (detects)	0.857		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	0.277
Maximum	8	Median	0.01
SD	1.098	CV	3.966
k hat (MLE)	0.309	k star (bias corrected MLE)	0.305
Theta hat (MLE)	0.896	Theta star (bias corrected MLE)	0.908
nu hat (MLE)	37.72	nu star (bias corrected)	37.2
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (37.20, α)	24.23	Adjusted Chi Square Value (37.20, β)	23.98
95% Gamma Approximate UCL (use when n>=50)	0.425	95% Gamma Adjusted UCL (use when n<50)	0.43
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.292	SD (KM)	1.084
Variance (KM)	1.176	SE of Mean (KM)	0.143
k hat (KM)	0.0726	k star (KM)	0.0799
nu hat (KM)	8.851	nu star (KM)	9.749
theta hat (KM)	4.025	theta star (KM)	3.655
80% gamma percentile (KM)	0.139	90% gamma percentile (KM)	0.692
95% gamma percentile (KM)	1.698	99% gamma percentile (KM)	5.175
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (9.75, α)	3.786	Adjusted Chi Square Value (9.75, β)	3.696

	A	B	C	D	E	F	G	H	I	J	K	L
1405	95% Gamma Approximate KM-UCL (use when n>=50)					0.752	95% Gamma Adjusted KM-UCL (use when n<50)					0.77
1406												
1407	**Lognormal GOF Test on Detected Observations Only**											
1408	Shapiro Wilk Test Statistic					0.824	**Shapiro Wilk GOF Test**					
1409	5% Shapiro Wilk Critical Value					0.897	Detected Data Not Lognormal at 5% Significance Level					
1410	Lilliefors Test Statistic					0.242	**Lilliefors GOF Test**					
1411	5% Lilliefors Critical Value					0.202	Detected Data Not Lognormal at 5% Significance Level					
1412	**Detected Data Not Lognormal at 5% Significance Level**											
1413												
1414	**Lognormal ROS Statistics Using Imputed Non-Detects**											
1415	Mean in Original Scale					0.304	Mean in Log Scale					-2.538
1416	SD in Original Scale					1.091	SD in Log Scale					1.215
1417	95% t UCL (assumes normality of ROS data)					0.538	95% Percentile Bootstrap UCL					0.554
1418	95% BCA Bootstrap UCL					0.715	95% Bootstrap t UCL					0.992
1419	95% H-UCL (Log ROS)					0.237						
1420												
1421	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
1422	KM Mean (logged)					-2.555	KM Geo Mean					0.0777
1423	KM SD (logged)					1.038	95% Critical H Value (KM-Log)					2.271
1424	KM Standard Error of Mean (logged)					0.145	95% H-UCL (KM -Log)					0.181
1425	KM SD (logged)					1.038	95% Critical H Value (KM-Log)					2.271
1426	KM Standard Error of Mean (logged)					0.145						
1427												
1428	**DL/2 Statistics**											
1429	**DL/2 Normal**						**DL/2 Log-Transformed**					
1430	Mean in Original Scale					0.293	Mean in Log Scale					-2.538
1431	SD in Original Scale					1.093	SD in Log Scale					1.049
1432	95% t UCL (Assumes normality)					0.527	95% H-Stat UCL					0.186
1433	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
1434												
1435	**Nonparametric Distribution Free UCL Statistics**											
1436	**Data do not follow a Discernible Distribution at 5% Significance Level**											
1437												
1438	**Suggested UCL to Use**											
1439	95% KM (Chebyshev) UCL					0.915						
1440												
1441	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1442	Recommendations are based upon data size, data distribution, and skewness.											
1443	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1444	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1445												

	A	B	C	D	E	F	G	H	I	J	K	L
1				Background Statistics for Data Sets with Non-Detects								
2	User Selected Options											
3	Date/Time of Computation			ProUCL 5.12/28/2018 10:17:52 AM								
4	From File			WorkSheet.xls								
5	Full Precision			OFF								
6	Confidence Coefficient			95%								
7	Coverage			95%								
8	Different or Future K Observations			1								
9	Number of Bootstrap Operations			2000								
10												
11	As culled											
12												
13						General Statistics						
14					Total Number of Observations	58					Number of Missing Observations	3
15					Number of Distinct Observations	25						
16					Number of Detects	34					Number of Non-Detects	24
17					Number of Distinct Detects	19					Number of Distinct Non-Detects	13
18					Minimum Detect	0.97					Minimum Non-Detect	0.6
19					Maximum Detect	4.1					Maximum Non-Detect	2.9
20					Variance Detected	0.758					Percent Non-Detects	41.38%
21					Mean Detected	2.549					SD Detected	0.871
22					Mean of Detected Logged Data	0.869					SD of Detected Logged Data	0.392
23												
24						Critical Values for Background Threshold Values (BTVs)						
25					Tolerance Factor K (For UTL)	2.024					d2max (for USL)	3.014
26												
27						Normal GOF Test on Detects Only						
28					Shapiro Wilk Test Statistic	0.96			Shapiro Wilk GOF Test			
29					5% Shapiro Wilk Critical Value	0.933			Detected Data appear Normal at 5% Significance Level			
30					Lilliefors Test Statistic	0.109			Lilliefors GOF Test			
31					5% Lilliefors Critical Value	0.15			Detected Data appear Normal at 5% Significance Level			
32						Detected Data appear Normal at 5% Significance Level						
33												
34						Kaplan Meier (KM) Background Statistics Assuming Normal Distribution						
35					KM Mean	1.883					KM SD	1.075
36					95% UTL95% Coverage	4.059					95% KM UPL (t)	3.696
37					90% KM Percentile (z)	3.261					95% KM Percentile (z)	3.651
38					99% KM Percentile (z)	4.384					95% KM USL	5.123
39												
40						DL/2 Substitution Background Statistics Assuming Normal Distribution						
41					Mean	1.835					SD	1.108
42					95% UTL95% Coverage	4.079					95% UPL (t)	3.704
43					90% Percentile (z)	3.256					95% Percentile (z)	3.658
44					99% Percentile (z)	4.414					95% USL	5.176
45						DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons						
46												
47						Gamma GOF Tests on Detected Observations Only						
48					A-D Test Statistic	0.576			Anderson-Darling GOF Test			
49					5% A-D Critical Value	0.748			Detected data appear Gamma Distributed at 5% Significance Level			
50					K-S Test Statistic	0.131			Kolmogorov-Smirnov GOF			
51					5% K-S Critical Value	0.151			Detected data appear Gamma Distributed at 5% Significance Level			
52						Detected data appear Gamma Distributed at 5% Significance Level						

	A–D	E	F	G–J	K	L
53						
54	Gamma Statistics on Detected Data Only					
55		k hat (MLE)	7.607		k star (bias corrected MLE)	6.956
56		Theta hat (MLE)	0.335		Theta star (bias corrected MLE)	0.366
57		nu hat (MLE)	517.3		nu star (bias corrected)	473
58		MLE Mean (bias corrected)	2.549			
59		MLE Sd (bias corrected)	0.967		95% Percentile of Chisquare (2kstar)	23.57
60						
61	Gamma ROS Statistics using Imputed Non-Detects					
62	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs					
63	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)					
64	For such situations, GROS method may yield incorrect values of UCLs and BTVs					
65	This is especially true when the sample size is small.					
66	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates					
67		Minimum	0.371		Mean	1.952
68		Maximum	4.1		Median	1.706
69		SD	1.001		CV	0.513
70		k hat (MLE)	3.701		k star (bias corrected MLE)	3.521
71		Theta hat (MLE)	0.528		Theta star (bias corrected MLE)	0.555
72		nu hat (MLE)	429.3		nu star (bias corrected)	408.4
73		MLE Mean (bias corrected)	1.952		MLE Sd (bias corrected)	1.04
74		95% Percentile of Chisquare (2kstar)	14.13		90% Percentile	3.347
75		95% Percentile	3.917		99% Percentile	5.141
76	The following statistics are computed using Gamma ROS Statistics on Imputed Data					
77	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
78		WH	HW		WH	HW
79	95% Approx. Gamma UTL with 95% Coverage	4.531	4.658	95% Approx. Gamma UPL	3.951	4.022
80	95% Gamma USL	6.55	6.961			
81						
82	Estimates of Gamma Parameters using KM Estimates					
83		Mean (KM)	1.883		SD (KM)	1.075
84		Variance (KM)	1.156		SE of Mean (KM)	0.151
85		k hat (KM)	3.067		k star (KM)	2.92
86		nu hat (KM)	355.8		nu star (KM)	338.8
87		theta hat (KM)	0.614		theta star (KM)	0.645
88		80% gamma percentile (KM)	2.694		90% gamma percentile (KM)	3.36
89		95% gamma percentile (KM)	3.982		99% gamma percentile (KM)	5.333
90						
91	The following statistics are computed using gamma distribution and KM estimates					
92	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
93		WH	HW		WH	HW
94	95% Approx. Gamma UTL with 95% Coverage	4.806	4.984	95% Approx. Gamma UPL	4.125	4.224
95	95% KM Gamma Percentile	4.046	4.137	95% Gamma USL	7.226	7.81
96						
97	Lognormal GOF Test on Detected Observations Only					
98		Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**		
99		5% Shapiro Wilk Critical Value	0.933	Data Not Lognormal at 5% Significance Level		
100		Lilliefors Test Statistic	0.133	**Lilliefors GOF Test**		
101		5% Lilliefors Critical Value	0.15	Detected Data appear Lognormal at 5% Significance Level		
102	Detected Data appear Approximate Lognormal at 5% Significance Level					
103						
104	Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects					

	A–E	F	G–K	L
105	Mean in Original Scale	1.975	Mean in Log Scale	0.561
106	SD in Original Scale	0.97	SD in Log Scale	0.496
107	95% UTL95% Coverage	4.78	95% BCA UTL95% Coverage	3.9
108	95% Bootstrap (%) UTL95% Coverage	3.93	95% UPL (t)	4.043
109	90% Percentile (z)	3.308	95% Percentile (z)	3.961
110	99% Percentile (z)	5.552	95% USL	7.808
111				
112	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
113	KM Mean of Logged Data	0.441	95% KM UTL (Lognormal)95% Coverage	5.787
114	KM SD of Logged Data	0.649	95% KM UPL (Lognormal)	4.647
115	95% KM Percentile Lognormal (z)	4.523	95% KM USL (Lognormal)	11.01
116				
117	Background DL/2 Statistics Assuming Lognormal Distribution			
118	Mean in Original Scale	1.835	Mean in Log Scale	0.385
119	SD in Original Scale	1.108	SD in Log Scale	0.72
120	95% UTL95% Coverage	6.319	95% UPL (t)	4.954
121	90% Percentile (z)	3.701	95% Percentile (z)	4.808
122	99% Percentile (z)	7.856	95% USL	12.89
123	DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.			
124				
125	Nonparametric Distribution Free Background Statistics			
126	Data appear to follow a Discernible Distribution at 5% Significance Level			
127				
128	Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
129	Order of Statistic, r	57	95% UTL with95% Coverage	3.9
130	Approx, f used to compute achieved CC	1.5	Approximate Actual Confidence Coefficient achieved by UTL	0.793
131	Approximate Sample Size needed to achieve specified CC	93	95% UPL	3.9
132	95% USL	4.1	95% KM Chebyshev UPL	6.61
133				
134	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
135	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
136	and consists of observations collected from clean unimpacted locations.			
137	The use of USL tends to provide a balance between false positives and false negatives provided the data			
138	represents a background data set and when many onsite observations need to be compared with the BTV.			
139				

Wilcoxon-Mann-Whitney Sample 1 vs Sample 2 Comparison Test for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/28/2018 11:54:57 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Selected Null Hypothesis	Sample 1 Mean/Median <= Sample 2 Mean/Median (Form 1)
Alternative Hypothesis	Sample 1 Mean/Median > Sample 2 Mean/Median

Sample 1 Data: As culled

Sample 2 Data: As Site

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	58	61
Number of Missing Observations	3	0
Number of Non-Detects	24	24
Number of Detect Data	34	37
Minimum Non-Detect	0.6	0.6
Maximum Non-Detect	2.9	2.9
Percent Non-detects	41.38%	39.34%
Minimum Detect	0.97	0.97
Maximum Detect	4.1	8
Mean of Detects	2.549	2.91
Median of Detects	2.6	2.7
SD of Detects	0.871	1.513

WMW test is meant for a Single Detection Limit Case

Use of Gehan or T-W test is suggested when multiple detection limits are present

All observations <= 2.9 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Sample 1 <= Mean/Median of Sample 2

Sample 1 Rank Sum W-Stat	3393
Standardized WMW U-Stat	-0.603
Mean (U)	1769
SD(U) - Adj ties	188
Approximate U-Stat Critical Value (0.05)	1.645
P-Value (Adjusted for Ties)	0.727

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Sample 1 <= Sample 2

P-Value >= alpha (0.05)

	A	B	C	D	E	F	G	H	I	J	K	L
1	Wilcoxon-Mann-Whitney Sample 1 vs Sample 2 Comparison Test for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.12/28/2018 11:54:57 AM								
5	From File			WorkSheet.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Selected Null Hypothesis			Sample 1 Mean/Median <= Sample 2 Mean/Median (Form 1)								
9	Alternative Hypothesis			Sample 1 Mean/Median > Sample 2 Mean/Median								
10												
11												
12	Sample 1 Data: As culled											
13	Sample 2 Data: As Site											
14												
15	Raw Statistics											
16					Sample 1	Sample 2						
17	Number of Valid Data				58	61						
18	Number of Missing Observations				3	0						
19	Number of Non-Detects				24	24						
20	Number of Detect Data				34	37						
21	Minimum Non-Detect				0.6	0.6						
22	Maximum Non-Detect				2.9	2.9						
23	Percent Non-detects				41.38%	39.34%						
24	Minimum Detect				0.97	0.97						
25	Maximum Detect				4.1	8						
26	Mean of Detects				2.549	2.91						
27	Median of Detects				2.6	2.7						
28	SD of Detects				0.871	1.513						
29												
30	WMW test is meant for a Single Detection Limit Case											
31	Use of Gehan or T-W test is suggested when multiple detection limits are present											
32	All observations <= 2.9 (Max DL) are ranked the same											
33												
34	Wilcoxon-Mann-Whitney (WMW) Test											
35												
36	H0: Mean/Median of Sample 1 <= Mean/Median of Sample 2											
37												
38	Sample 1 Rank Sum W-Stat				3393							
39	Standardized WMW U-Stat				-0.603							
40	Mean (U)				1769							
41	SD(U) - Adj ties				188							
42	Approximate U-Stat Critical Value (0.05)				1.645							
43	P-Value (Adjusted for Ties)				0.727							
44												
45	Conclusion with Alpha = 0.05											
46	Do Not Reject H0, Conclude Sample 1 <= Sample 2											
47	P-Value >= alpha (0.05)											
48												

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/1/2018 3:09:51 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Pb DTTP All Depths

General Statistics

Total Number of Observations	34	Number of Distinct Observations	31
		Number of Missing Observations	0
Minimum	2.2	Mean	11.92
Maximum	70.3	Median	9.05
SD	12.32	Std. Error of Mean	2.113
Coefficient of Variation	1.033	Skewness	3.64

Normal GOF Test

Shapiro Wilk Test Statistic	0.559	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.933	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.38	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.15	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	15.5	95% Adjusted-CLT UCL (Chen-1995)	16.81
		95% Modified-t UCL (Johnson-1978)	15.72

Gamma GOF Test

A-D Test Statistic	2.931	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.76	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.297	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.153	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.985	k star (bias corrected MLE)	1.829
Theta hat (MLE)	6.007	Theta star (bias corrected MLE)	6.518
nu hat (MLE)	135	nu star (bias corrected)	124.4
MLE Mean (bias corrected)	11.92	MLE Sd (bias corrected)	8.815
		Approximate Chi Square Value (0.05)	99.64
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	98.55

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	14.89	95% Adjusted Gamma UCL (use when n<50)	15.05

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk Lognormal GOF Test**

5% Shapiro Wilk Critical Value	0.933	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.239	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.15	Data Not Lognormal at 5% Significance Level	
Data Not Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	0.788	Mean of logged Data	2.206
Maximum of Logged Data	4.253	SD of logged Data	0.692
Assuming Lognormal Distribution			
95% H-UCL	14.87	90% Chebyshev (MVUE) UCL	15.85
95% Chebyshev (MVUE) UCL	17.85	97.5% Chebyshev (MVUE) UCL	20.62
99% Chebyshev (MVUE) UCL	26.07		
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Distribution Free UCLs			
95% CLT UCL	15.4	95% Jackknife UCL	15.5
95% Standard Bootstrap UCL	15.41	95% Bootstrap-t UCL	19.82
95% Hall's Bootstrap UCL	29.23	95% Percentile Bootstrap UCL	15.81
95% BCA Bootstrap UCL	17.03		
90% Chebyshev(Mean, Sd) UCL	18.26	95% Chebyshev(Mean, Sd) UCL	21.14
97.5% Chebyshev(Mean, Sd) UCL	25.12	99% Chebyshev(Mean, Sd) UCL	32.95
Suggested UCL to Use			
95% Chebyshev (Mean, Sd) UCL	21.14		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Pb DTTP Upper Two Feet			
General Statistics			
Total Number of Observations	22	Number of Distinct Observations	22
		Number of Missing Observations	0
Minimum	2.2	Mean	14.14
Maximum	70.3	Median	8.95
SD	14.85	Std. Error of Mean	3.166
Coefficient of Variation	1.05	Skewness	2.918
Normal GOF Test			
Shapiro Wilk Test Statistic	0.619	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.911	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.354	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.184	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Assuming Normal Distribution			

	A–E	F	G–K	L
105	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
106	95% Student's-t UCL	19.58	95% Adjusted-CLT UCL (Chen-1995)	21.45
107			95% Modified-t UCL (Johnson-1978)	19.91
108				
109	**Gamma GOF Test**			
110	A-D Test Statistic	1.749	**Anderson-Darling Gamma GOF Test**	
111	5% A-D Critical Value	0.758	Data Not Gamma Distributed at 5% Significance Level	
112	K-S Test Statistic	0.289	**Kolmogorov-Smirnov Gamma GOF Test**	
113	5% K-S Critical Value	0.188	Data Not Gamma Distributed at 5% Significance Level	
114	**Data Not Gamma Distributed at 5% Significance Level**			
115				
116	**Gamma Statistics**			
117	k hat (MLE)	1.695	k star (bias corrected MLE)	1.494
118	Theta hat (MLE)	8.339	Theta star (bias corrected MLE)	9.46
119	nu hat (MLE)	74.59	nu star (bias corrected)	65.75
120	MLE Mean (bias corrected)	14.14	MLE Sd (bias corrected)	11.56
121			Approximate Chi Square Value (0.05)	48.09
122	Adjusted Level of Significance	0.0386	Adjusted Chi Square Value	46.96
123				
124	**Assuming Gamma Distribution**			
125	95% Approximate Gamma UCL (use when n>=50))	19.33	95% Adjusted Gamma UCL (use when n<50)	19.79
126				
127	**Lognormal GOF Test**			
128	Shapiro Wilk Test Statistic	0.884	**Shapiro Wilk Lognormal GOF Test**	
129	5% Shapiro Wilk Critical Value	0.911	Data Not Lognormal at 5% Significance Level	
130	Lilliefors Test Statistic	0.231	**Lilliefors Lognormal GOF Test**	
131	5% Lilliefors Critical Value	0.184	Data Not Lognormal at 5% Significance Level	
132	**Data Not Lognormal at 5% Significance Level**			
133				
134	**Lognormal Statistics**			
135	Minimum of Logged Data	0.788	Mean of logged Data	2.326
136	Maximum of Logged Data	4.253	SD of logged Data	0.776
137				
138	**Assuming Lognormal Distribution**			
139	95% H-UCL	20.38	90% Chebyshev (MVUE) UCL	20.9
140	95% Chebyshev (MVUE) UCL	24.22	97.5% Chebyshev (MVUE) UCL	28.81
141	99% Chebyshev (MVUE) UCL	37.85		
142				
143	**Nonparametric Distribution Free UCL Statistics**			
144	**Data do not follow a Discernible Distribution (0.05)**			
145				
146	**Nonparametric Distribution Free UCLs**			
147	95% CLT UCL	19.34	95% Jackknife UCL	19.58
148	95% Standard Bootstrap UCL	19.14	95% Bootstrap-t UCL	24.97
149	95% Hall's Bootstrap UCL	39.43	95% Percentile Bootstrap UCL	19.8
150	95% BCA Bootstrap UCL	22.02		
151	90% Chebyshev(Mean, Sd) UCL	23.63	95% Chebyshev(Mean, Sd) UCL	27.94
152	97.5% Chebyshev(Mean, Sd) UCL	33.91	99% Chebyshev(Mean, Sd) UCL	45.64
153				
154	**Suggested UCL to Use**			
155	95% Chebyshev (Mean, Sd) UCL	27.94		
156				

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Pb RB All Depths

General Statistics

Total Number of Observations	16	Number of Distinct Observations	15
Number of Detects	15	Number of Non-Detects	1
Number of Distinct Detects	14	Number of Distinct Non-Detects	1
Minimum Detect	1.2	Minimum Non-Detect	1
Maximum Detect	33.1	Maximum Non-Detect	1
Variance Detects	80.79	Percent Non-Detects	6.25%
Mean Detects	9.413	SD Detects	8.988
Median Detects	6.5	CV Detects	0.955
Skewness Detects	1.754	Kurtosis Detects	2.756
Mean of Logged Detects	1.865	SD of Logged Detects	0.908

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.789	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.242	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8.888	KM Standard Error of Mean	2.239
KM SD	8.651	95% KM (BCA) UCL	13
95% KM (t) UCL	12.81	95% KM (Percentile Bootstrap) UCL	12.76
95% KM (z) UCL	12.57	95% KM Bootstrap t UCL	15.53
90% KM Chebyshev UCL	15.6	95% KM Chebyshev UCL	18.65
97.5% KM Chebyshev UCL	22.87	99% KM Chebyshev UCL	31.16

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.39	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.754	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.149	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.226	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.471	k star (bias corrected MLE)	1.221
Theta hat (MLE)	6.398	Theta star (bias corrected MLE)	7.707
nu hat (MLE)	44.14	nu star (bias corrected)	36.64
Mean (detects)	9.413		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	8.826
Maximum	33.1	Median	6.2
SD	8.996	CV	1.019
k hat (MLE)	0.825	k star (bias corrected MLE)	0.712
Theta hat (MLE)	10.7	Theta star (bias corrected MLE)	12.4
nu hat (MLE)	26.39	nu star (bias corrected)	22.78
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (22.78, α)	12.92	Adjusted Chi Square Value (22.78, β)	12.08
95% Gamma Approximate UCL (use when n>=50)	15.56	95% Gamma Adjusted UCL (use when n<50)	16.64

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8.888	SD (KM)	8.651
Variance (KM)	74.84	SE of Mean (KM)	2.239
k hat (KM)	1.055	k star (KM)	0.899
nu hat (KM)	33.77	nu star (KM)	28.78
theta hat (KM)	8.421	theta star (KM)	9.883
80% gamma percentile (KM)	14.42	90% gamma percentile (KM)	21.01
95% gamma percentile (KM)	27.65	99% gamma percentile (KM)	43.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (28.78, α)	17.53	Adjusted Chi Square Value (28.78, β)	16.54
95% Gamma Approximate KM-UCL (use when n>=50)	14.59	95% Gamma Adjusted KM-UCL (use when n<50)	15.46

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.972	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.144	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8.868	Mean in Log Scale	1.726
SD in Original Scale	8.953	SD in Log Scale	1.04
95% t UCL (assumes normality of ROS data)	12.79	95% Percentile Bootstrap UCL	12.73
95% BCA Bootstrap UCL	13.13	95% Bootstrap t UCL	16.52
95% H-UCL (Log ROS)	20.26		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.749	KM Geo Mean	5.747
KM SD (logged)	0.962	95% Critical H Value (KM-Log)	2.646
KM Standard Error of Mean (logged)	0.249	95% H-UCL (KM -Log)	17.62
KM SD (logged)	0.962	95% Critical H Value (KM-Log)	2.646
KM Standard Error of Mean (logged)	0.249		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	8.856	Mean in Log Scale	1.705
SD in Original Scale	8.965	SD in Log Scale	1.086
95% t UCL (Assumes normality)	12.79	95% H-Stat UCL	21.99

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	15.46	95% GROS Adjusted Gamma UCL	16.64

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Pb RB Upper Two Feet

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
Number of Detects	10	Number of Non-Detects	1
Number of Distinct Detects	9	Number of Distinct Non-Detects	1
Minimum Detect	1.2	Minimum Non-Detect	1
Maximum Detect	33.1	Maximum Non-Detect	1
Variance Detects	91.44	Percent Non-Detects	9.091%
Mean Detects	9.17	SD Detects	9.562
Median Detects	6.65	CV Detects	1.043
Skewness Detects	2.006	Kurtosis Detects	4.495
Mean of Logged Detects	1.785	SD of Logged Detects	0.99

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.772	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.261	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8.427	KM Standard Error of Mean	2.848
KM SD	8.963	95% KM (BCA) UCL	12.97
95% KM (t) UCL	13.59	95% KM (Percentile Bootstrap) UCL	13.4
95% KM (z) UCL	13.11	95% KM Bootstrap t UCL	18.57
90% KM Chebyshev UCL	16.97	95% KM Chebyshev UCL	20.84
97.5% KM Chebyshev UCL	26.22	99% KM Chebyshev UCL	36.77

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.307	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.185	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.272	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.303	k star (bias corrected MLE)	0.979
Theta hat (MLE)	7.039	Theta star (bias corrected MLE)	9.371
nu hat (MLE)	26.05	nu star (bias corrected)	19.57
Mean (detects)	9.17		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	8.337
Maximum	33.1	Median	5.8
SD	9.483	CV	1.137
k hat (MLE)	0.664	k star (bias corrected MLE)	0.544
Theta hat (MLE)	12.55	Theta star (bias corrected MLE)	15.33
nu hat (MLE)	14.62	nu star (bias corrected)	11.96
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (11.96, α)	5.203	Adjusted Chi Square Value (11.96, β)	4.498
95% Gamma Approximate UCL (use when n>=50)	19.17	95% Gamma Adjusted UCL (use when n<50)	22.18

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8.427	SD (KM)	8.963
Variance (KM)	80.33	SE of Mean (KM)	2.848
k hat (KM)	0.884	k star (KM)	0.704
nu hat (KM)	19.45	nu star (KM)	15.48
theta hat (KM)	9.532	theta star (KM)	11.98
80% gamma percentile (KM)	13.85	90% gamma percentile (KM)	21.13
95% gamma percentile (KM)	28.63	99% gamma percentile (KM)	46.53

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.48, α)	7.596	Adjusted Chi Square Value (15.48, β)	6.715
95% Gamma Approximate KM-UCL (use when n>=50)	17.17	95% Gamma Adjusted KM-UCL (use when n<50)	19.43

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.975	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.167	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8.384	Mean in Log Scale	1.564
SD in Original Scale	9.439	SD in Log Scale	1.193
95% t UCL (assumes normality of ROS data)	13.54	95% Percentile Bootstrap UCL	13.31
95% BCA Bootstrap UCL	15.24	95% Bootstrap t UCL	18.18
95% H-UCL (Log ROS)	34.81		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.623	KM Geo Mean	5.069
KM SD (logged)	1.032	95% Critical H Value (KM-Log)	3.059
KM Standard Error of Mean (logged)	0.328	95% H-UCL (KM -Log)	23.42
KM SD (logged)	1.032	95% Critical H Value (KM-Log)	3.059
KM Standard Error of Mean (logged)	0.328		

DL/2 Statistics

	A	B	C	D	E	F	G	H	I	J	K	L
365	DL/2 Normal						DL/2 Log-Transformed					
366					Mean in Original Scale	8.382					Mean in Log Scale	1.56
367					SD in Original Scale	9.441					SD in Log Scale	1.2
368					95% t UCL (Assumes normality)	13.54					95% H-Stat UCL	35.46
369	DL/2 is not a recommended method, provided for comparisons and historical reasons											
370												
371	Nonparametric Distribution Free UCL Statistics											
372	Detected Data appear Approximate Normal Distributed at 5% Significance Level											
373												
374	Suggested UCL to Use											
375					95% KM (t) UCL	13.59						
376												
377	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test											
378	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL											
379												
380	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
381	Recommendations are based upon data size, data distribution, and skewness.											
382	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
383	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
384												
385	Hg DTTP All Depths											
386												
387	General Statistics											
388					Total Number of Observations	34					Number of Distinct Observations	22
389					Number of Detects	16					Number of Non-Detects	18
390					Number of Distinct Detects	15					Number of Distinct Non-Detects	8
391					Minimum Detect	0.04					Minimum Non-Detect	0.06
392					Maximum Detect	8					Maximum Non-Detect	0.16
393					Variance Detects	4.17					Percent Non-Detects	52.94%
394					Mean Detects	0.938					SD Detects	2.042
395					Median Detects	0.11					CV Detects	2.178
396					Skewness Detects	3.137					Kurtosis Detects	10.63
397					Mean of Logged Detects	-1.637					SD of Logged Detects	1.668
398												
399	Normal GOF Test on Detects Only											
400					Shapiro Wilk Test Statistic	0.505	Shapiro Wilk GOF Test					
401					5% Shapiro Wilk Critical Value	0.887	Detected Data Not Normal at 5% Significance Level					
402					Lilliefors Test Statistic	0.397	Lilliefors GOF Test					
403					5% Lilliefors Critical Value	0.213	Detected Data Not Normal at 5% Significance Level					
404	Detected Data Not Normal at 5% Significance Level											
405												
406	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
407					KM Mean	0.474					KM Standard Error of Mean	0.252
408					KM SD	1.425					95% KM (BCA) UCL	0.983
409					95% KM (t) UCL	0.901					95% KM (Percentile Bootstrap) UCL	0.943
410					95% KM (z) UCL	0.889					95% KM Bootstrap t UCL	1.829
411					90% KM Chebyshev UCL	1.231					95% KM Chebyshev UCL	1.574
412					97.5% KM Chebyshev UCL	2.05					99% KM Chebyshev UCL	2.986
413												
414	Gamma GOF Tests on Detected Observations Only											
415					A-D Test Statistic	2.012	Anderson-Darling GOF Test					
416					5% A-D Critical Value	0.814	Detected Data Not Gamma Distributed at 5% Significance Level					

	A	B	C	D	E	F	G	H	I	J	K	L
417					K-S Test Statistic	0.373	Kolmogorov-Smirnov GOF					
418					5% K-S Critical Value	0.23	Detected Data Not Gamma Distributed at 5% Significance Level					
419	Detected Data Not Gamma Distributed at 5% Significance Level											
420												
421	Gamma Statistics on Detected Data Only											
422					k hat (MLE)	0.416					k star (bias corrected MLE)	0.379
423					Theta hat (MLE)	2.255					Theta star (bias corrected MLE)	2.471
424					nu hat (MLE)	13.3					nu star (bias corrected)	12.14
425					Mean (detects)	0.938						
426												
427	Gamma ROS Statistics using Imputed Non-Detects											
428	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
429	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
430	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
431	This is especially true when the sample size is small.											
432	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
433					Minimum	0.01					Mean	0.456
434					Maximum	8					Median	0.0425
435					SD	1.452					CV	3.185
436					k hat (MLE)	0.305					k star (bias corrected MLE)	0.297
437					Theta hat (MLE)	1.497					Theta star (bias corrected MLE)	1.533
438					nu hat (MLE)	20.71					nu star (bias corrected)	20.22
439					Adjusted Level of Significance (β)	0.0422						
440					Approximate Chi Square Value (20.22, α)	11.01					Adjusted Chi Square Value (20.22, β)	10.68
441					95% Gamma Approximate UCL (use when n>=50)	0.837					95% Gamma Adjusted UCL (use when n<50)	0.864
442												
443	Estimates of Gamma Parameters using KM Estimates											
444					Mean (KM)	0.474					SD (KM)	1.425
445					Variance (KM)	2.031					SE of Mean (KM)	0.252
446					k hat (KM)	0.11					k star (KM)	0.12
447					nu hat (KM)	7.512					nu star (KM)	8.182
448					theta hat (KM)	4.288					theta star (KM)	3.937
449					80% gamma percentile (KM)	0.417					90% gamma percentile (KM)	1.343
450					95% gamma percentile (KM)	2.702					99% gamma percentile (KM)	6.847
451												
452	Gamma Kaplan-Meier (KM) Statistics											
453					Approximate Chi Square Value (8.18, α)	2.841					Adjusted Chi Square Value (8.18, β)	2.687
454					95% Gamma Approximate KM-UCL (use when n>=50)	1.364					95% Gamma Adjusted KM-UCL (use when n<50)	1.442
455												
456	Lognormal GOF Test on Detected Observations Only											
457					Shapiro Wilk Test Statistic	0.813	Shapiro Wilk GOF Test					
458					5% Shapiro Wilk Critical Value	0.887	Detected Data Not Lognormal at 5% Significance Level					
459					Lilliefors Test Statistic	0.282	Lilliefors GOF Test					
460					5% Lilliefors Critical Value	0.213	Detected Data Not Lognormal at 5% Significance Level					
461	Detected Data Not Lognormal at 5% Significance Level											
462												
463	Lognormal ROS Statistics Using Imputed Non-Detects											
464					Mean in Original Scale	0.48					Mean in Log Scale	-2.273
465					SD in Original Scale	1.445					SD in Log Scale	1.373
466					95% t UCL (assumes normality of ROS data)	0.899					95% Percentile Bootstrap UCL	0.915
467					95% BCA Bootstrap UCL	1.195					95% Bootstrap t UCL	1.732
468					95% H-UCL (Log ROS)	0.534						

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.274	KM Geo Mean	0.103
KM SD (logged)	1.279	95% Critical H Value (KM-Log)	2.809
KM Standard Error of Mean (logged)	0.234	95% H-UCL (KM -Log)	0.436
KM SD (logged)	1.279	95% Critical H Value (KM-Log)	2.809
KM Standard Error of Mean (logged)	0.234		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.475	Mean in Log Scale	-2.242
SD in Original Scale	1.446	SD in Log Scale	1.281
95% t UCL (Assumes normality)	0.895	95% H-Stat UCL	0.452

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1.574		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Hg DTTP Upper Two Feet

General Statistics

Total Number of Observations	22	Number of Distinct Observations	17
Number of Detects	12	Number of Non-Detects	10
Number of Distinct Detects	12	Number of Distinct Non-Detects	5
Minimum Detect	0.04	Minimum Non-Detect	0.06
Maximum Detect	8	Maximum Non-Detect	0.15
Variance Detects	5.456	Percent Non-Detects	45.45%
Mean Detects	1.122	SD Detects	2.336
Median Detects	0.086	CV Detects	2.081
Skewness Detects	2.73	Kurtosis Detects	7.89
Mean of Logged Detects	-1.624	SD of Logged Detects	1.821

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.54	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.408	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.639	KM Standard Error of Mean	0.386
KM SD	1.734	95% KM (BCA) UCL	1.362
95% KM (t) UCL	1.304	95% KM (Percentile Bootstrap) UCL	1.31
95% KM (z) UCL	1.274	95% KM Bootstrap t UCL	2.384

	A–E	F	G–K	L
521	90% KM Chebyshev UCL	1.798	95% KM Chebyshev UCL	2.323
522	97.5% KM Chebyshev UCL	3.051	99% KM Chebyshev UCL	4.482
523				
524	**Gamma GOF Tests on Detected Observations Only**			
525	A-D Test Statistic	1.655	**Anderson-Darling GOF Test**	
526	5% A-D Critical Value	0.808	Detected Data Not Gamma Distributed at 5% Significance Level	
527	K-S Test Statistic	0.376	**Kolmogorov-Smirnov GOF**	
528	5% K-S Critical Value	0.263	Detected Data Not Gamma Distributed at 5% Significance Level	
529	**Detected Data Not Gamma Distributed at 5% Significance Level**			
530				
531	Gamma Statistics on Detected Data Only			
532	k hat (MLE)	0.381	k star (bias corrected MLE)	0.341
533	Theta hat (MLE)	2.944	Theta star (bias corrected MLE)	3.287
534	nu hat (MLE)	9.149	nu star (bias corrected)	8.195
535	Mean (detects)	1.122		
536				
537	**Gamma ROS Statistics using Imputed Non-Detects**			
538	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
539	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
540	For such situations, GROS method may yield incorrect values of UCLs and BTVs			
541	This is especially true when the sample size is small.			
542	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
543	Minimum	0.01	Mean	0.627
544	Maximum	8	Median	0.0495
545	SD	1.78	CV	2.84
546	k hat (MLE)	0.292	k star (bias corrected MLE)	0.283
547	Theta hat (MLE)	2.145	Theta star (bias corrected MLE)	2.217
548	nu hat (MLE)	12.86	nu star (bias corrected)	12.44
549	Adjusted Level of Significance (β)	0.0386		
550	Approximate Chi Square Value (12.44, α)	5.518	Adjusted Chi Square Value (12.44, β)	5.176
551	95% Gamma Approximate UCL (use when n>=50)	1.413	95% Gamma Adjusted UCL (use when n<50)	1.506
552				
553	**Estimates of Gamma Parameters using KM Estimates**			
554	Mean (KM)	0.639	SD (KM)	1.734
555	Variance (KM)	3.008	SE of Mean (KM)	0.386
556	k hat (KM)	0.136	k star (KM)	0.148
557	nu hat (KM)	5.975	nu star (KM)	6.493
558	theta hat (KM)	4.707	theta star (KM)	4.331
559	80% gamma percentile (KM)	0.686	90% gamma percentile (KM)	1.891
560	95% gamma percentile (KM)	3.529	99% gamma percentile (KM)	8.298
561				
562	**Gamma Kaplan-Meier (KM) Statistics**			
563	Approximate Chi Square Value (6.49, α)	1.897	Adjusted Chi Square Value (6.49, β)	1.718
564	95% Gamma Approximate KM-UCL (use when n>=50)	2.188	95% Gamma Adjusted KM-UCL (use when n<50)	2.416
565				
566	**Lognormal GOF Test on Detected Observations Only**			
567	Shapiro Wilk Test Statistic	0.786	**Shapiro Wilk GOF Test**	
568	5% Shapiro Wilk Critical Value	0.859	Detected Data Not Lognormal at 5% Significance Level	
569	Lilliefors Test Statistic	0.282	**Lilliefors GOF Test**	
570	5% Lilliefors Critical Value	0.243	Detected Data Not Lognormal at 5% Significance Level	
571	**Detected Data Not Lognormal at 5% Significance Level**			
572				

Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.646	Mean in Log Scale	-2.171
SD in Original Scale	1.773	SD in Log Scale	1.533
95% t UCL (assumes normality of ROS data)	1.297	95% Percentile Bootstrap UCL	1.32
95% BCA Bootstrap UCL	1.731	95% Bootstrap t UCL	2.4
95% H-UCL (Log ROS)	1.15		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-2.189	KM Geo Mean	0.112
KM SD (logged)	1.441	95% Critical H Value (KM-Log)	3.247
KM Standard Error of Mean (logged)	0.327	95% H-UCL (KM -Log)	0.879
KM SD (logged)	1.441	95% Critical H Value (KM-Log)	3.247
KM Standard Error of Mean (logged)	0.327		
DL/2 Statistics			
DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.642	Mean in Log Scale	-2.135
SD in Original Scale	1.774	SD in Log Scale	1.449
95% t UCL (Assumes normality)	1.293	95% H-Stat UCL	0.947
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution at 5% Significance Level			
Suggested UCL to Use			
95% KM (Chebyshev) UCL	2.323		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

UCL Statistics for Uncensored Full Data Sets			
User Selected Options			
Date/Time of Computation	ProUCL 5.12/28/2018 7:14:24 PM		
From File	5034.01 Organics, Log Pond.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
DRO			
General Statistics			
Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	1
Minimum	18	Mean	98.67
Maximum	594	Median	62
SD	157.5	Std. Error of Mean	45.48
Coefficient of Variation	1.597	Skewness	3.341
Normal GOF Test			
Shapiro Wilk Test Statistic	0.46	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.456	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	180.3	95% Adjusted-CLT UCL (Chen-1995)	220.3
		95% Modified-t UCL (Johnson-1978)	187.7
Gamma GOF Test			
A-D Test Statistic	1.414	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.754	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.359	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.252	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	1.115	k star (bias corrected MLE)	0.892
Theta hat (MLE)	88.48	Theta star (bias corrected MLE)	110.6
nu hat (MLE)	26.76	nu star (bias corrected)	21.41
MLE Mean (bias corrected)	98.67	MLE Sd (bias corrected)	104.5
		Approximate Chi Square Value (0.05)	11.89
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	10.83
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50))	177.6	95% Adjusted Gamma UCL (use when n<50)	195.1
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.85	Shapiro Wilk Lognormal GOF Test	

5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.268	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.89	Mean of logged Data	4.08
Maximum of Logged Data	6.387	SD of logged Data	0.886

Assuming Lognormal Distribution

95% H-UCL	180.7	90% Chebyshev (MVUE) UCL	152.2
95% Chebyshev (MVUE) UCL	183.1	97.5% Chebyshev (MVUE) UCL	226
99% Chebyshev (MVUE) UCL	310.3		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	173.5	95% Jackknife UCL	180.3
95% Standard Bootstrap UCL	168.8	95% Bootstrap-t UCL	484.8
95% Hall's Bootstrap UCL	553.5	95% Percentile Bootstrap UCL	187.4
95% BCA Bootstrap UCL	237.7		
90% Chebyshev(Mean, Sd) UCL	235.1	95% Chebyshev(Mean, Sd) UCL	296.9
97.5% Chebyshev(Mean, Sd) UCL	382.7	99% Chebyshev(Mean, Sd) UCL	551.2

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	296.9		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ORO

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	35	Mean	96.64
Maximum	160	Median	95
SD	38.91	Std. Error of Mean	11.73
Coefficient of Variation	0.403	Skewness	-0.0217

Normal GOF Test

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.102	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

	A–E	F	G–K	L
105	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
106	95% Student's-t UCL	117.9	95% Adjusted-CLT UCL (Chen-1995)	115.9
107			95% Modified-t UCL (Johnson-1978)	117.9
108				
109	**Gamma GOF Test**			
110	A-D Test Statistic	0.232	**Anderson-Darling Gamma GOF Test**	
111	5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
112	K-S Test Statistic	0.131	**Kolmogorov-Smirnov Gamma GOF Test**	
113	5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level	
114	**Detected data appear Gamma Distributed at 5% Significance Level**			
115				
116	**Gamma Statistics**			
117	k hat (MLE)	5.77	k star (bias corrected MLE)	4.257
118	Theta hat (MLE)	16.75	Theta star (bias corrected MLE)	22.7
119	nu hat (MLE)	126.9	nu star (bias corrected)	93.66
120	MLE Mean (bias corrected)	96.64	MLE Sd (bias corrected)	46.84
121			Approximate Chi Square Value (0.05)	72.34
122	Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	69.29
123				
124	**Assuming Gamma Distribution**			
125	95% Approximate Gamma UCL (use when n>=50))	125.1	95% Adjusted Gamma UCL (use when n<50)	130.6
126				
127	**Lognormal GOF Test**			
128	Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk Lognormal GOF Test**	
129	5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level	
130	Lilliefors Test Statistic	0.164	**Lilliefors Lognormal GOF Test**	
131	5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level	
132	**Data appear Lognormal at 5% Significance Level**			
133				
134	**Lognormal Statistics**			
135	Minimum of Logged Data	3.555	Mean of logged Data	4.482
136	Maximum of Logged Data	5.075	SD of logged Data	0.469
137				
138	**Assuming Lognormal Distribution**			
139	95% H-UCL	135.5	90% Chebyshev (MVUE) UCL	139.8
140	95% Chebyshev (MVUE) UCL	159	97.5% Chebyshev (MVUE) UCL	185.5
141	99% Chebyshev (MVUE) UCL	237.6		
142				
143	**Nonparametric Distribution Free UCL Statistics**			
144	**Data appear to follow a Discernible Distribution at 5% Significance Level**			
145				
146	**Nonparametric Distribution Free UCLs**			
147	95% CLT UCL	115.9	95% Jackknife UCL	117.9
148	95% Standard Bootstrap UCL	114.9	95% Bootstrap-t UCL	117.4
149	95% Hall's Bootstrap UCL	116.3	95% Percentile Bootstrap UCL	115.5
150	95% BCA Bootstrap UCL	114.7		
151	90% Chebyshev(Mean, Sd) UCL	131.8	95% Chebyshev(Mean, Sd) UCL	147.8
152	97.5% Chebyshev(Mean, Sd) UCL	169.9	99% Chebyshev(Mean, Sd) UCL	213.4
153				
154	**Suggested UCL to Use**			
155	95% Student's-t UCL	117.9		
156				

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PCP

General Statistics

Total Number of Observations	1	Number of Distinct Observations	1
		Number of Missing Observations	11
Minimum	1.6	Mean	1.6
Maximum	1.6	Median	1.6

Warning: This data set only has 1 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable PCP was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

TEQ

General Statistics

Total Number of Observations	3	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	38.7	Mean	73.93
Maximum	142	Median	41.1
SD	58.96	Std. Error of Mean	34.04
Coefficient of Variation	0.797	Skewness	1.729

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.

For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).

Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.767	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.378	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	173.3	95% Adjusted-CLT UCL (Chen-1995)	166.2
		95% Modified-t UCL (Johnson-1978)	179

Gamma GOF Test

Not Enough Data to Perform GOF Test

Gamma Statistics

k hat (MLE)	2.733	k star (bias corrected MLE)	N/A
Theta hat (MLE)	27.05	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	16.4	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A
		Approximate Chi Square Value (0.05)	N/A
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	N/A	95% Adjusted Gamma UCL (use when n<50)	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.785	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.371	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.656	Mean of logged Data	4.109
Maximum of Logged Data	4.956	SD of logged Data	0.734

Assuming Lognormal Distribution

95% H-UCL	11390	90% Chebyshev (MVUE) UCL	158.6
95% Chebyshev (MVUE) UCL	197.7	97.5% Chebyshev (MVUE) UCL	251.9
99% Chebyshev (MVUE) UCL	358.4		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	129.9	95% Jackknife UCL	173.3
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	176.1	95% Chebyshev(Mean, Sd) UCL	222.3
97.5% Chebyshev(Mean, Sd) UCL	286.5	99% Chebyshev(Mean, Sd) UCL	412.6

Suggested UCL to Use

95% Student's-t UCL	173.3		

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Uncensored Full Data Sets			
User Selected Options			
Date/Time of Computation	ProUCL 5.12/28/2018 7:31:27 PM		
From File	5034.01 Organics, Log Pond 0-2'.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
DRO			
General Statistics			
Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	1
Minimum	18	Mean	98.67
Maximum	594	Median	62
SD	157.5	Std. Error of Mean	45.48
Coefficient of Variation	1.597	Skewness	3.341
Normal GOF Test			
Shapiro Wilk Test Statistic	0.46	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.456	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	180.3	95% Adjusted-CLT UCL (Chen-1995)	220.3
		95% Modified-t UCL (Johnson-1978)	187.7
Gamma GOF Test			
A-D Test Statistic	1.414	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.754	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.359	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.252	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	1.115	k star (bias corrected MLE)	0.892
Theta hat (MLE)	88.48	Theta star (bias corrected MLE)	110.6
nu hat (MLE)	26.76	nu star (bias corrected)	21.41
MLE Mean (bias corrected)	98.67	MLE Sd (bias corrected)	104.5
		Approximate Chi Square Value (0.05)	11.89
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	10.83
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50))	177.6	95% Adjusted Gamma UCL (use when n<50)	195.1
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.85	**Shapiro Wilk Lognormal GOF Test**	

5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.268	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.89	Mean of logged Data	4.08
Maximum of Logged Data	6.387	SD of logged Data	0.886

Assuming Lognormal Distribution

95% H-UCL	180.7	90% Chebyshev (MVUE) UCL	152.2
95% Chebyshev (MVUE) UCL	183.1	97.5% Chebyshev (MVUE) UCL	226
99% Chebyshev (MVUE) UCL	310.3		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	173.5	95% Jackknife UCL	180.3
95% Standard Bootstrap UCL	170.9	95% Bootstrap-t UCL	480.3
95% Hall's Bootstrap UCL	554.5	95% Percentile Bootstrap UCL	188
95% BCA Bootstrap UCL	235.9		
90% Chebyshev(Mean, Sd) UCL	235.1	95% Chebyshev(Mean, Sd) UCL	296.9
97.5% Chebyshev(Mean, Sd) UCL	382.7	99% Chebyshev(Mean, Sd) UCL	551.2

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	296.9		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ORO

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	35	Mean	96.64
Maximum	160	Median	95
SD	38.91	Std. Error of Mean	11.73
Coefficient of Variation	0.403	Skewness	-0.0217

Normal GOF Test

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.102	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	117.9	95% Adjusted-CLT UCL (Chen-1995)	115.9
		95% Modified-t UCL (Johnson-1978)	117.9
Gamma GOF Test			
A-D Test Statistic	0.232	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.131	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	5.77	k star (bias corrected MLE)	4.257
Theta hat (MLE)	16.75	Theta star (bias corrected MLE)	22.7
nu hat (MLE)	126.9	nu star (bias corrected)	93.66
MLE Mean (bias corrected)	96.64	MLE Sd (bias corrected)	46.84
		Approximate Chi Square Value (0.05)	72.34
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	69.29
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50))	125.1	95% Adjusted Gamma UCL (use when n<50)	130.6
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.164	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	3.555	Mean of logged Data	4.482
Maximum of Logged Data	5.075	SD of logged Data	0.469
Assuming Lognormal Distribution			
95% H-UCL	135.5	90% Chebyshev (MVUE) UCL	139.8
95% Chebyshev (MVUE) UCL	159	97.5% Chebyshev (MVUE) UCL	185.5
99% Chebyshev (MVUE) UCL	237.6		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	115.9	95% Jackknife UCL	117.9
95% Standard Bootstrap UCL	115	95% Bootstrap-t UCL	119
95% Hall's Bootstrap UCL	116.4	95% Percentile Bootstrap UCL	114.2
95% BCA Bootstrap UCL	115.6		
90% Chebyshev(Mean, Sd) UCL	131.8	95% Chebyshev(Mean, Sd) UCL	147.8
97.5% Chebyshev(Mean, Sd) UCL	169.9	99% Chebyshev(Mean, Sd) UCL	213.4
Suggested UCL to Use			
95% Student's-t UCL	117.9		

157	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
158	Recommendations are based upon data size, data distribution, and skewness.
159	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
160	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.
161	
162	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**
163	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**
164	

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/28/2018 7:18:34 PM
From File	5034.01 Organics, Dip Tank - Transfer Pit.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

DRO

General Statistics

Total Number of Observations	53	Number of Distinct Observations	42
		Number of Missing Observations	70
Number of Detects	44	Number of Non-Detects	9
Number of Distinct Detects	37	Number of Distinct Non-Detects	7
Minimum Detect	1.6	Minimum Non-Detect	0.99
Maximum Detect	47000	Maximum Non-Detect	35
Variance Detects	50181333	Percent Non-Detects	16.98%
Mean Detects	1079	SD Detects	7084
Median Detects	4.1	CV Detects	6.566
Skewness Detects	6.633	Kurtosis Detects	44
Mean of Logged Detects	1.968	SD of Logged Detects	1.671

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.155	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.944	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.534	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.132	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	896.1	KM Standard Error of Mean	888.4
KM SD	6393	95% KM (BCA) UCL	2671
95% KM (t) UCL	2384	95% KM (Percentile Bootstrap) UCL	2669
95% KM (z) UCL	2357	95% KM Bootstrap t UCL	508056
90% KM Chebyshev UCL	3561	95% KM Chebyshev UCL	4768
97.5% KM Chebyshev UCL	6444	99% KM Chebyshev UCL	9735

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	13.89	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.956	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.458	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.151	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.153	k star (bias corrected MLE)	0.158
Theta hat (MLE)	7060	Theta star (bias corrected MLE)	6848
nu hat (MLE)	13.45	nu star (bias corrected)	13.86
Mean (detects)	1079		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	895.7
Maximum	47000	Median	3.6
SD	6455	CV	7.206
k hat (MLE)	0.132	k star (bias corrected MLE)	0.137
Theta hat (MLE)	6802	Theta star (bias corrected MLE)	6547
nu hat (MLE)	13.96	nu star (bias corrected)	14.5
Adjusted Level of Significance (β)	0.0455		
Approximate Chi Square Value (14.50, α)	6.916	Adjusted Chi Square Value (14.50, β)	6.769
95% Gamma Approximate UCL (use when n>=50)	1878	95% Gamma Adjusted UCL (use when n<50)	1919

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	896.1	SD (KM)	6393
Variance (KM)	40876537	SE of Mean (KM)	888.4
k hat (KM)	0.0196	k star (KM)	0.0311
nu hat (KM)	2.082	nu star (KM)	3.298
theta hat (KM)	45615	theta star (KM)	28803
80% gamma percentile (KM)	12.73	90% gamma percentile (KM)	571.8
95% gamma percentile (KM)	3586	99% gamma percentile (KM)	22909

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.30, α)	0.466	Adjusted Chi Square Value (3.30, β)	0.44
95% Gamma Approximate KM-UCL (use when n>=50)	6344	95% Gamma Adjusted KM-UCL (use when n<50)	6719

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.628	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.944	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.247	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.132	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	896	Mean in Log Scale	1.656
SD in Original Scale	6455	SD in Log Scale	1.72
95% t UCL (assumes normality of ROS data)	2381	95% Percentile Bootstrap UCL	2669
95% BCA Bootstrap UCL	3557	95% Bootstrap t UCL	499899
95% H-UCL (Log ROS)	49.73		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.744	KM Geo Mean	5.718
KM SD (logged)	1.605	95% Critical H Value (KM-Log)	3.084
KM Standard Error of Mean (logged)	0.224	95% H-UCL (KM -Log)	41.22
KM SD (logged)	1.605	95% Critical H Value (KM-Log)	3.084
KM Standard Error of Mean (logged)	0.224		

DL/2 Statistics

DL/2 Normal	**DL/2 Log-Transformed**

	A	B	C	D	E	F	G	H	I	J	K	L
105					Mean in Original Scale	896.3					Mean in Log Scale	1.718
106					SD in Original Scale	6455					SD in Log Scale	1.682
107					95% t UCL (Assumes normality)	2381					95% H-Stat UCL	48.19
108			DL/2 is not a recommended method, provided for comparisons and historical reasons									
109												
110					Nonparametric Distribution Free UCL Statistics							
111				Data do not follow a Discernible Distribution at 5% Significance Level								
112												
113						Suggested UCL to Use						
114					95% KM (Chebyshev) UCL	4768						
115												
116		Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
117				Recommendations are based upon data size, data distribution, and skewness.								
118		These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
119		However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
120												
121	ORO											
122												
123						General Statistics						
124					Total Number of Observations	52					Number of Distinct Observations	38
125											Number of Missing Observations	66
126					Number of Detects	44					Number of Non-Detects	8
127					Number of Distinct Detects	35					Number of Distinct Non-Detects	4
128					Minimum Detect	1.3					Minimum Non-Detect	13
129					Maximum Detect	520					Maximum Non-Detect	50
130					Variance Detects	7293					Percent Non-Detects	15.38%
131					Mean Detects	31.62					SD Detects	85.4
132					Median Detects	3.95					CV Detects	2.701
133					Skewness Detects	4.746					Kurtosis Detects	25.73
134					Mean of Logged Detects	1.921					SD of Logged Detects	1.492
135												
136					Normal GOF Test on Detects Only							
137					Shapiro Wilk Test Statistic	0.401			Shapiro Wilk GOF Test			
138					5% Shapiro Wilk Critical Value	0.944		Detected Data Not Normal at 5% Significance Level				
139					Lilliefors Test Statistic	0.363			Lilliefors GOF Test			
140					5% Lilliefors Critical Value	0.132		Detected Data Not Normal at 5% Significance Level				
141					Detected Data Not Normal at 5% Significance Level							
142												
143			Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs									
144					KM Mean	27.51					KM Standard Error of Mean	10.99
145					KM SD	78.29					95% KM (BCA) UCL	49.6
146					95% KM (t) UCL	45.92					95% KM (Percentile Bootstrap) UCL	46.88
147					95% KM (z) UCL	45.59					95% KM Bootstrap t UCL	69.91
148					90% KM Chebyshev UCL	60.48					95% KM Chebyshev UCL	75.41
149					97.5% KM Chebyshev UCL	96.13					99% KM Chebyshev UCL	136.8
150												
151					Gamma GOF Tests on Detected Observations Only							
152					A-D Test Statistic	5.758			Anderson-Darling GOF Test			
153					5% A-D Critical Value	0.831		Detected Data Not Gamma Distributed at 5% Significance Level				
154					K-S Test Statistic	0.31			Kolmogorov-Smirnov GOF			
155					5% K-S Critical Value	0.142		Detected Data Not Gamma Distributed at 5% Significance Level				
156					Detected Data Not Gamma Distributed at 5% Significance Level							

Gamma Statistics on Detected Data Only

k hat (MLE)	0.425	k star (bias corrected MLE)	0.411
Theta hat (MLE)	74.38	Theta star (bias corrected MLE)	76.88
nu hat (MLE)	37.41	nu star (bias corrected)	36.19
Mean (detects)	31.62		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	27.4
Maximum	520	Median	3.45
SD	79.16	CV	2.889
k hat (MLE)	0.319	k star (bias corrected MLE)	0.313
Theta hat (MLE)	85.94	Theta star (bias corrected MLE)	87.46
nu hat (MLE)	33.16	nu star (bias corrected)	32.58
Adjusted Level of Significance (β)	0.0454		
Approximate Chi Square Value (32.58, α)	20.53	Adjusted Chi Square Value (32.58, β)	20.26
95% Gamma Approximate UCL (use when n>=50)	43.47	95% Gamma Adjusted UCL (use when n<50)	44.06

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	27.51	SD (KM)	78.29
Variance (KM)	6129	SE of Mean (KM)	10.99
k hat (KM)	0.123	k star (KM)	0.129
nu hat (KM)	12.84	nu star (KM)	13.44
theta hat (KM)	222.8	theta star (KM)	213
80% gamma percentile (KM)	26.12	90% gamma percentile (KM)	79.4
95% gamma percentile (KM)	155.4	99% gamma percentile (KM)	383.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.44, α)	6.187	Adjusted Chi Square Value (13.44, β)	6.046
95% Gamma Approximate KM-UCL (use when n>=50)	59.75	95% Gamma Adjusted KM-UCL (use when n<50)	61.14

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.816	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.944	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.241	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.132	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	27.58	Mean in Log Scale	1.857
SD in Original Scale	79.01	SD in Log Scale	1.398
95% t UCL (assumes normality of ROS data)	45.94	95% Percentile Bootstrap UCL	48.39
95% BCA Bootstrap UCL	56.14	95% Bootstrap t UCL	74.86
95% H-UCL (Log ROS)	29.41		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.821	KM Geo Mean	6.178

KM SD (logged)	1.402	95% Critical H Value (KM-Log)	2.795
KM Standard Error of Mean (logged)	0.201	95% H-UCL (KM -Log)	28.59
KM SD (logged)	1.402	95% Critical H Value (KM-Log)	2.795
KM Standard Error of Mean (logged)	0.201		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	29.21	Mean in Log Scale	2.021
SD in Original Scale	78.7	SD in Log Scale	1.414
95% t UCL (Assumes normality)	47.49	95% H-Stat UCL	35.78

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	75.41		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PCP

General Statistics

Total Number of Observations	108	Number of Distinct Observations	37
		Number of Missing Observations	19
Number of Detects	26	Number of Non-Detects	82
Number of Distinct Detects	24	Number of Distinct Non-Detects	14
Minimum Detect	0.027	Minimum Non-Detect	0.02
Maximum Detect	150	Maximum Non-Detect	4.7
Variance Detects	2070	Percent Non-Detects	75.93%
Mean Detects	21.49	SD Detects	45.5
Median Detects	5.15	CV Detects	2.118
Skewness Detects	2.482	Kurtosis Detects	4.755
Mean of Logged Detects	1.181	SD of Logged Detects	2.217

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.49	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.403	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.289	KM Standard Error of Mean	2.328
KM SD	23.72	95% KM (BCA) UCL	10.06
95% KM (t) UCL	9.151	95% KM (Percentile Bootstrap) UCL	9.526
95% KM (z) UCL	9.118	95% KM Bootstrap t UCL	11.52
90% KM Chebyshev UCL	12.27	95% KM Chebyshev UCL	15.44
97.5% KM Chebyshev UCL	19.83	99% KM Chebyshev UCL	28.45

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.244	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.84	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.207	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.185	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.356	k star (bias corrected MLE)	0.34
Theta hat (MLE)	60.43	Theta star (bias corrected MLE)	63.16
nu hat (MLE)	18.49	nu star (bias corrected)	17.69
Mean (detects)	21.49		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	5.196
Maximum	150	Median	0.01
SD	23.85	CV	4.589
k hat (MLE)	0.158	k star (bias corrected MLE)	0.16
Theta hat (MLE)	32.8	Theta star (bias corrected MLE)	32.43
nu hat (MLE)	34.22	nu star (bias corrected)	34.61
Adjusted Level of Significance (β)	0.0478		
Approximate Chi Square Value (34.61, α)	22.15	Adjusted Chi Square Value (34.61, β)	22.01
95% Gamma Approximate UCL (use when n>=50)	8.119	95% Gamma Adjusted UCL (use when n<50)	8.168

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.289	SD (KM)	23.72
Variance (KM)	562.5	SE of Mean (KM)	2.328
k hat (KM)	0.0497	k star (KM)	0.0545
nu hat (KM)	10.74	nu star (KM)	11.78
theta hat (KM)	106.3	theta star (KM)	97
80% gamma percentile (KM)	0.959	90% gamma percentile (KM)	8.978
95% gamma percentile (KM)	28.93	99% gamma percentile (KM)	111.1

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (11.78, α)	5.08	Adjusted Chi Square Value (11.78, β)	5.021
95% Gamma Approximate KM-UCL (use when n>=50)	12.26	95% Gamma Adjusted KM-UCL (use when n<50)	12.41

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.112	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.268	Mean in Log Scale	-2.87

	A–E	F	G–K	L
313	SD in Original Scale	23.83	SD in Log Scale	3.29
314	95% t UCL (assumes normality of ROS data)	9.073	95% Percentile Bootstrap UCL	8.983
315	95% BCA Bootstrap UCL	10.43	95% Bootstrap t UCL	11.29
316	95% H-UCL (Log ROS)	62.02		
317				
318	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**			
319	KM Mean (logged)	-2.01	KM Geo Mean	0.134
320	KM SD (logged)	2.383	95% Critical H Value (KM-Log)	3.79
321	KM Standard Error of Mean (logged)	0.32	95% H-UCL (KM -Log)	5.497
322	KM SD (logged)	2.383	95% Critical H Value (KM-Log)	3.79
323	KM Standard Error of Mean (logged)	0.32		
324				
325	**DL/2 Statistics**			
326	**DL/2 Normal**		**DL/2 Log-Transformed**	
327	Mean in Original Scale	5.67	Mean in Log Scale	-0.312
328	SD in Original Scale	23.74	SD in Log Scale	1.719
329	95% t UCL (Assumes normality)	9.461	95% H-Stat UCL	5.254
330	**DL/2 is not a recommended method, provided for comparisons and historical reasons**			
331				
332	**Nonparametric Distribution Free UCL Statistics**			
333	**Detected Data appear Lognormal Distributed at 5% Significance Level**			
334				
335	**Suggested UCL to Use**			
336	KM H-UCL	5.497		
337				
338	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
339	Recommendations are based upon data size, data distribution, and skewness.			
340	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
341	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
342				

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/28/2018 7:37:30 PM
From File	5034.01 Organics, Dip Tank - Transfer Pit 0-2'.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

DRO

General Statistics

Total Number of Observations	32	Number of Distinct Observations	28
		Number of Missing Observations	5
Number of Detects	27	Number of Non-Detects	5
Number of Distinct Detects	24	Number of Distinct Non-Detects	5
Minimum Detect	1.6	Minimum Non-Detect	1
Maximum Detect	47000	Maximum Non-Detect	35
Variance Detects	81762127	Percent Non-Detects	15.63%
Mean Detects	1755	SD Detects	9042
Median Detects	4.9	CV Detects	5.151
Skewness Detects	5.196	Kurtosis Detects	27
Mean of Logged Detects	2.363	SD of Logged Detects	2.008

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.199	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.537	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1482	KM Standard Error of Mean	1473
KM SD	8175	95% KM (BCA) UCL	4420
95% KM (t) UCL	3979	95% KM (Percentile Bootstrap) UCL	4418
95% KM (z) UCL	3904	95% KM Bootstrap t UCL	826128
90% KM Chebyshev UCL	5900	95% KM Chebyshev UCL	7901
97.5% KM Chebyshev UCL	10679	99% KM Chebyshev UCL	16135

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	7.747	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.949	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.476	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.19	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.15	k star (bias corrected MLE)	0.158
Theta hat (MLE)	11671	Theta star (bias corrected MLE)	11083
nu hat (MLE)	8.122	nu star (bias corrected)	8.553
Mean (detects)	1755		

	A B C D E	F	G H I J K	L
53	**Gamma ROS Statistics using Imputed Non-Detects**			
54	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
55	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
56	For such situations, GROS method may yield incorrect values of UCLs and BTVs			
57	This is especially true when the sample size is small.			
58	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
59	Minimum	0.01	Mean	1481
60	Maximum	47000	Median	4.5
61	SD	8306	CV	5.608
62	k hat (MLE)	0.13	k star (bias corrected MLE)	0.139
63	Theta hat (MLE)	11382	Theta star (bias corrected MLE)	10674
64	nu hat (MLE)	8.328	nu star (bias corrected)	8.881
65	Adjusted Level of Significance (β)	0.0416		
66	Approximate Chi Square Value (8.88, α)	3.255	Adjusted Chi Square Value (8.88, β)	3.075
67	95% Gamma Approximate UCL (use when n>=50)	4041	95% Gamma Adjusted UCL (use when n<50)	4278
68				
69	**Estimates of Gamma Parameters using KM Estimates**			
70	Mean (KM)	1482	SD (KM)	8175
71	Variance (KM)	66836538	SE of Mean (KM)	1473
72	k hat (KM)	0.0328	k star (KM)	0.0506
73	nu hat (KM)	2.102	nu star (KM)	3.238
74	theta hat (KM)	45110	theta star (KM)	29282
75	80% gamma percentile (KM)	209.5	90% gamma percentile (KM)	2297
76	95% gamma percentile (KM)	7914	99% gamma percentile (KM)	32077
77				
78	**Gamma Kaplan-Meier (KM) Statistics**			
79	Approximate Chi Square Value (3.24, α)	0.446	Adjusted Chi Square Value (3.24, β)	0.399
80	95% Gamma Approximate KM-UCL (use when n>=50)	10749	95% Gamma Adjusted KM-UCL (use when n<50)	12018
81	95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)			
82				
83	**Lognormal GOF Test on Detected Observations Only**			
84	Shapiro Wilk Test Statistic	0.674	**Shapiro Wilk GOF Test**	
85	5% Shapiro Wilk Critical Value	0.923	Detected Data Not Lognormal at 5% Significance Level	
86	Lilliefors Test Statistic	0.242	**Lilliefors GOF Test**	
87	5% Lilliefors Critical Value	0.167	Detected Data Not Lognormal at 5% Significance Level	
88	**Detected Data Not Lognormal at 5% Significance Level**			
89				
90	**Lognormal ROS Statistics Using Imputed Non-Detects**			
91	Mean in Original Scale	1481	Mean in Log Scale	2.037
92	SD in Original Scale	8306	SD in Log Scale	2.048
93	95% t UCL (assumes normality of ROS data)	3971	95% Percentile Bootstrap UCL	4418
94	95% BCA Bootstrap UCL	5890	95% Bootstrap t UCL	831850
95	95% H-UCL (Log ROS)	263		
96				
97	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**			
98	KM Mean (logged)	2.129	KM Geo Mean	8.406
99	KM SD (logged)	1.909	95% Critical H Value (KM-Log)	3.692
100	KM Standard Error of Mean (logged)	0.346	95% H-UCL (KM -Log)	184.5
101	KM SD (logged)	1.909	95% Critical H Value (KM-Log)	3.692
102	KM Standard Error of Mean (logged)	0.346		
103				
104	**DL/2 Statistics**			

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	1482	Mean in Log Scale	2.141
SD in Original Scale	8306	SD in Log Scale	1.97
95% t UCL (Assumes normality)	3972	95% H-Stat UCL	226.3

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	10679		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ORO

General Statistics

Total Number of Observations	31	Number of Distinct Observations	28
		Number of Missing Observations	2
Number of Detects	27	Number of Non-Detects	4
Number of Distinct Detects	25	Number of Distinct Non-Detects	3
Minimum Detect	1.6	Minimum Non-Detect	13
Maximum Detect	520	Maximum Non-Detect	50
Variance Detects	11250	Percent Non-Detects	12.9%
Mean Detects	48.79	SD Detects	106.1
Median Detects	6.4	CV Detects	2.174
Skewness Detects	3.707	Kurtosis Detects	15.67
Mean of Logged Detects	2.427	SD of Logged Detects	1.637

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.495	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.328	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	43.28	KM Standard Error of Mean	17.98
KM SD	98.22	95% KM (BCA) UCL	75.99
95% KM (t) UCL	73.81	95% KM (Percentile Bootstrap) UCL	74.67
95% KM (z) UCL	72.86	95% KM Bootstrap t UCL	111.7
90% KM Chebyshev UCL	97.24	95% KM Chebyshev UCL	121.7
97.5% KM Chebyshev UCL	155.6	99% KM Chebyshev UCL	222.2

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.438	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.82	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.288	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.179	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	0.443	k star (bias corrected MLE)	0.419
Theta hat (MLE)	110.1	Theta star (bias corrected MLE)	116.6
nu hat (MLE)	23.93	nu star (bias corrected)	22.6
Mean (detects)	48.79		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	42.82
Maximum	520	Median	4.6
SD	100	CV	2.335
k hat (MLE)	0.336	k star (bias corrected MLE)	0.325
Theta hat (MLE)	127.4	Theta star (bias corrected MLE)	131.8
nu hat (MLE)	20.83	nu star (bias corrected)	20.15
Adjusted Level of Significance (β)	0.0413		
Approximate Chi Square Value (20.15, α)	10.96	Adjusted Chi Square Value (20.15, β)	10.59
95% Gamma Approximate UCL (use when n>=50)	78.72	95% Gamma Adjusted UCL (use when n<50)	81.52
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	43.28	SD (KM)	98.22
Variance (KM)	9647	SE of Mean (KM)	17.98
k hat (KM)	0.194	k star (KM)	0.197
nu hat (KM)	12.04	nu star (KM)	12.21
theta hat (KM)	222.9	theta star (KM)	219.8
80% gamma percentile (KM)	56.57	90% gamma percentile (KM)	130.9
95% gamma percentile (KM)	223.9	99% gamma percentile (KM)	480.7
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (12.21, α)	5.365	Adjusted Chi Square Value (12.21, β)	5.113
95% Gamma Approximate KM-UCL (use when n>=50)	98.5	95% Gamma Adjusted KM-UCL (use when n<50)	103.3
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.923	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.22	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.167	Detected Data Not Lognormal at 5% Significance Level	
Detected Data Not Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	43.32	Mean in Log Scale	2.339
SD in Original Scale	99.8	SD in Log Scale	1.549
95% t UCL (assumes normality of ROS data)	73.74	95% Percentile Bootstrap UCL	76.58
95% BCA Bootstrap UCL	91.72	95% Bootstrap t UCL	115.3
95% H-UCL (Log ROS)	83.91		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			

KM Mean (logged)	2.306	KM Geo Mean	10.03
KM SD (logged)	1.552	95% Critical H Value (KM-Log)	3.15
KM Standard Error of Mean (logged)	0.288	95% H-UCL (KM -Log)	81.59
KM SD (logged)	1.552	95% Critical H Value (KM-Log)	3.15
KM Standard Error of Mean (logged)	0.288		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	44.54	Mean in Log Scale	2.444
SD in Original Scale	99.43	SD in Log Scale	1.544
95% t UCL (Assumes normality)	74.85	95% H-Stat UCL	91.83

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	121.7		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PCP

General Statistics

Total Number of Observations	67	Number of Distinct Observations	30
		Number of Missing Observations	1
Number of Detects	24	Number of Non-Detects	43
Number of Distinct Detects	22	Number of Distinct Non-Detects	8
Minimum Detect	0.068	Minimum Non-Detect	0.02
Maximum Detect	150	Maximum Non-Detect	4.7
Variance Detects	2227	Percent Non-Detects	64.18%
Mean Detects	22.64	SD Detects	47.19
Median Detects	5.15	CV Detects	2.084
Skewness Detects	2.359	Kurtosis Detects	4.099
Mean of Logged Detects	1.285	SD of Logged Detects	2.109

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.497	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.916	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.423	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.177	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8.276	KM Standard Error of Mean	3.702
KM SD	29.66	95% KM (BCA) UCL	14.6
95% KM (t) UCL	14.45	95% KM (Percentile Bootstrap) UCL	14.66
95% KM (z) UCL	14.37	95% KM Bootstrap t UCL	29.01
90% KM Chebyshev UCL	19.38	95% KM Chebyshev UCL	24.41

	A–E	F	G–K	L
261	97.5% KM Chebyshev UCL	31.4	99% KM Chebyshev UCL	45.11
262				
263	**Gamma GOF Tests on Detected Observations Only**			
264	A-D Test Statistic	1.4	**Anderson-Darling GOF Test**	
265	5% A-D Critical Value	0.837	Detected Data Not Gamma Distributed at 5% Significance Level	
266	K-S Test Statistic	0.246	**Kolmogorov-Smirnov GOF**	
267	5% K-S Critical Value	0.192	Detected Data Not Gamma Distributed at 5% Significance Level	
268	**Detected Data Not Gamma Distributed at 5% Significance Level**			
269				
270	**Gamma Statistics on Detected Data Only**			
271	k hat (MLE)	0.364	k star (bias corrected MLE)	0.346
272	Theta hat (MLE)	62.2	Theta star (bias corrected MLE)	65.38
273	nu hat (MLE)	17.48	nu star (bias corrected)	16.63
274	Mean (detects)	22.64		
275				
276	**Gamma ROS Statistics using Imputed Non-Detects**			
277	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
278	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
279	For such situations, GROS method may yield incorrect values of UCLs and BTVs			
280	This is especially true when the sample size is small.			
281	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
282	Minimum	0.01	Mean	8.118
283	Maximum	150	Median	0.01
284	SD	29.93	CV	3.687
285	k hat (MLE)	0.165	k star (bias corrected MLE)	0.168
286	Theta hat (MLE)	49.17	Theta star (bias corrected MLE)	48.42
287	nu hat (MLE)	22.13	nu star (bias corrected)	22.47
288	Adjusted Level of Significance (β)	0.0464		
289	Approximate Chi Square Value (22.47, α)	12.69	Adjusted Chi Square Value (22.47, β)	12.53
290	95% Gamma Approximate UCL (use when n>=50)	14.37	95% Gamma Adjusted UCL (use when n<50)	14.56
291				
292	**Estimates of Gamma Parameters using KM Estimates**			
293	Mean (KM)	8.276	SD (KM)	29.66
294	Variance (KM)	879.9	SE of Mean (KM)	3.702
295	k hat (KM)	0.0778	k star (KM)	0.0843
296	nu hat (KM)	10.43	nu star (KM)	11.3
297	theta hat (KM)	106.3	theta star (KM)	98.17
298	80% gamma percentile (KM)	4.348	90% gamma percentile (KM)	20.25
299	95% gamma percentile (KM)	48.21	99% gamma percentile (KM)	143
300				
301	**Gamma Kaplan-Meier (KM) Statistics**			
302	Approximate Chi Square Value (11.30, α)	4.767	Adjusted Chi Square Value (11.30, β)	4.674
303	95% Gamma Approximate KM-UCL (use when n>=50)	19.61	95% Gamma Adjusted KM-UCL (use when n<50)	20
304				
305	**Lognormal GOF Test on Detected Observations Only**			
306	Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**	
307	5% Shapiro Wilk Critical Value	0.916	Detected Data appear Lognormal at 5% Significance Level	
308	Lilliefors Test Statistic	0.118	**Lilliefors GOF Test**	
309	5% Lilliefors Critical Value	0.177	Detected Data appear Lognormal at 5% Significance Level	
310	**Detected Data appear Lognormal at 5% Significance Level**			
311				
312	**Lognormal ROS Statistics Using Imputed Non-Detects**			

	A	B	C	D	E	F	G	H	I	J	K	L
313	Mean in Original Scale					8.254	Mean in Log Scale					-1.412
314	SD in Original Scale					29.89	SD in Log Scale					2.851
315	95% t UCL (assumes normality of ROS data)					14.35	95% Percentile Bootstrap UCL					15.06
316	95% BCA Bootstrap UCL					17.11	95% Bootstrap t UCL					17.22
317	95% H-UCL (Log ROS)					48.56						
318												
319	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
320	KM Mean (logged)					-1.148	KM Geo Mean					0.317
321	KM SD (logged)					2.517	95% Critical H Value (KM-Log)					3.111
322	KM Standard Error of Mean (logged)					0.417	95% H-UCL (KM -Log)					19.76
323	KM SD (logged)					2.517	95% Critical H Value (KM-Log)					3.111
324	KM Standard Error of Mean (logged)					0.417						
325												
326	**DL/2 Statistics**											
327	**DL/2 Normal**						**DL/2 Log-Transformed**					
328	Mean in Original Scale					8.563	Mean in Log Scale					0.0295
329	SD in Original Scale					29.81	SD in Log Scale					1.808
330	95% t UCL (Assumes normality)					14.64	95% H-Stat UCL					9.725
331	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
332												
333	**Nonparametric Distribution Free UCL Statistics**											
334	**Detected Data appear Lognormal Distributed at 5% Significance Level**											
335												
336	**Suggested UCL to Use**											
337	95% KM (Chebyshev) UCL					24.41						
338												
339	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
340	Recommendations are based upon data size, data distribution, and skewness.											
341	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
342	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
343												

UCL Statistics for Uncensored Full Data Sets			
User Selected Options			
Date/Time of Computation	ProUCL 5.12/28/2018 6:53:11 PM		
From File	5034.01 Organics, Boiler Room.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
DRO			
General Statistics			
Total Number of Observations	67	Number of Distinct Observations	56
		Number of Missing Observations	3
Minimum	1.4	Mean	290.5
Maximum	5000	Median	73
SD	663	Std. Error of Mean	81
Coefficient of Variation	2.283	Skewness	5.76
Normal GOF Test			
Shapiro Wilk Test Statistic	0.444	Shapiro Wilk GOF Test	
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.331	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.108	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	425.6	95% Adjusted-CLT UCL (Chen-1995)	484.6
		95% Modified-t UCL (Johnson-1978)	435.1
Gamma GOF Test			
A-D Test Statistic	0.998	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.831	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.108	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.116	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.44	k star (bias corrected MLE)	0.43
Theta hat (MLE)	660.5	Theta star (bias corrected MLE)	675.4
nu hat (MLE)	58.93	nu star (bias corrected)	57.62
MLE Mean (bias corrected)	290.5	MLE Sd (bias corrected)	442.9
		Approximate Chi Square Value (0.05)	41.17
Adjusted Level of Significance	0.0464	Adjusted Chi Square Value	40.87
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50)	406.5	95% Adjusted Gamma UCL (use when n<50)	409.6
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.96	Shapiro Wilk Lognormal GOF Test	

5% Shapiro Wilk P Value	0.0815	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0828	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.108	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.336	Mean of logged Data	4.198
Maximum of Logged Data	8.517	SD of logged Data	1.956

Assuming Lognormal Distribution

95% H-UCL	909.5	90% Chebyshev (MVUE) UCL	865.6
95% Chebyshev (MVUE) UCL	1069	97.5% Chebyshev (MVUE) UCL	1351
99% Chebyshev (MVUE) UCL	1905		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	423.7	95% Jackknife UCL	425.6
95% Standard Bootstrap UCL	424	95% Bootstrap-t UCL	584.8
95% Hall's Bootstrap UCL	961.8	95% Percentile Bootstrap UCL	443.1
95% BCA Bootstrap UCL	504.6		
90% Chebyshev(Mean, Sd) UCL	533.5	95% Chebyshev(Mean, Sd) UCL	643.5
97.5% Chebyshev(Mean, Sd) UCL	796.3	99% Chebyshev(Mean, Sd) UCL	1096

Suggested UCL to Use

95% Adjusted Gamma UCL	409.6		

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ORO

General Statistics

Total Number of Observations	65	Number of Distinct Observations	55
		Number of Missing Observations	0
Minimum	1.1	Mean	828.9
Maximum	14000	Median	160
SD	1898	Std. Error of Mean	235.4
Coefficient of Variation	2.289	Skewness	5.546

Normal GOF Test

Shapiro Wilk Test Statistic	0.454	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.331	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.11	Data Not Normal at 5% Significance Level	

	A–E	F	G–K	L
105	Data Not Normal at 5% Significance Level			
106				
107	**Assuming Normal Distribution**			
108	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
109	95% Student's-t UCL	1222	95% Adjusted-CLT UCL (Chen-1995)	1389
110			95% Modified-t UCL (Johnson-1978)	1249
111				
112	**Gamma GOF Test**			
113	A-D Test Statistic	0.714	**Anderson-Darling Gamma GOF Test**	
114	5% A-D Critical Value	0.844	Detected data appear Gamma Distributed at 5% Significance Level	
115	K-S Test Statistic	0.101	**Kolmogorov-Smirnov Gamma GOF Test**	
116	5% K-S Critical Value	0.119	Detected data appear Gamma Distributed at 5% Significance Level	
117	**Detected data appear Gamma Distributed at 5% Significance Level**			
118				
119	**Gamma Statistics**			
120	k hat (MLE)	0.383	k star (bias corrected MLE)	0.376
121	Theta hat (MLE)	2162	Theta star (bias corrected MLE)	2204
122	nu hat (MLE)	49.85	nu star (bias corrected)	48.89
123	MLE Mean (bias corrected)	828.9	MLE Sd (bias corrected)	1352
124			Approximate Chi Square Value (0.05)	33.83
125	Adjusted Level of Significance	0.0463	Adjusted Chi Square Value	33.55
126				
127	**Assuming Gamma Distribution**			
128	95% Approximate Gamma UCL (use when n>=50)	1198	95% Adjusted Gamma UCL (use when n<50)	1208
129				
130	**Lognormal GOF Test**			
131	Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk Lognormal GOF Test**	
132	5% Shapiro Wilk P Value	0.0306	Data Not Lognormal at 5% Significance Level	
133	Lilliefors Test Statistic	0.0975	**Lilliefors Lognormal GOF Test**	
134	5% Lilliefors Critical Value	0.11	Data appear Lognormal at 5% Significance Level	
135	**Data appear Approximate Lognormal at 5% Significance Level**			
136				
137	**Lognormal Statistics**			
138	Minimum of Logged Data	0.0953	Mean of logged Data	4.992
139	Maximum of Logged Data	9.547	SD of logged Data	2.273
140				
141	**Assuming Lognormal Distribution**			
142	95% H-UCL	4841	90% Chebyshev (MVUE) UCL	4004
143	95% Chebyshev (MVUE) UCL	5041	97.5% Chebyshev (MVUE) UCL	6481
144	99% Chebyshev (MVUE) UCL	9309		
145				
146	**Nonparametric Distribution Free UCL Statistics**			
147	**Data appear to follow a Discernible Distribution at 5% Significance Level**			
148				
149	**Nonparametric Distribution Free UCLs**			
150	95% CLT UCL	1216	95% Jackknife UCL	1222
151	95% Standard Bootstrap UCL	1218	95% Bootstrap-t UCL	1633
152	95% Hall's Bootstrap UCL	2761	95% Percentile Bootstrap UCL	1260
153	95% BCA Bootstrap UCL	1436		
154	90% Chebyshev(Mean, Sd) UCL	1535	95% Chebyshev(Mean, Sd) UCL	1855
155	97.5% Chebyshev(Mean, Sd) UCL	2299	99% Chebyshev(Mean, Sd) UCL	3171
156				

Suggested UCL to Use

95% Adjusted Gamma UCL	1208

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PCP

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	67
Minimum	0.075	Mean	0.688
Maximum	1.3	Median	0.688

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable PCP was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

TEQ

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	1.63	Mean	63.96
Maximum	144	Median	55.7
SD	50.17	Std. Error of Mean	20.48
Coefficient of Variation	0.784	Skewness	0.629

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.972	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	105.2	95% Adjusted-CLT UCL (Chen-1995)	103.3
		95% Modified-t UCL (Johnson-1978)	106.1

Gamma GOF Test

A-D Test Statistic	0.365	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.715	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.219	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.341	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.999	k star (bias corrected MLE)	0.611
Theta hat (MLE)	64	Theta star (bias corrected MLE)	104.7
nu hat (MLE)	11.99	nu star (bias corrected)	7.329
MLE Mean (bias corrected)	63.96	MLE Sd (bias corrected)	81.83
		Approximate Chi Square Value (0.05)	2.353
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	1.467

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	199.2	95% Adjusted Gamma UCL (use when n<50)	319.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.803	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.295	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.489	Mean of logged Data	3.581
Maximum of Logged Data	4.97	SD of logged Data	1.605

Assuming Lognormal Distribution

95% H-UCL	11585	90% Chebyshev (MVUE) UCL	261.3
95% Chebyshev (MVUE) UCL	337.8	97.5% Chebyshev (MVUE) UCL	444
99% Chebyshev (MVUE) UCL	652.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	97.64	95% Jackknife UCL	105.2
95% Standard Bootstrap UCL	93.89	95% Bootstrap-t UCL	124.1
95% Hall's Bootstrap UCL	185.3	95% Percentile Bootstrap UCL	96.54
95% BCA Bootstrap UCL	96.82		
90% Chebyshev(Mean, Sd) UCL	125.4	95% Chebyshev(Mean, Sd) UCL	153.2
97.5% Chebyshev(Mean, Sd) UCL	191.9	99% Chebyshev(Mean, Sd) UCL	267.7

Suggested UCL to Use

95% Student's-t UCL	105.2		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

	A	B	C	D	E	F	G	H	I	J	K	L
261	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
262												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.12/28/2018 7:43:36 PM								
5	From File			5034.01 Organics, Boiler Room 0-2'.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	DRO											
12												
13	General Statistics											
14	Total Number of Observations					46	Number of Distinct Observations					39
15							Number of Missing Observations					2
16	Minimum					3.8	Mean					372.7
17	Maximum					5000	Median					130
18	SD					771.8	Std. Error of Mean					113.8
19	Coefficient of Variation					2.071	Skewness					5.099
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.457	Shapiro Wilk GOF Test					
23	5% Shapiro Wilk Critical Value					0.945	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.316	Lilliefors GOF Test					
25	5% Lilliefors Critical Value					0.129	Data Not Normal at 5% Significance Level					
26	Data Not Normal at 5% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					563.8	95% Adjusted-CLT UCL (Chen-1995)					651.3
31							95% Modified-t UCL (Johnson-1978)					578.1
32												
33	Gamma GOF Test											
34	A-D Test Statistic					0.738	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.806	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.128	Kolmogorov-Smirnov Gamma GOF Test					
37	5% K-S Critical Value					0.137	Detected data appear Gamma Distributed at 5% Significance Level					
38	Detected data appear Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					0.578	k star (bias corrected MLE)					0.554
42	Theta hat (MLE)					645.3	Theta star (bias corrected MLE)					672.3
43	nu hat (MLE)					53.14	nu star (bias corrected)					51
44	MLE Mean (bias corrected)					372.7	MLE Sd (bias corrected)					500.6
45							Approximate Chi Square Value (0.05)					35.6
46	Adjusted Level of Significance					0.0448	Adjusted Chi Square Value					35.19
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL (use when n>=50)					533.9	95% Adjusted Gamma UCL (use when n<50)					540.3
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.977	Shapiro Wilk Lognormal GOF Test					

5% Shapiro Wilk Critical Value	0.945	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0943	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.129	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	1.335	Mean of logged Data	4.845
Maximum of Logged Data	8.517	SD of logged Data	1.589
Assuming Lognormal Distribution			
95% H-UCL	920	90% Chebyshev (MVUE) UCL	823.6
95% Chebyshev (MVUE) UCL	1005	97.5% Chebyshev (MVUE) UCL	1256
99% Chebyshev (MVUE) UCL	1750		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	559.9	95% Jackknife UCL	563.8
95% Standard Bootstrap UCL	560.1	95% Bootstrap-t UCL	826
95% Hall's Bootstrap UCL	1295	95% Percentile Bootstrap UCL	565.7
95% BCA Bootstrap UCL	734.6		
90% Chebyshev(Mean, Sd) UCL	714.1	95% Chebyshev(Mean, Sd) UCL	868.7
97.5% Chebyshev(Mean, Sd) UCL	1083	99% Chebyshev(Mean, Sd) UCL	1505
Suggested UCL to Use			
95% Adjusted Gamma UCL	540.3		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
ORO			
General Statistics			
Total Number of Observations	45	Number of Distinct Observations	38
		Number of Missing Observations	0
Minimum	3.1	Mean	1036
Maximum	14000	Median	320
SD	2194	Std. Error of Mean	327
Coefficient of Variation	2.117	Skewness	4.989
Normal GOF Test			
Shapiro Wilk Test Statistic	0.462	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.945	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.319	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.131	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Assuming Normal Distribution			

	A–E	F	G–K	L
105	95% Normal UCL		95% UCLs (Adjusted for Skewness)	
106	95% Student's-t UCL	1586	95% Adjusted-CLT UCL (Chen-1995)	1834
107			95% Modified-t UCL (Johnson-1978)	1626
108				
109	Gamma GOF Test			
110	A-D Test Statistic	0.705	Anderson-Darling Gamma GOF Test	
111	5% A-D Critical Value	0.812	Detected data appear Gamma Distributed at 5% Significance Level	
112	K-S Test Statistic	0.105	Kolmogorov-Smirnov Gamma GOF Test	
113	5% K-S Critical Value	0.139	Detected data appear Gamma Distributed at 5% Significance Level	
114	Detected data appear Gamma Distributed at 5% Significance Level			
115				
116	Gamma Statistics			
117	k hat (MLE)	0.518	k star (bias corrected MLE)	0.498
118	Theta hat (MLE)	2001	Theta star (bias corrected MLE)	2081
119	nu hat (MLE)	46.61	nu star (bias corrected)	44.84
120	MLE Mean (bias corrected)	1036	MLE Sd (bias corrected)	1468
121			Approximate Chi Square Value (0.05)	30.48
122	Adjusted Level of Significance	0.0447	Adjusted Chi Square Value	30.08
123				
124	Assuming Gamma Distribution			
125	95% Approximate Gamma UCL (use when n>=50)	1525	95% Adjusted Gamma UCL (use when n<50)	1545
126				
127	Lognormal GOF Test			
128	Shapiro Wilk Test Statistic	0.982	Shapiro Wilk Lognormal GOF Test	
129	5% Shapiro Wilk Critical Value	0.945	Data appear Lognormal at 5% Significance Level	
130	Lilliefors Test Statistic	0.0715	Lilliefors Lognormal GOF Test	
131	5% Lilliefors Critical Value	0.131	Data appear Lognormal at 5% Significance Level	
132	Data appear Lognormal at 5% Significance Level			
133				
134	Lognormal Statistics			
135	Minimum of Logged Data	1.131	Mean of logged Data	5.724
136	Maximum of Logged Data	9.547	SD of logged Data	1.75
137				
138	Assuming Lognormal Distribution			
139	95% H-UCL	3409	90% Chebyshev (MVUE) UCL	2721
140	95% Chebyshev (MVUE) UCL	3362	97.5% Chebyshev (MVUE) UCL	4250
141	99% Chebyshev (MVUE) UCL	5996		
142				
143	Nonparametric Distribution Free UCL Statistics			
144	Data appear to follow a Discernible Distribution at 5% Significance Level			
145				
146	Nonparametric Distribution Free UCLs			
147	95% CLT UCL	1574	95% Jackknife UCL	1586
148	95% Standard Bootstrap UCL	1566	95% Bootstrap-t UCL	2304
149	95% Hall's Bootstrap UCL	3586	95% Percentile Bootstrap UCL	1635
150	95% BCA Bootstrap UCL	1981		
151	90% Chebyshev(Mean, Sd) UCL	2018	95% Chebyshev(Mean, Sd) UCL	2462
152	97.5% Chebyshev(Mean, Sd) UCL	3079	99% Chebyshev(Mean, Sd) UCL	4290
153				
154	Suggested UCL to Use			
155	95% Adjusted Gamma UCL	1545		
156				

	A	B	C	D	E	F	G	H	I	J	K	L
157	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
158	Recommendations are based upon data size, data distribution, and skewness.											
159	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
160	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
161												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.12/28/2018 7:26:39 PM								
5	From File			5034.01 Organics, Refuse Burner.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	DRO											
12												
13	General Statistics											
14	Total Number of Observations					34	Number of Distinct Observations					32
15							Number of Missing Observations					0
16	Minimum					1.7	Mean					422.1
17	Maximum					1900	Median					255
18	SD					458.9	Std. Error of Mean					78.7
19	Coefficient of Variation					1.087	Skewness					1.39
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.843	Shapiro Wilk GOF Test					
23	5% Shapiro Wilk Critical Value					0.933	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.18	Lilliefors GOF Test					
25	5% Lilliefors Critical Value					0.15	Data Not Normal at 5% Significance Level					
26	Data Not Normal at 5% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					555.3	95% Adjusted-CLT UCL (Chen-1995)					571.6
31							95% Modified-t UCL (Johnson-1978)					558.4
32												
33	Gamma GOF Test											
34	A-D Test Statistic					0.721	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.804	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.132	Kolmogorov-Smirnov Gamma GOF Test					
37	5% K-S Critical Value					0.159	Detected data appear Gamma Distributed at 5% Significance Level					
38	Detected data appear Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					0.58	k star (bias corrected MLE)					0.548
42	Theta hat (MLE)					728.1	Theta star (bias corrected MLE)					770
43	nu hat (MLE)					39.42	nu star (bias corrected)					37.28
44	MLE Mean (bias corrected)					422.1	MLE Sd (bias corrected)					570.1
45							Approximate Chi Square Value (0.05)					24.3
46	Adjusted Level of Significance					0.0422	Adjusted Chi Square Value					23.78
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL (use when n>=50)					647.5	95% Adjusted Gamma UCL (use when n<50)					661.7
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.889	Shapiro Wilk Lognormal GOF Test					

5% Shapiro Wilk Critical Value	0.933	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.184	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.15	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.531	Mean of logged Data	4.974
Maximum of Logged Data	7.55	SD of logged Data	1.939

Assuming Lognormal Distribution

95% H-UCL	3384	90% Chebyshev (MVUE) UCL	1944
95% Chebyshev (MVUE) UCL	2452	97.5% Chebyshev (MVUE) UCL	3157
99% Chebyshev (MVUE) UCL	4542		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	551.5	95% Jackknife UCL	555.3
95% Standard Bootstrap UCL	546.4	95% Bootstrap-t UCL	584.3
95% Hall's Bootstrap UCL	586	95% Percentile Bootstrap UCL	558.7
95% BCA Bootstrap UCL	568		
90% Chebyshev(Mean, Sd) UCL	658.2	95% Chebyshev(Mean, Sd) UCL	765.1
97.5% Chebyshev(Mean, Sd) UCL	913.6	99% Chebyshev(Mean, Sd) UCL	1205

Suggested UCL to Use

95% Adjusted Gamma UCL	661.7		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ORO

General Statistics

Total Number of Observations	34	Number of Distinct Observations	32
		Number of Missing Observations	0
Minimum	1.3	Mean	1314
Maximum	5900	Median	675
SD	1565	Std. Error of Mean	268.4
Coefficient of Variation	1.191	Skewness	1.348

Normal GOF Test

Shapiro Wilk Test Statistic	0.811	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.202	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.15	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1768	95% Adjusted-CLT UCL (Chen-1995)	1821
		95% Modified-t UCL (Johnson-1978)	1778
Gamma GOF Test			
A-D Test Statistic	0.408	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.813	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.107	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.16	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.493	k star (bias corrected MLE)	0.469
Theta hat (MLE)	2663	Theta star (bias corrected MLE)	2799
nu hat (MLE)	33.54	nu star (bias corrected)	31.91
MLE Mean (bias corrected)	1314	MLE Sd (bias corrected)	1918
		Approximate Chi Square Value (0.05)	20
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	19.54
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50)	2096	95% Adjusted Gamma UCL (use when n<50)	2146
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.13	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.15	Data appear Lognormal at 5% Significance Level	
Data appear Approximate Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	0.262	Mean of logged Data	5.89
Maximum of Logged Data	8.683	SD of logged Data	2.171
Assuming Lognormal Distribution			
95% H-UCL	18225	90% Chebyshev (MVUE) UCL	8006
95% Chebyshev (MVUE) UCL	10216	97.5% Chebyshev (MVUE) UCL	13283
99% Chebyshev (MVUE) UCL	19307		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	1755	95% Jackknife UCL	1768
95% Standard Bootstrap UCL	1750	95% Bootstrap-t UCL	1844
95% Hall's Bootstrap UCL	1835	95% Percentile Bootstrap UCL	1749
95% BCA Bootstrap UCL	1859		
90% Chebyshev(Mean, Sd) UCL	2119	95% Chebyshev(Mean, Sd) UCL	2483
97.5% Chebyshev(Mean, Sd) UCL	2990	99% Chebyshev(Mean, Sd) UCL	3984
Suggested UCL to Use			
95% Adjusted Gamma UCL	2146		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TEQ

General Statistics

Total Number of Observations	62	Number of Distinct Observations	61
		Number of Missing Observations	0
Minimum	0.49	Mean	81.31
Maximum	450	Median	46.42
SD	93.36	Std. Error of Mean	11.86
Coefficient of Variation	1.148	Skewness	1.65

Normal GOF Test

Shapiro Wilk Test Statistic	0.811	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	1.646E-10	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.112	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	101.1	95% Adjusted-CLT UCL (Chen-1995)	103.5
		95% Modified-t UCL (Johnson-1978)	101.5

Gamma GOF Test

A-D Test Statistic	0.468	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.802	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0864	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.118	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.648	k star (bias corrected MLE)	0.628
Theta hat (MLE)	125.5	Theta star (bias corrected MLE)	129.6
nu hat (MLE)	80.37	nu star (bias corrected)	77.81
MLE Mean (bias corrected)	81.31	MLE Sd (bias corrected)	102.6
		Approximate Chi Square Value (0.05)	58.49
Adjusted Level of Significance	0.0461	Adjusted Chi Square Value	58.09

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	108.2	95% Adjusted Gamma UCL (use when n<50)	108.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.00159	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.125	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.112	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.713	Mean of logged Data	3.456
Maximum of Logged Data	6.109	SD of logged Data	1.695

Assuming Lognormal Distribution

95% H-UCL	241.5	90% Chebyshev (MVUE) UCL	241.7
95% Chebyshev (MVUE) UCL	293.9	97.5% Chebyshev (MVUE) UCL	366.4
99% Chebyshev (MVUE) UCL	508.8		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	100.8	95% Jackknife UCL	101.1
95% Standard Bootstrap UCL	100.9	95% Bootstrap-t UCL	104.9
95% Hall's Bootstrap UCL	105.7	95% Percentile Bootstrap UCL	102.3
95% BCA Bootstrap UCL	103.1		
90% Chebyshev(Mean, Sd) UCL	116.9	95% Chebyshev(Mean, Sd) UCL	133
97.5% Chebyshev(Mean, Sd) UCL	155.4	99% Chebyshev(Mean, Sd) UCL	199.3

Suggested UCL to Use

95% Approximate Gamma UCL	108.2		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.12/28/2018 7:46:10 PM								
5	From File			5034.01 Organics, Refuse Burner 0-2'.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	DRO											
12												
13	General Statistics											
14	Total Number of Observations					20	Number of Distinct Observations					20
15							Number of Missing Observations					0
16	Minimum					8.1	Mean					362.1
17	Maximum					1300	Median					285
18	SD					348	Std. Error of Mean					77.8
19	Coefficient of Variation					0.961	Skewness					1.064
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.886	Shapiro Wilk GOF Test					
23	5% Shapiro Wilk Critical Value					0.905	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.154	Lilliefors GOF Test					
25	5% Lilliefors Critical Value					0.192	Data appear Normal at 5% Significance Level					
26	Data appear Approximate Normal at 5% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					496.6	95% Adjusted-CLT UCL (Chen-1995)					509.9
31							95% Modified-t UCL (Johnson-1978)					499.7
32												
33	Gamma GOF Test											
34	A-D Test Statistic					0.605	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.783	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.138	Kolmogorov-Smirnov Gamma GOF Test					
37	5% K-S Critical Value					0.202	Detected data appear Gamma Distributed at 5% Significance Level					
38	Detected data appear Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					0.714	k star (bias corrected MLE)					0.64
42	Theta hat (MLE)					507.3	Theta star (bias corrected MLE)					565.7
43	nu hat (MLE)					28.55	nu star (bias corrected)					25.6
44	MLE Mean (bias corrected)					362.1	MLE Sd (bias corrected)					452.6
45							Approximate Chi Square Value (0.05)					15.08
46	Adjusted Level of Significance					0.038	Adjusted Chi Square Value					14.44
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL (use when n>=50))					615	95% Adjusted Gamma UCL (use when n<50)					642.2
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.86	Shapiro Wilk Lognormal GOF Test					

	A–E	F	G–K	L
53	5% Shapiro Wilk Critical Value	0.905	Data Not Lognormal at 5% Significance Level	
54	Lilliefors Test Statistic	0.191	**Lilliefors Lognormal GOF Test**	
55	5% Lilliefors Critical Value	0.192	Data appear Lognormal at 5% Significance Level	
56	**Data appear Approximate Lognormal at 5% Significance Level**			
57				
58	**Lognormal Statistics**			
59	Minimum of Logged Data	2.092	Mean of logged Data	5.048
60	Maximum of Logged Data	7.17	SD of logged Data	1.705
61				
62	**Assuming Lognormal Distribution**			
63	95% H-UCL	2916	90% Chebyshev (MVUE) UCL	1368
64	95% Chebyshev (MVUE) UCL	1728	97.5% Chebyshev (MVUE) UCL	2229
65	99% Chebyshev (MVUE) UCL	3211		
66				
67	**Nonparametric Distribution Free UCL Statistics**			
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**			
69				
70	**Nonparametric Distribution Free UCLs**			
71	95% CLT UCL	490.1	95% Jackknife UCL	496.6
72	95% Standard Bootstrap UCL	486.9	95% Bootstrap-t UCL	520.7
73	95% Hall's Bootstrap UCL	526.8	95% Percentile Bootstrap UCL	493.3
74	95% BCA Bootstrap UCL	516.4		
75	90% Chebyshev(Mean, Sd) UCL	595.5	95% Chebyshev(Mean, Sd) UCL	701.3
76	97.5% Chebyshev(Mean, Sd) UCL	848	99% Chebyshev(Mean, Sd) UCL	1136
77				
78	**Suggested UCL to Use**			
79	95% Student's-t UCL	496.6		
80				
81	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test			
82	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL			
83				
84	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
85	Recommendations are based upon data size, data distribution, and skewness.			
86	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
87	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
88				
89				
90	ORO			
91				
92	**General Statistics**			
93	Total Number of Observations	20	Number of Distinct Observations	19
94			Number of Missing Observations	0
95	Minimum	13	Mean	1167
96	Maximum	4600	Median	570
97	SD	1331	Std. Error of Mean	297.6
98	Coefficient of Variation	1.141	Skewness	1.238
99				
100	**Normal GOF Test**			
101	Shapiro Wilk Test Statistic	0.828	**Shapiro Wilk GOF Test**	
102	5% Shapiro Wilk Critical Value	0.905	Data Not Normal at 5% Significance Level	
103	Lilliefors Test Statistic	0.214	**Lilliefors GOF Test**	
104	5% Lilliefors Critical Value	0.192	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1681	95% Adjusted-CLT UCL (Chen-1995)	1744
		95% Modified-t UCL (Johnson-1978)	1695
Gamma GOF Test			
A-D Test Statistic	0.354	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.796	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.132	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.204	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.573	k star (bias corrected MLE)	0.521
Theta hat (MLE)	2035	Theta star (bias corrected MLE)	2240
nu hat (MLE)	22.93	nu star (bias corrected)	20.83
MLE Mean (bias corrected)	1167	MLE Sd (bias corrected)	1617
		Approximate Chi Square Value (0.05)	11.46
Adjusted Level of Significance	0.038	Adjusted Chi Square Value	10.92
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50)	2119	95% Adjusted Gamma UCL (use when n<50)	2226
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.137	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.192	Data appear Lognormal at 5% Significance Level	
Data appear Approximate Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	2.565	Mean of logged Data	5.977
Maximum of Logged Data	8.434	SD of logged Data	1.915
Assuming Lognormal Distribution			
95% H-UCL	15290	90% Chebyshev (MVUE) UCL	5145
95% Chebyshev (MVUE) UCL	6573	97.5% Chebyshev (MVUE) UCL	8554
99% Chebyshev (MVUE) UCL	12446		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	1656	95% Jackknife UCL	1681
95% Standard Bootstrap UCL	1651	95% Bootstrap-t UCL	1812
95% Hall's Bootstrap UCL	1739	95% Percentile Bootstrap UCL	1692
95% BCA Bootstrap UCL	1782		
90% Chebyshev(Mean, Sd) UCL	2059	95% Chebyshev(Mean, Sd) UCL	2464
97.5% Chebyshev(Mean, Sd) UCL	3025	99% Chebyshev(Mean, Sd) UCL	4127

Suggested UCL to Use

95% Adjusted Gamma UCL	2226

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TEQ

General Statistics

Total Number of Observations	34	Number of Distinct Observations	34
		Number of Missing Observations	0
Minimum	0.59	Mean	64.25
Maximum	201	Median	49.75
SD	58.77	Std. Error of Mean	10.08
Coefficient of Variation	0.915	Skewness	0.958

Normal GOF Test

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.933	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.157	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.15	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	81.31	95% Adjusted-CLT UCL (Chen-1995)	82.6
		95% Modified-t UCL (Johnson-1978)	81.58

Gamma GOF Test

A-D Test Statistic	0.265	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.78	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0806	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.156	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.914	k star (bias corrected MLE)	0.853
Theta hat (MLE)	70.33	Theta star (bias corrected MLE)	75.36
nu hat (MLE)	62.12	nu star (bias corrected)	57.98
MLE Mean (bias corrected)	64.25	MLE Sd (bias corrected)	69.58
		Approximate Chi Square Value (0.05)	41.47
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	40.78

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	89.82	95% Adjusted Gamma UCL (use when n<50)	91.34

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.918	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.933	Data Not Lognormal at 5% Significance Level

	A	B	C	D	E	F	G	H	I	J	K	L
209					Lilliefors Test Statistic	0.129	**Lilliefors Lognormal GOF Test**					
210					5% Lilliefors Critical Value	0.15	Data appear Lognormal at 5% Significance Level					
211	**Data appear Approximate Lognormal at 5% Significance Level**											
212												
213	**Lognormal Statistics**											
214					Minimum of Logged Data	-0.528					Mean of logged Data	3.524
215					Maximum of Logged Data	5.303					SD of logged Data	1.412
216												
217	**Assuming Lognormal Distribution**											
218					95% H-UCL	191.8					90% Chebyshev (MVUE) UCL	166.7
219					95% Chebyshev (MVUE) UCL	202.8					97.5% Chebyshev (MVUE) UCL	252.8
220					99% Chebyshev (MVUE) UCL	351.2						
221												
222	**Nonparametric Distribution Free UCL Statistics**											
223	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
224												
225	**Nonparametric Distribution Free UCLs**											
226					95% CLT UCL	80.83					95% Jackknife UCL	81.31
227					95% Standard Bootstrap UCL	80.75					95% Bootstrap-t UCL	83.46
228					95% Hall's Bootstrap UCL	82.73					95% Percentile Bootstrap UCL	80.74
229					95% BCA Bootstrap UCL	82.94						
230					90% Chebyshev(Mean, Sd) UCL	94.49					95% Chebyshev(Mean, Sd) UCL	108.2
231					97.5% Chebyshev(Mean, Sd) UCL	127.2					99% Chebyshev(Mean, Sd) UCL	164.5
232												
233	**Suggested UCL to Use**											
234					95% Adjusted Gamma UCL	91.34						
235												
236	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
237	Recommendations are based upon data size, data distribution, and skewness.											
238	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
239	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
240												

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/4/2018 10:51:14 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GW Pb

General Statistics

Total Number of Observations	14	Number of Distinct Observations	12
Number of Detects	12	Number of Non-Detects	2
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	0.013	Minimum Non-Detect	0.005
Maximum Detect	0.19	Maximum Non-Detect	0.005
Variance Detects	0.00245	Percent Non-Detects	14.29%
Mean Detects	0.0407	SD Detects	0.0495
Median Detects	0.023	CV Detects	1.217
Skewness Detects	2.942	Kurtosis Detects	9.11
Mean of Logged Detects	-3.556	SD of Logged Detects	0.753

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.564	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.323	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0356	KM Standard Error of Mean	0.0127
KM SD	0.0456	95% KM (BCA) UCL	0.0598
95% KM (t) UCL	0.0581	95% KM (Percentile Bootstrap) UCL	0.0576
95% KM (z) UCL	0.0565	95% KM Bootstrap t UCL	0.121
90% KM Chebyshev UCL	0.0738	95% KM Chebyshev UCL	0.0911
97.5% KM Chebyshev UCL	0.115	99% KM Chebyshev UCL	0.162

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.245	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.745	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.278	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.249	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.56	k star (bias corrected MLE)	1.225
Theta hat (MLE)	0.0261	Theta star (bias corrected MLE)	0.0332
nu hat (MLE)	37.44	nu star (bias corrected)	29.41
Mean (detects)	0.0407		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	0.0363
Maximum	0.19	Median	0.021
SD	0.0469	CV	1.291
k hat (MLE)	1.427	k star (bias corrected MLE)	1.169
Theta hat (MLE)	0.0254	Theta star (bias corrected MLE)	0.031
nu hat (MLE)	39.97	nu star (bias corrected)	32.74
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (32.74, α)	20.66	Adjusted Chi Square Value (32.74, β)	19.39
95% Gamma Approximate UCL (use when n>=50)	0.0575	95% Gamma Adjusted UCL (use when n<50)	0.0613
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.0356	SD (KM)	0.0456
Variance (KM)	0.00208	SE of Mean (KM)	0.0127
k hat (KM)	0.609	k star (KM)	0.526
nu hat (KM)	17.04	nu star (KM)	14.72
theta hat (KM)	0.0585	theta star (KM)	0.0677
80% gamma percentile (KM)	0.0585	90% gamma percentile (KM)	0.0952
95% gamma percentile (KM)	0.134	99% gamma percentile (KM)	0.23
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (14.72, α)	7.068	Adjusted Chi Square Value (14.72, β)	6.376
95% Gamma Approximate KM-UCL (use when n>=50)	0.0741	95% Gamma Adjusted KM-UCL (use when n<50)	0.0821
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.237	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Approximate Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.0356	Mean in Log Scale	-3.799
SD in Original Scale	0.0473	SD in Log Scale	0.931
95% t UCL (assumes normality of ROS data)	0.058	95% Percentile Bootstrap UCL	0.0578
95% BCA Bootstrap UCL	0.0678	95% Bootstrap t UCL	0.113
95% H-UCL (Log ROS)	0.069		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-3.805	KM Geo Mean	0.0223
KM SD (logged)	0.904	95% Critical H Value (KM-Log)	2.637
KM Standard Error of Mean (logged)	0.252	95% H-UCL (KM -Log)	0.0649
KM SD (logged)	0.904	95% Critical H Value (KM-Log)	2.637
KM Standard Error of Mean (logged)	0.252		
DL/2 Statistics			
DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0352	Mean in Log Scale	-3.904

SD in Original Scale	0.0476	SD in Log Scale	1.123
95% t UCL (Assumes normality)	0.0577	95% H-Stat UCL	0.0965
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level			
Suggested UCL to Use			
KM H-UCL	0.0649		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
GW TEQ			
General Statistics			
Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	0
Minimum	0.168	Mean	18.36
Maximum	130	Median	3.76
SD	35.01	Std. Error of Mean	9.356
Coefficient of Variation	1.906	Skewness	2.894
Normal GOF Test			
Shapiro Wilk Test Statistic	0.578	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.312	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	34.93	95% Adjusted-CLT UCL (Chen-1995)	41.49
		95% Modified-t UCL (Johnson-1978)	36.14
Gamma GOF Test			
A-D Test Statistic	0.428	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.813	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.161	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.4	k star (bias corrected MLE)	0.362
Theta hat (MLE)	45.87	Theta star (bias corrected MLE)	50.7
nu hat (MLE)	11.21	nu star (bias corrected)	10.14
MLE Mean (bias corrected)	18.36	MLE Sd (bias corrected)	30.51
		Approximate Chi Square Value (0.05)	4.031
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	3.534

	A	B	C	D	E	F	G	H	I	J	K	L
157												
158	Assuming Gamma Distribution											
159	95% Approximate Gamma UCL (use when n>=50)					46.21	95% Adjusted Gamma UCL (use when n<50)					52.7
160												
161	Lognormal GOF Test											
162	Shapiro Wilk Test Statistic					0.957	Shapiro Wilk Lognormal GOF Test					
163	5% Shapiro Wilk Critical Value					0.874	Data appear Lognormal at 5% Significance Level					
164	Lilliefors Test Statistic					0.107	Lilliefors Lognormal GOF Test					
165	5% Lilliefors Critical Value					0.226	Data appear Lognormal at 5% Significance Level					
166	Data appear Lognormal at 5% Significance Level											
167												
168	Lognormal Statistics											
169	Minimum of Logged Data					-1.784	Mean of logged Data					1.267
170	Maximum of Logged Data					4.868	SD of logged Data					2.114
171												
172	Assuming Lognormal Distribution											
173	95% H-UCL					588.8	90% Chebyshev (MVUE) UCL					65.91
174	95% Chebyshev (MVUE) UCL					85.49	97.5% Chebyshev (MVUE) UCL					112.7
175	99% Chebyshev (MVUE) UCL					166						
176												
177	Nonparametric Distribution Free UCL Statistics											
178	Data appear to follow a Discernible Distribution at 5% Significance Level											
179												
180	Nonparametric Distribution Free UCLs											
181	95% CLT UCL					33.75	95% Jackknife UCL					34.93
182	95% Standard Bootstrap UCL					32.94	95% Bootstrap-t UCL					72.32
183	95% Hall's Bootstrap UCL					95.72	95% Percentile Bootstrap UCL					34.38
184	95% BCA Bootstrap UCL					43.17						
185	90% Chebyshev(Mean, Sd) UCL					46.43	95% Chebyshev(Mean, Sd) UCL					59.15
186	97.5% Chebyshev(Mean, Sd) UCL					76.79	99% Chebyshev(Mean, Sd) UCL					111.5
187												
188	Suggested UCL to Use											
189	95% Adjusted Gamma UCL					52.7						
190												
191	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
192	Recommendations are based upon data size, data distribution, and skewness.											
193	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
194	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
195												

Outlier Tests for Selected Variables excluding nondetects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/28/2018 10:14:49 AM
From File	WorkSheet.xls
Full Precision	OFF

Rosner's Outlier Test for 1 Outliers in As culled

Total N	58
Number NDs	24
Number Detects	34
Mean of Detects	2.549
SD of Detects	0.871
Number of data	34
Number of suspected outliers	1
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	2.549	0.858	0.97	31	1.841	2.97	3.3

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Sb	D_Sb	As	D_As	Ba	D_Ba	Be	D_Be	Cd	D_Cd	Cr	D_Cr	Co	D_Co	Cu	D_Cu	Pb	D_Pb	Mo	D_Mo	Ni	D_Ni	Se	D_Se	Ag	D_Ag	Tl	D-Tl	V	D_V	Zn	D_Zn	Hg	D_Hg
2	0	1	0	63	1	1	0	1	0	10	1	2.7	1	11	1	7.5	1	1	0	12	1	1	0	1	0	1	0	21	1	19	1	0.1	0
2	0	1	0	39	1	1	0	1	0	7.6	1	1.7	1	6	1	2.6	1	1	0	9.3	1	1	0	1	0	1	0	8.9	1	10	1	0.1	0
2	0	1.2	1	270	1	1	0	1	0	8.5	1	1.4	1	34	1	9.3	1	1	0	11	1	1	0	1	0	1	0	9.8	1	56	1	0.1	0
2	0	1.9	1	320	1	1	0	1	0	24	1	4	1	30	1	13	1	1	0	38	1	1	0	1	0	1	0	15	1	45	1	0.1	0
2	0	3.1	1	380	1	1	0	1	0	25	1	3.3	1	44	1	15	1	1	0	29	1	1	0	1	0	1	0	11	1	98	1	0.1	0
2	0	2.2	1	100	1	1	0	1	0	11	1	3	1	17	1	6.5	1	1	0	12	1	1	0	1	0	1	0	31	1	20	1	0.1	0
2	0	1	0	30	1	1	0	1	0	4.9	1	1.5	1	5.9	1	2.9	1	1	0	6.2	1	1	0	1	0	1	0	8.5	1	9.9	1	0.1	0
2	0	1	0	5.5	1	1	0	1	0	1	0	1	0	2	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	4.3	1	0.1	0
2	0	2.5	1	610	1	1	0	1	0	30	1	5.3	1	49	1	25	1	1	0	46	1	1	0	1	0	1	0	24	1	97	1	0.1	0
2	0	1	0	34	1	1	0	1	0	3.3	1	1.4	1	4.2	1	1.2	1	1	0	3.1	1	1	0	1	0	1	0	8.4	1	8.3	1	0.1	0
2	0	1	0	43	1	1	0	1	0	5.8	1	2.1	1	9.3	1	2.9	1	1	0	4.9	1	1	0	1	0	1	0	19	1	15	1	0.1	0
2	0	1	0	40	1	1	0	1	0	7	1	2.1	1	7.6	1	2.8	1	1	0	5.3	1	2.3	1	1	0	1	0	17	1	14	1	0.1	0
2	0	3.2	1	180	1	1	0	1	0	19	1	5.2	1	39	1	5.8	1	1	0	24	1	1	0	1	0	1	0	48	1	24	1	0.1	0
2	0	3.9	1	210	1	1	0	1	0	27	1	7.2	1	18	1	7.7	1	1	0	25	1	1	0	1	0	1	0	68	1	26	1	0.1	0
2	0	3.4	1	180	1	1	0	1	0	29	1	6.4	1	16	1	5.9	1	1	0	26	1	1	0	1	0	1	0	69	1	24	1	0.1	0
7	0	1.2	0	18.3	0	0.21	0	0.58	0	5.2	1	1.6	1	11.4	1	2.4	1			9	1	4.1	0	1.2	0	2.9	0	29	1	11.8	1	0.072	0
8.8	0	2.2	1	112	1	1.2	1	0.29	1	35.1	1	7.2	1	40.4	1	9.1	1			35	1	5.1	0	1.5	0	3.7	0	80.1	1	29.8	1	0.15	0
8	0	1	1	46.6	1	0.57	0	0.21	1	22.2	1	2.5	1	19.1	1	2.7	1			12.7	1	4.7	0	1.3	0	3.3	0	46.4	1	21.1	1	0.13	0
7.9	0	2.3	1	117	1	0.71	0	0.26	1	22.1	1	4	1	27.9	1	34.4	1			20.2	1	4.6	0	1.3	0	3.3	0	54.8	1	45.6	1	0.16	1
8.3	0	3.2	1	416	1	0.97	0	0.32	1	32.1	1	6.5	1	30.7	1	8.4	1			26.7	1	4.8	0	1.4	0	3.5	0	70.3	1	38.9	1	0.14	0
8.3	0	2.7	1	117	1	1	0	0.35	1	39.8	1	4.1	1	26.8	1	7.5	1			33	1	4.9	0	1.4	0	3.5	0	73.3	1	33.2	1	0.12	1
7	0	0.6	0	27.7	1	0.18	0	0.2	1	6.5	1	1.8	1	16.5	1	25.6	1			10.6	1	4.1	0	1.2	0	2.9	0	21.6	1	31.8	1	0.04	1
6.9	0	1.1	0	12	1	0.09	0	0.57	0	28.4	1	17.3	1	82.6	1	2.2	1			89.8	1	4	0	1.1	0	2.9	0	19.6	1	30.6	1	0.11	0
9.1	0	2.1	0	143	1	0.92	0	0.25	1	33	1	5.9	1	26.8	1	9	1			27.5	1	5.3	0	1.5	0	3.8	0	78.6	1	65.2	1	0.053	1
8.3	0	2.3	0	132	1	0.92	0	0.25	1	26.1	1	4	1	29	1	23.1	1			29.7	1	4.8	0	1.4	0	3.4	0	62.9	1	43.3	1	2.4	1
8.2	0	2.4	0	252	1	0.92	0	0.28	1	28.8	1	6.6	1	27.2	1	7.7	1			28.3	1	4.8	0	1.4	0	3.4	0	66.8	1	34.1	1	0.17	1
8.2	0	2.3	0	38.9	1	0.6	0	0.25	1	18.9	1	1.9	1	17.4	1	3.1	1			10.3	1	4.8	0	1.4	0	3.4	0	46	1	18.1	1	0.14	0
8.1	0	2.7	0	136	1	0.85	0	0.29	1	25.6	1	4.7	1	27.4	1	7.6	1			23.6	1	4.7	0	1.4	0	3.4	0	64	1	36.1	1	0.045	1
8	0	2.5	0	311	1	0.72	0	0.18	1	27.7	1	3.3	1	21.4	1	7.1	1			21.5	1	4.7	0	1.3	0	3.3	0	60.2	1	26.4	1	0.13	0
9.9	0	2.9	0	185	1	1.3	0	0.36	1	45.4	1	6.3	1	35.1	1	9.3	1			47.4	1	5.8	0	1.6	0	4.1	0	101	1	43.4	1	0.16	1
8.1	0	1.8	0	138	1	1.2	0	0.37	1	3.3	1	8	1	28.7	1	9.2	1			30.8	1	4.7	0	1.3	0	3.4	0	73.6	1	39.7	1	0.4	1
9	0	2.3	0	161	1	1.2	1	0.53	1	41.1	1	10.5	1	30.3	1	8.8	1			45.6	1	5.3	0	1.5	0	3.8	0	86.5	1	40.4	1	0.15	0
7.6	0	2.4	0	144	1	0.83	1	0.15	1	30.9	1	5.7	1	31.1	1	6.6	1			26.1	1	4.4	0	1.3	0	3.2	0	80	1	35.6	1	0.13	0
8.1	0	3.2	1	137	1	1.3	1	0.4	1	30.5	1	6	1	32.1	1	9.6	1			29.9	1	4.7	0	1.3	0	3.4	0	78.1	1	36.9	1	0.13	0
9	0	2.5	0	163	1	1.4	1	0.42	1	28.9	1	7.6	1	25	1	10.2	1			31.7	1	5.2	0	1.5	0	3.7	0	70.3	1	40.2	1	0.15	0
9.8	0	1.8	1	138	1	1.3	1	0.6	1	43.5	1	2.2	1	30.4	1	9.6	1			28.6	1	5.7	0	1.6	0	4.3	0	86.6	1	28.6	1	0.16	0
7.9	0	2.4	1	126	1	1	1	0.35	1	25.1	1	6	1	28	1	7.3	1			24.3	1	4.6	0	1.3	0	3.3	0	53.2	1	33.1	1	0.067	1
8.1	0	1.9	1	122	1	0.97	1	0.36	1	24.3	1	4.8	1	25.9	1	6.9	1			24.1	1	4.7	0	1.3	0	3.4	0	58	1	29.5	1	0.054	1
9	0	3	1	255	1	1.4	1	0.59	1	49.3	1	14.1	1	35.2	1	10.8	1			45.7	1	5.2	0	1.5	0	3.7	0	106	1	45.4	1	0.15	0
8.7	0	3.5	1	202	1	1.5	1	0.67	1	32.2	1	6.8	1	29.6	1	11.1	1			34.3	1	5.1	0	1.5	0	3.6	0	78.5	1	41.2	1	0.15	0
8.8	0	1.9	1	168	1	1.3	1	0.49	1	36.8	1	7.6	1	27.9	1	9.4	1			35.9	1	5.1	0	1.5	0	3.7	0	79.3	1	36.6	1	0.15	0
7.7	0	1.6	1	106	1	0.77	1	0.24	1	31.5	1	7.5	1	30.5	1	7.4	1			29.3	1	4.5	0	1.3	0	3.2	0	68.6	1	40.8	1	0.13	0
1.5	0	2.7	1	132	1	0.81	1	0.5	1	27.5	1	6.1	1	39.3	1	70.3	1			30.4	1	5.1	0	1.5	0	3.6	0	68.1	1	71.3	1	2.3	1
8.5	0	3	1	122	1	1.1	1	0.37	1	30	1	6.2	1	34.9	1	23.9	1			28.2	1	4.9	0	1.4	0	3.5	0	72.3	1	46.4	1	8	1
9	0	1.7	1	109	1	1.4	1	0.42	1	39.4	1	5.6	1	25.6	1	10	1			35.8	1	5.2	0	1.5	0	3.7	0	81	1	36.8	1	1.2	1
8.9	0	1.7	1	146	1	1.2	0	0.57	1	39.6	1	8.8	1	28.1	1	8.7	1			37.3	1	5.2	0	1.5	0	3.7	0	83.9	1	38.1	1	0.061	1
8.7	0	3.9	1	168	1	1.5	1	0.49	1	39.8	1	2.1	1	17.8	1	9	1			24.5	1	5.1	0	1.4	0	3.6	0	57.3	1	32.1	1	0.14	0
8.9	0	3.5	1	299	1	1.5	1	0.85	1	66.9	1	13.7	1	28.8	1	13.4	1			71.8	1	5.2	0	1.5	0	3.7	0	134	1	56.5	1	0.091	1
9.5	0	3.5	1	282	1	1.1	1	0.55	1	68.4	1	11.9	1	33.2	1	21.6	1			75.8	1	5.5	0	1.6	0	4	0	103	1	64.5	1	0.16	0
8.4	0	2.7	1	304	1	0.88	0	0.44	1	51.4	1	8.7	1	40.8	1	11.1	1			44	1	4.9	0	1.4	0	3.5	0	127	1	40.8	1	0.048	1
7.6	0	1.2	1	118	1	1	0	0.54	1	48.4	1	10.5	1	38.5	1	27.5	1			56.6	1	4.4	0	1.3	0	3.2	0	90.1	1	64.4	1	0.13	0
8.3	0	1.4	0	37.8	1	1.1	0	0.59	1	6.9	1	1.8	1	20.6	1	8.3	1			7.4	1	4.8	0	1.4	0	3.5	0	40.7	1	8.6	1	0.14	0
0.96	0	1.4	0	14.4	1	1.1	0	0.54	1	10.8	1	7	0	18.4	1	7.5	1			11.9	1	4.9	0	1.4	0	3.5	0	36.9	1	7.5	1	0.14	0
1.6	0	0.97	1	199	1	1.3	0	0.7	1	14.4	1	7.1	0	34.1	1	9.5	1			13.9	1	5	0	1.4	0	3.5	0	50	1	21.9	1	0.057	1
7.7	0	2.4	1	429	1	1.5	1	0.93	1	48.7	1	11.2	1	45.6	1	23	1			42.7	1	4.6	0	1.3	0	3.2	0	98.4	1	55.7	1	0.13	0
4.8	1	5.7	1	224	1	1.1	1			42	1	14.6	1	31.3	1	9.1	1			35.5	1			0.32	0			87.4	1	40.5	1	0.08	0
3.3	1	7.3	1	118	1	1.2	1			25.8	1	7.1	1	19.3	1	9.3	1			22.1	1			0.62	1			56.9	1	33.9	1	0.07	0
1.4	1	0.63	0	25.3	1	0.21	0			18.9	1	9.4	1	61.8	1	8	1			42.2	1			0.21	0			19.3	1	109	1	0.06	0
3.6	1	4.1	1	273	1	0.57	1			29.7	1	6.8	1	39	1	33.1	1			36.9	1			0.28	0			53.2	1	82.9	1	0.07	0
4.5	1	8	1	412	1	1	1			74.5	1	14.7	1	31.9	1	11.6	1			84.8	1			0.32	0			102	1	76.1	1	0.07	0
1.6	1	3.2	1	113	1	0.38	1			80.5	1	10.4	1	22.6	1	9.9	1			82.6	1			0.27	0			57	1	35.3	1	0.07	0

	A	B
1	As culled	D_As culled
2	1	0
3	1	0
4	1.2	1
5	1.9	1
6	3.1	1
7	2.2	1
8	1	0
9	1	0
10	2.5	1
11	1	0
12	1	0
13	1	0
14	3.2	1
15	3.9	1
16	3.4	1
17	1.2	0
18	2.2	1
19	1	1
20	2.3	1
21	3.2	1
22	2.7	1
23	0.6	0
24	1.1	0
25	2.1	0
26	2.3	0
27	2.4	0
28	2.3	0
29	2.7	0
30	2.5	0
31	2.9	0
32	1.8	0
33	2.3	0
34	2.4	0
35	3.2	1
36	2.5	0
37	1.8	1
38	2.4	1
39	1.9	1
40	3	1
41	3.5	1
42	1.9	1
43	1.6	1
44	2.7	1
45	3	1
46	1.7	1
47	1.7	1
48	3.9	1
49	3.5	1
50	3.5	1
51	2.7	1
52	1.2	1
53	1.4	0
54	1.4	0
55	0.97	1
56	2.4	1
57		
58		
59	0.63	0
60	4.1	1
61		
62	3.2	1

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Pb DTTP Al	D_Pb DTTP	Pb DTTP U	D_Pb DTTP	Pb RB All D	D_Pb RB Al	Pb RB Uppe	D_Pb RB U	Hg DTTP Al	D_Hg DTTP	Hg DTTP U	D_Hg DTTP Upper Two Feet		
2	34.4	1	34.4	1	6.5	1	33.1	1	0.16	1	0.16	1		
3	7.7	1	7.7	1	33.1	1	7.7	1	0.17	1	0.17	1		
4	10	1	70.3	1	5.9	1	5.8	1	1.2	1	2.3	1		
5	70.3	1	23.1	1	7.7	1	2.9	1	2.3	1	2.4	1		
6	23.1	1	23.9	1	5.8	1	1.2	1	2.4	1	8	1		
7	23.9	1	8	1	2.8	1	1	0	8	1	0.06	0		
8	8	1	2.2	1	2.9	1	2.9	1	0.06	0	0.11	0		
9	9.3	1	9.6	1	1.2	1	15	1	0.07	0	0.13	0		
10	9.1	1	7.1	1	25	1	13	1	0.08	0	0.13	0		
11	2.2	1	8.4	1	1	0	2.6	1	0.11	0	0.14	0		
12	7.4	1	9.4	1	2.9	1	7.5	1	0.13	0	0.15	0		
13	9.6	1	11.1	1	15	1			0.13	0	0.15	0		
14	6.6	1	10.2	1	13	1			0.13	0	0.15	0		
15	7.1	1	8.8	1	9.3	1			0.13	0	0.15	0		
16	2.7	1	9.1	1	2.6	1			0.13	0	0.15	0		
17	3.1	1	25.6	1	7.5	1			0.14	0	0.04	1		
18	8.4	1	7.6	1					0.14	0	0.045	1		
19	9.4	1	6.9	1					0.15	0	0.054	1		
20	11.1	1	8.7	1					0.15	0	0.061	1		
21	10.8	1	7.3	1					0.15	0	0.067	1		
22	10.2	1	2.4	1					0.15	0	0.072	1		
23	8.8	1	9.2	1					0.15	0	0.1	1		
24	9.1	1							0.15	0				
25	9.6	1							0.16	0				
26	25.6	1							0.04	1				
27	7.6	1							0.045	1				
28	9	1							0.053	1				
29	6.9	1							0.054	1				
30	8.7	1							0.061	1				
31	7.3	1							0.067	1				
32	2.4	1							0.072	1				
33	9.2	1							0.1	1				
34	7.5	1							0.12	1				
35	9.3	1							0.16	1				

DRO	D_DRO	ORO	D_ORO	PCP	D_PCP	TEQ	D_TEQ
8.6	0	82	1	0.075	1	3.61	1
5.9	0	38	1	1.3	0	95.9	1
3.5	0	14	0			30.8	1
3.4	0	14	0	0.067	0	60	1
3.2	0	13	0	0.067	0	144	1
160	1	730	1	0.067	0	51.4	1
130	1	540	1	0.067	0	1.63	1
160	1	550	1	0.067	0	78	1
93	1	320	1	0.067	0	15.8	1
410	1	1,100	1	0.067	0	142	1
310	1	520	1	0.067	0	38.7	1
1.4	1	2.7	1	1.6	0	41.1	1
36	1	160	1	1.6	0	180	1
26	1	89	1	1.6	0	7.02	1
15	1	41	1	1.6	0	64.8	1
840	1	3,200	1	1.6	0	19.2	1
330	1	1,100	1	1.6	0	17.2	1
71	1	350	1	1.6	0	7.66	1
430	1	1,800	1	1.6	0	39.6	1
490	1	1,700	1	1.6	0	7.42	1
330	1	1,200	1	2.5	1.0	37.8	1
240	1	1,100	1	**5.4**	**1.0**	7.69	1
5,000	1	**14,000**	1	1.6	0	171	1
730	1	2,100	1	1.6	0	7.41	1
1,200	1	4,000	1	1.6	0	121	1
640	1	2,400	1	1.6	0	116	1
900	1	3,000	1	1.6	0	141	1
130	1	270	1	1.6	0	196	1
6.8	1	10	1	1.6	0	100	1
1.7	1	1.1	1	1.6	0	142	1
72	1	120	1	1.6	0	450	1
56	1	91	1	1.6	0	60.1	1
2.4	1	3.0	1	1.6	0	7.98	1
55	1	110	1	1.6	0	3.91	1
310	1	920	1	1.6	0	2.77	1
2.0	1	1.7	1	1.6	0	5.23	1
73	1	98	1	1.6	0	3.04	1
9.6	1	54	1	1.6	0	2.02	1
31	1	85	1	1.6	0	22.33	1
120	1	240	1	1.6	0	27.71	1
3.8	1	3.1	1	1.6	0	15.23	1
3.1	1	3.7	1	1.6	0	2.44	1
140	1	350	1	1.6	0	41.18	1
7.2	1	14	1	1.6	0	30.8	1
2.1	1	1.6	1	1.6	0	48.5	1
130	1	280	1	1.6	0	8.2	1

78	1	120	1	1.6	0	49.5	1
71	1	160	1	1.6	0	150	1
120	1	320	1	1.6	0	8.67	1
68	1	120	1	1.6	0	110.66	1
55	1	140	1	1.6	0	310.59	1
650	1	1,400	1	1.6	0	1.36	1
17	1	39	1	1.6	0	16.08	1
5.8	1	5.5	1	1.6	0	22.54	1
320	1	1,000	1	**7.3**	**1.0**	44.33	1
260	1	420	1	**7.5**	**1.0**	0.49	1
10	1	18	1	2.4	1.0	199.05	1
12	1	28	1	1.6	0	201	1
10	1	17	1	1.6	0	216	1
310	1	830	1	1.6	0	3.35	1
520	1	1,000	1	1.6	0	43.4	1
5.6	1	7.5	1	1.6	0	21.5	1
590	1	1,500	1	1.6	0	241	1
1,600	1	3,500	1	1.6	0	110	1
6.3	1	9.1	1	1.6	0	149	1
34	1	78	1	1.6	0	68.6	1
33	1	89	1	1.6	0	61.5	1
130	1	310	1	1.6	0	3.85	1
52	1	100	1	**5.6**	**1.0**	62	1
7.3	1	10	1	**8.0**	**1.0**	124	1
784		16	1	1.6	0	271	1
14	0	6.7	1	0.02	0	41	1
7.9	1	2.5	1	0.02	0	99	1
5.5	1	2.2	1	1.1	1	4.4	1
3.4	1	4.0	1	0.027	1	260	1
3.2	1	150	1	**130**	**1**	180	1
6.9	1	4.3	1	0.27	1	110	1
58	1	2.4	1	0.14	1	190	1
3.5	1	1.3	1	0.25	1	91	1
2.9	1	2.6	1	0.068	1	3.5	1
2.1	1	6.5	1	1.2	0	13	1
2.7	1	4.0	1	1.1	0	58	1
6.0	1	1.9	1	4.7	0	0.59	1
3.8	1	3.1	1	1.2	0	4	1
2.6	1	1.6	1	1.2	0	51	1
2.3	1	1.8	1	**11**	**1**	70	1
1.6	1	86	1	**12**	**1**	36	1
2.4	1	31	1	0.095	1	30	1
41	1	13	1	0.75	1		
19	1	3.7	1	1.5	1		
10	1	44	1	1.3	0		
4.3	1	4.5	1	1.3	0		
62	1	3.2	1	1.3	0		

5.8	1	2.4	1	1.1	0
4.2	1	3.9	1	0.49	1
3.1	1	2.2	1	0.18	1
4.0	1	2.6	1	1.4	0
3.1	1	7.8	1	**7.9**	**1**
4.0	1	2.3	1	**4.9**	**1**
4.9	1	1.9	1	0.2	1
3.2	1	4.6	1	1.2	0
2.8	1	3.7	1	1.2	0
4.3	1	2.8	1	1	0
3.7	1	4.2	1	**150**	**1**
3.6	1	2.2	1	**150**	**1**
4.7	1	2.3	1	**15**	**1**
3.1	1	83	1	0.95	0
3.1	1	130	1		
33	1	23	1	0.4	0
54	1	6.4	1	**32**	**1**
15	1	17	1	1.2	0
4.9	1	2.6	1	2.5	1
9.8	1	50	0	1.6	0
3.0	1	50	0		
1	0	50	0		
0.99	0	50	0		
44	1	14	0		
0.99	0	15	0		
3.5	0	13	0		
3.8	0	520	1		
3.3	0	170	1		
35	0	13	0		
8.9	0	89	1		
3.3	0	46	1		
47,000	**1**	66	1		
72	1	120	1		
29	1	95	1		
38	1	130	1		
80	1	100	1		
57	1	140	1		
69	1	160	1		
54	1	82	1		
67	1	35	1		
83	1				
23	1				
18	1	570	1		
		720	1		
594	**1**	4,100	1		
100	1	2600			
56 J	1	65	1		

130	1	120	1
<160		130	1
9.7	1	460	1
22	1	520	1
54	1	1,500	1
130	1	1300	1
74	1	1,600	1
490	1	1,200	1
100 J	1	1,300	1
450	1	79	1
270	1	36	1
340	1	33	1
24	1	2,300	1
12	1	2,200	1
11	1	3,100	1
720	1	4,500	1
670	1	**5,900**	1
960	1	3,500	1
1,300	1	2,600	1
1,900	1	180	1
810	1	860	1
640	1	630	1
59	1	2,400	1
240	1	4,600	1
210	1	2,700	1
570	1	2,000	1
1,300	1	400	1
770	1	300	1
630	1	95	1
190	1	21	1
150	1	21	1
39	1	1.3	1
8.3	1	420	1
14	1	280	1
1.7	1	270	1
300	1	780	1
170	1	720	1
170	1	1,200	1
410	1	13	1
580	1	16	1
860	1	10	1
8.1	1		
8.9	1		
5.4	1		

	A	B	C	D	E	F	G
1	DRO	D_DRO	ORO	D_ORO	PCP	D_PCP	TEQ
2	72	1	89	1			142
3	29	1	46	1			38.7
4	38	1	66	1			41.1
5	80	1	120	1			
6	57	1	95	1			
7	69	1	130	1			
8	54	1	100	1			
9	67	1	140	1			
10	83	1	160	1			
11	23	1	82	1			
12	18	1	35	1			
13					1.6	0	
14	594	1					

	A	B	C	D	E	F	G
1	DRO	D-DRO	ORO	D_ORO	PCP	D_PCP	TEQ
2	72	1	89	1			142
3	29	1	46	1			41.1
4	38	1	66	1			
5	80	1	120	1			
6	57	1	95	1			
7	69	1	130	1			
8	54	1	100	1			
9	67	1	140	1			
10	83	1	160	1			
11	23	1	82	1			
12	18	1	35	1			
13					1.6	0	
14	594	1					

	A	B	C	D	E	F	G
1	DRO	D_DRO	ORO	D_ORO	PCP	D_PCP	TEQ
2	160	1	730	1			95.9
3	130	1	540	1			30.8
4	160	1	550	1			60
5	93	1	320	1			144
6	410	1	1100	1			51.4
7	310	1	520	1			1.63
8	1.4	1	2.7	1			
9	36	1	160	1			
10	26	1	89	1			
11	15	1	41	1			
12	840	1	3200	1			
13	330	1	1100	1			
14	71	1	350	1			
15	430	1	1800	1			
16	490	1	1700	1			
17	330	1	1200	1			
18	240	1	1100	1			
19	5000	1	14000	1			
20	730	1	2100	1			
21	1200	1	4000	1			
22	640	1	2400	1			
23	900	1	3000	1			
24	130	1	270	1			
25	6.8	1	10	1			
26	1.7	1	1.1	1			
27	72	1	120	1			
28	56	1	91	1			
29	2.4	1	3	1			
30	55	1	110	1			
31	310	1	920	1			
32	2	1	1.7	1			
33	73	1	98	1			
34	9.6	1	54	1			
35	31	1	85	1			
36	120	1	240	1			
37	3.8	1	3.1	1			
38	3.1	1	3.7	1			
39	140	1	350	1			
40	7.2	1	14	1			
41	2.1	1	1.6	1			
42	130	1	280	1			
43	78	1	120	1			
44	71	1	160	1			
45	120	1	320	1			
46	68	1	120	1			
47	55	1	140	1			
48	650	1	1400	1			
49	17	1	39	1			
50	5.8	1	5.5	1			
51	320	1	1000	1			
52	260	1	420	1			

	A	B	C	D	E	F	G
53	10	1	18	1			
54	12	1	28	1			
55	10	1	17	1			
56	310	1	830	1			
57	520	1	1000	1			
58	5.6	1	7.5	1			
59	590	1	1500	1			
60	1600	1	3500	1			
61	6.3	1	9.1	1			
62	34	1	78	1			
63	33	1	89	1			
64	130	1	310	1			
65	52	1	100	1			
66	7.3	1	10	1			
67							
68							
69					0.075	1	
70	784				1.3	0	
71	14	0					

	A	B	C	D	E	F	G
1	DRO	D_DRO	ORO	D_ORO	PCP	D_PCP	TEQ
2	160	1	730	1			95.9
3	130	1	540	1			60
4	160	1	550	1			51.4
5	93	1	320	1			
6	410	1	1100	1			
7	310	1	520	1			
8	36	1	160	1			
9	26	1	89	1			
10	840	1	3200	1			
11	330	1	1100	1			
12	430	1	1800	1			
13	490	1	1700	1			
14	240	1	1100	1			
15	5000	1	14000	1			
16	1200	1	4000	1			
17	640	1	2400	1			
18	130	1	270	1			
19	6.8	1	10	1			
20	72	1	120	1			
21	56	1	91	1			
22	55	1	110	1			
23	310	1	920	1			
24	73	1	98	1			
25	9.6	1	54	1			
26	120	1	240	1			
27	3.8	1	3.1	1			
28	140	1	350	1			
29	7.2	1	14	1			
30	130	1	280	1			
31	78	1	120	1			
32	120	1	320	1			
33	68	1	120	1			
34	650	1	1400	1			
35	17	1	39	1			
36	320	1	1000	1			
37	260	1	420	1			
38	10	1	18	1			
39	12	1	28	1			
40	310	1	830	1			
41	520	1	1000	1			
42	590	1	1500	1			
43	1600	1	3500	1			
44	34	1	78	1			
45	33	1	89	1			
46	130	1	310	1			
47							
48							
49	784				1.3	0	

	A	B	C	D	E	F	G
1	DRO	D_DRO	ORO	D_ORO	PCP	D_PCP	TEQ
2					0.067	0	78
3					0.067	0	15.8
4					0.067	0	
5					0.067	0	
6					0.067	0	
7					0.067	0	
8					0.067	0	
9					0.067	0	
10	7.9	1	16	1	1.6	0	
11	5.5	1	6.7	1	1.6	0	
12	3.4	1	2.5	1	1.6	0	
13	3.2	1	2.2	1	1.6	0	
14	6.9	1	4	1	1.6	0	
15	58	1	150	1	1.6	0	
16	3.5	1	4.3	1	1.6	0	
17	2.9	1	2.4	1	1.6	0	
18	2.1	1	1.3	1	1.6	0	
19	2.7	1	2.6	1	2.5	1	
20	6	1	6.5	1	5.4	1	
21	3.8	1	4	1	1.6	0	
22	2.6	1	1.9	1	1.6	0	
23	2.3	1	3.1	1	1.6	0	
24	1.6	1	1.6	1	1.6	0	
25	2.4	1	1.8	1	1.6	0	
26					1.6	0	
27					1.6	0	
28					1.6	0	
29					1.6	0	
30					1.6	0	
31					1.6	0	
32					1.6	0	
33					1.6	0	
34					1.6	0	
35					1.6	0	
36					1.6	0	
37					1.6	0	
38					1.6	0	
39					1.6	0	
40					1.6	0	
41					1.6	0	
42	41	1	86	1	1.6	0	
43	19	1	31	1	1.6	0	
44	10	1	13	1	1.6	0	
45					1.6	0	
46					1.6	0	
47					1.6	0	
48					1.6	0	
49					1.6	0	
50					1.6	0	
51					1.6	0	
52					1.6	0	

	A	B	C	D	E	F	G
53	4.3	1	3.7	1	7.3	1	
54	62	1	44	1	7.5	1	
55	5.8	1	4.5	1	2.4	1	
56	4.2	1	3.2	1	1.6	0	
57	3.1	1	2.4	1	1.6	0	
58					1.6	0	
59					1.6	0	
60					1.6	0	
61					1.6	0	
62					1.6	0	
63					1.6	0	
64					1.6	0	
65					1.6	0	
66					1.6	0	
67					5.6	1	
68					8	1	
69					1.6	0	
70	4	1	3.9	1			
71	3.1	1	2.2	1			
72	4	1	2.6	1			
73	4.9	1	7.8	1			
74	3.2	1	2.3	1			
75	2.8	1	1.9	1			
76	4.3	1	4.6	1			
77	3.7	1	3.7	1			
78	3.6	1	2.8	1			
79	4.7	1	4.2	1			
80	3.1	1	2.2	1			
81	3.1	1	2.3	1			
82	33	1	83	1			
83	54	1	130	1			
84	15	1	23	1			
85	4.9	1	6.4	1			
86	9.8	1	17	1			
87	3	1	2.6	1			
88					0.02	0	
89					0.02	0	
90	1	0	50	0	1.1	1	
91	0.99	0	50	0	0.027	1	
92	44	1	50	0	130	1	
93	0.99	0	50	0	0.27	1	
94					0.14		
95					0.25		
96					0.068		
97					1.2	0	
98					1.1	0	
99					4.7	0	
100					1.2	0	
101					1.2	0	
102					11	1	
103					12	1	
104					0.095	1	

	A	B	C	D	E	F	G
105					0.75	1	
106					1.5	1	
107					1.3	0	
108					1.3	0	
109					1.3	0	
110					1.1	0	
111					0.49	1	
112	3.5	0	14	0	0.18	1	
113	3.8	0	15	0	1.4	0	
114					7.9	1	
115	3.3	0	13	0	4.9	1	
116					0.2	1	
117	35	0	520	1	1.2	0	
118	8.9	0	170	1	1.2	0	
119	3.3	0	13	0	1	0	
120					150	1	
121					150	1	
122					15	1	
123					0.95	0	
124	47000	1					
125					0.4	0	
126					32	1	
127					1.2	0	
128					2.5	1	

	A	B	C	D	E	F	G
1	DRO	D_DRO	ORO	D_ORO	PCP	D_PCP	TEQ
2	7.9	1	16	1	0.067	0	78
3	5.5	1	6.7	1	0.067	0	
4	58	1	150	1	0.067	0	
5	3.5	1	4.3	1	0.067	0	
6	2.7	1	2.6	1	1.6	0	
7	6	1	6.5	1	1.6	0	
8	2.3	1	3.1	1	1.6	0	
9	1.6	1	1.6	1	1.6	0	
10	41	1	86	1	2.5	1	
11	19	1	31	1	5.4	1	
12	4.3	1	3.7	1	1.6	0	
13	62	1	44	1	1.6	0	
14	5.8	1	4.5	1	1.6	0	
15	4	1	3.9	1	1.6	0	
16	3.1	1	2.2	1	1.6	0	
17	4.9	1	7.8	1	1.6	0	
18	3.2	1	2.3	1	1.6	0	
19	4.3	1	4.6	1	1.6	0	
20	3.7	1	3.7	1	1.6	0	
21	4.7	1	4.2	1	1.6	0	
22	3.1	1	2.2	1	1.6	0	
23	33	1	83	1	1.6	0	
24	54	1	130	1	1.6	0	
25	4.9	1	6.4	1	1.6	0	
26	9.8	1	17	1	1.6	0	
27					1.6	0	
28	1	0	50	0	1.6	0	
29	44	1	50	0	1.6	0	
30	3.5	0	14	0	1.6	0	
31					1.6	0	
32	3.3	0	13	0	7.3	1	
33	35	0	520	1	7.5	1	
34	8.9	0	170	1	2.4	1	
35					1.6	0	
36					1.6	0	
37					1.6	0	
38	47000	1			1.6	0	
39					1.6	0	
40					1.6	0	
41					5.6	1	
42					8	1	
43					0.02	0	
44					1.1	1	
45					130	1	
46					0.14	1	
47					0.25	1	
48					0.068	1	
49					1.2	0	
50					4.7	0	
51					1.2	0	
52					11	1	

	A	B	C	D	E	F	G
53					12	1	
54					0.75	1	
55					1.5	1	
56					1.3	0	
57					0.49	1	
58					0.18	1	
59					7.9	1	
60					4.9	1	
61					1.2	0	
62					1.2	0	
63					150	1	
64					150	1	
65					0.95	0	
66							
67					0.4	0	
68					32	1	
69					2.5	1	

	A	B	C	D	E	F	G
1	DRO	D_DRO	ORO	D_ORO	PCP	D_PCP	TEQ
2	270	1	1200	1			141
3	340	1	1300	1			196
4	24	1	79	1			100
5	12	1	36	1			142
6	11	1	33	1			450
7	720	1	2300	1			60.1
8	670	1	2200	1			7.98
9	960	1	3100	1			3.91
10	1300	1	4500	1			2.77
11	1900	1	5900	1			5.23
12	810	1	3500	1			3.04
13	640	1	2600	1			2.02
14	59	1	180	1			22.33
15	240	1	860	1			27.71
16	210	1	630	1			15.23
17	570	1	2400	1			2.44
18	1300	1	4600	1			41.2
19	770	1	2700	1			30.8
20	630	1	2000	1			48.5
21	190	1	400	1			8.2
22	150	1	300	1			49.5
23	39	1	95	1			150
24	8.3	1	21	1			8.67
25	14	1	21	1			110.66
26	1.7	1	1.3	1			310.59
27	300	1	420	1			1.36
28	170	1	280	1			16.08
29	170	1	270	1			22.54
30	410	1	780	1			44.33
31	580	1	720	1			0.49
32	860	1	1200	1			199.05
33	8.1	1	13	1			201
34	8.9	1	16	1			216
35	5.4	1	10	1			3.35
36							43.4
37							21.5
38							241
39							110
40							149
41							68.6
42							61.5
43							3.85
44							62
45							124
46							271
47							41
48							99
49							4.4
50							260
51							180
52							110

	A	B	C	D	E	F	G
53							190
54							91
55							3.5
56							13
57							58
58							0.59
59							4
60							51
61							70
62							36
63							30

	A	B	C	D	E	F	G
1	DRO	D_DRO	ORO	D_ORO	PCP	D_PCP	TEQ
2	270	1	1200	1			141
3	340	1	1300	1			100
4	24	1	79	1			60.1
5	720	1	2300	1			3.91
6	670	1	2200	1			2.77
7	810	1	3500	1			22.33
8	640	1	2600	1			27.71
9	59	1	180	1			15.23
10	570	1	2400	1			30.8
11	1300	1	4600	1			48.5
12	190	1	400	1			8.2
13	150	1	300	1			8.67
14	8.3	1	21	1			110.66
15	14	1	21	1			16.08
16	300	1	420	1			22.54
17	170	1	280	1			199.05
18	410	1	780	1			201
19	580	1	720	1			43.4
20	8.1	1	13	1			21.5
21	8.9	1	16	1			149
22							68.6
23							62
24							124
25							99
26							4.4
27							180
28							110
29							91
30							3.5
31							58
32							0.59
33							51
34							70
35							30

	A	B	C	D
1	GW Pb	D_GW Pb	GW TEQ	D_GW TEQ
2	0.024	1	0.257	1
3	0.005	0	22.3	1
4	0.018	1	8.52	1
5	0.02	1	0.24	1
6	0.022	1	1.02	1
7	0.042	1	20.3	1
8	0.018	1	14.1	1
9	0.069	1	0.168	1
10	0.015	1	0.551	1
11	0.005	0	1.73	1
12	0.032	1	3.62	1
13	0.025	1	50.4	1
14	0.013	1	130	1
15	0.19	1	3.9	1

APPENDIX D

Table 1a - Summary of Statistical Evaluation for Inorganics in Soil, Entire Site
The Landing - Old Mill Section
Mount Shasta, California

Constituent	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn	CrVI
Population	61	61	61	61	55	61	61	61	61	61	15	61	55	61	55	61	61	40
Detections	6	37	60	24	38	60	58	60	60	18	1	60	1	1	0	60	61	1
Max Non-Detect	9.9	2.9	18	1.3	1.0	1.0	1.0	2.0	1.0	0.06	1.0	1.0	5.8	1.6	4.1	1.0	2.0	6.2
Min Non-Detect	0.96	0.6	18	0.09	0.57	1.0	7.1	2.0	1.0	0.16	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.2
% Non-Detect	90	39	2	61	45	2	5	2	2	70	93	2	98	98	100	2	100	98
Minimum[1]	<0.96	0.97	5.5	0.38	0.15	3	1.4	4.2	1.2	0.04	1.2	3.1	2.3	0.62	na	8.4	4.3	0.2
Maximum[1]	4.8	8.0	610	1.5	0.93	80.5	17.3	82.6	70.3	8.0	1.2	89.8	2.3	0.62	na	134	109	0.2
Mean Detect	3.2	2.9	166	1.14	0.43	29.2	6.23	28.3	11.7	0.86	1.2	30.8	2.3	0.62	na	59.5	38.5	0.2
SD[2]	1.43	1.51	121	0.30	0.18	17.4	3.85	13.2	10.7	1.93	na	19.7	na	na	na	30.7	22.4	na
CV[2]	0.45	0.52	0.73	0.27	0.43	0.60	0.62	0.47	0.92	2.26	na	0.64	na	na	na	0.52	0.58	na
Outlier Values[3]	none	5.7,7.3,8.0	610	none	none	none	none	82.6	70.3,34.4,33.1	multiple	na	none	na	na	na	none	none	none
Distribution[2]	Normal	Gamma	Non-Parametric	Normal	Normal	Non-Parametric	Gamma	Non-Parametric	Non-Parametric	Non-Parametric	na	Non-Parametric	na	na	na	Normal	Gamma	na
UCL method[2]	95% KM (t)	95% KM Approx. Gamma	95% KM (Chebyshev)	95% KM (t)	95% KM (t)	95% KM (Chebyshev)	95% KM Approx. Gamma	95% KM (Chebyshev)	95% KM (Chebyshev)	95% KM (Chebyshev)	na	95% KM (Chebyshev)	na	na	na	95% KM (t)	95% KM Approx. Gamma	na
UCL value[2]	**2.19**	**2.51**	**231**	**0.79**	**0.47**	**38.6**	**6.99**	**35.4**	**17.4**	**0.92**	na	**41.4**	na	na	na	**65.3**	**44.0**	na

Table 1b - Summary of Statistical Evaluation for Organics in Soil, Entire Site
The Landing - Old Mill Section
Mount Shasta, California

Constituent	DRO	ORO	PCP	TEQ
Population	180	179	111	88
Detections	164	167	30	88
Max Non-Detect	784	2600	5	na
Min Non-Detect	0.99	13	0.02	na
% Non-Detect	9	7	73	0
Minimum[1]	1.4	1.1	0.03	0.49
Maximum[1]	47000	14000	150	450
Mean Detect	507	672	18.6	74.4
Distribution[2]	Non-Parametric	Non-Parametric	Lognormal	Gamma
UCL method[2]	95% KM (Chebyshev)	95% KM (Chebyshev)	KM-H	95% Approx. Gamma
UCL value[2]	**1607**	**1099**	**4.69**	**93.2**

Notes:
1 Soil concentrations are shown in milligrams per kilograms (mg/kg)
2 At five percent signifcance level based on Rosner's Outlier Test
3 Distribution, UCL/BTV method and CV, SD, UCL/BTV calculations by ProUCL 5.1 (USEPA, 2016). Background population determined pursuant to DTSC (1997) guidance.
< = constituent not detected at concentration greater than or equal to the listed laboratory detection limit
BTV = background threshold value of background population, defined as the population nearest the origin on quantile-quantile plot per DTSC (1997) guidance.
CV = coefficient of variation
EPC = exposure point concentration

KM = Kaplan Meier
NA = not applicable or not available
UCL = upper confidence limit on the arithmetic mean
SD = standard deviation
$C_{UL0.95}$ ($X_{0.99}$) = 95% UCL of the 99th percentile
Values in **bold** font are used as EPCs.

Table 1c - Summary of Statistical Evaluation for COCs in Soil, All Depths
The Landing - Old Mill Section
Mount Shasta, California

AOC	**Log Pond Area**				**Dip Tank/Transfer Pit Area**						**Boiler Room Area**				**Refuse Burner Area**				
Constituent	**DRO**	**ORO**	**PCP**	**TEQ**	**DRO**	**ORO**	**PCP**	**TEQ**	**Pb**	**Hg**	**DRO**	**ORO**	**PCP**	**TEQ**	**DRO**	**ORO**	**PCP**	**TEQ**	**Pb**
Population	12	11	1	3	53	52	108	2	34	34	67	65	2	3	34	34	0	62	16
Detections	12	11	0	3	44	44	26	2	34	16	67	65	1	3	34	34	0	62	15
Max Non-Detect	na	na	1.6	na	35	50	4.7	na	na	0.16	na	na	1.3	na	na	na	na	na	1.0
Min Non-Detect	na	na	1.6	na	0.99	13	0.02	na	na	0.06	na	na	1.3	na	na	na	na	na	1.0
% Non-Detect	0	0	100	0	20	15	76	0	0	53	0	0	50	0	0	0	na	100	6
Minimum[1]	12	35	na	38.7	1.6	1.3	0.03	15.8	2.2	0.04	1.4	1.1	0.075	51.4	1.7	1.3	na	0.49	1.2
Maximum[1]	594	160	na	**142**	47000	520	150	**78**	70.3	8.0	5000	14000	**0.075**	**95.9**	1900	5900	na	450	33.1
Mean Detect	99	96.6	na	73.9	1079	31.6	21.5	46.9	11.9	0.94	291	828.9	na	69.1	422	1314	na	81.3	9.41
Distribution[2]	Non-Parametric	Normal	na	na	Non-Parametric	Non-Parametric	Lognormal	na	Non-Parametric	Non-Parametric	Gamma	Gamma	na	na	Gamma	Gamma	na	Gamma	Gamma
UCL method[2]	95% KM (Mean, SD)	95% Student's-t	na	na	95% KM (Chebyshev)	95% KM (Chebyshev)	KM H	na	95% Chebyshev (Mean, SD)	95% KM (Chebyshev)	95% Adjusted Gamma	95% Adjusted Gamma	na	na	95% Adjusted Gamma	95% Adjusted Gamma	na	95% KM Approx. Gamma	95% KM Adjusted Gamma
UCL value[2]	**297**	**118**	na	na	**4768**	**75.4**	**5.50**	na	**21.1**	**1.57**	**410**	**1208**	na	na	**662**	**2146**	na	**108**	**15.5**

Table 1d - Summary of Statistical Evaluation for COCs in Soil, Upper Two Feet
The Landing - Old Mill Section
Mount Shasta, California

AOC	**Log Pond Area**				**Dip Tank/Transfer Pit Area**						**Boiler Room Area**				**Refuse Burner Area**				
Constituent	**DRO**	**ORO**	**PCP**	**TEQ**	**DRO**	**ORO**	**PCP**	**TEQ**	**Pb**	**Hg**	**DRO**	**ORO**	**PCP**	**TEQ**	**DRO**	**ORO**	**PCP**	**TEQ**	**Pb**
Population	12	11	1	2	32	31	67	1	22	22	46	45	1	3	20	20	0	34	11
Detections	12	11	0	2	27	27	24	1	22	12	46	45	0	3	20	20	0	34	10
Max Non-Detect	na	na	1.6	na	35	50	4.7	na	na	0.15	na	na	1.3	na	na	na	na	na	1.0
Min Non-Detect	na	na	1.6	na	1	13	0.02	na	na	0.06	na	na	1.3	na	na	na	na	na	1.0
% Non-Detect	0	0	100	0	16	13	64	0	0	45	0	-	100	0	0	0	na	0	6
Minimum[1]	18	35	na	41.1	1.6	1.6	0.07	78	2.2	0.04	3.8	3.1	na	51.4	8.1	13	na	0.59	1.2
Maximum[1]	594	160	na	**142**	47000	520	150	**78**	70.3	8.0	5000	14000	na	**95.9**	1300	4600	na	201	33.1
Mean Detect	98.7	96.6	na	91.6	1755	48.8	22.6	na	14.1	1.1	373	1036	na	69.1	362	1167	na	64.2	9.1
Distribution[2]	Non-Parametric	Normal	na	na	Non-Parametric	Non-Parametric	Non-Parametric	na	Non-Parametric	Non-Parametric	Gamma	Gamma	na	na	Approx. Normal	Gamma	na	Gamma	Approx. Normal
UCL method[2]	95% KM (Mean, SD)	95% Student's-t	na	na	97.5% KM (Chebyshev)	95% KM (Chebyshev)	95% KM (Chebyshev)	na	95% Chebyshev (Mean, SD)	95% KM (Chebyshev)	95% Adjusted Gamma	95% Adjusted Gamma	na	na	95% Student's-t	95% Adjusted Gamma	na	95% Adjusted Gamma	95% KM(t)
UCL value[2]	**297**	**118**	na	na	**10,679**	**122**	**24.4**	na	**27.9**	**2.32**	**540**	**1545**	na	na	**497**	**2226**	na	**91.3**	**13.6**

Notes:
1 Soil concentrations are shown in milligrams per kilograms (mg/kg)
2 At five percent signifcance level based on Rosner's Outlier Test
3 Distribution, UCL/BTV method and CV, SD, UCL/BTV calculations by ProUCL 5.1 (USEPA, 2016). Background population determined pursuant to DTSC (1997) guidance.
< = constituent not detected at concentration greater than or equal to the listed laboratory detection limit
BTV = background threshold value of background population, defined as the population nearest the origin on quantile-quantile plot per DTSC (1997) guidance.
CV = coefficient of variation
EPC = exposure point concentration

KM = Kaplan Meier
NA = not applicable or not available
UCL = upper confidence limit on the arithmetic mean
SD = standard deviation
$C_{UL0.95}$ ($X_{0.99}$) = 95% UCL of the 99th percentile
Values in **bold** font are used as EPCs.

Table 1e - Summary of Statistical Evaluation for COCs, Groundwater Monitoring Wells OM-2 through OM-5
The Landing - Old Mill Section
Mount Shasta, California

Constituent	Pb	Hg	DRO	ORO	PCP	TEQ
Unit	mg/L	mg/L	ug/L	ug/L	ug/L	pg/L
Population	14	14	14	14	10	14
Detections	12	1	6	6	0	14
Max Non-Detect	0.005	0.2	50	50	1.0	na
Min Non-Detect	0.005	0.2	50	50	0.1	na
% Non-Detect	14	93	57	57	100	0
Minimum[1]	0.013	0.42	70	80	na	0.168
Maximum[1]	0.19	**0.42**	**170**	**170**	na	130
Mean Detect	0.041	na	120	125	na	18.4
Distribution[2]	Approx. Lognormal	na	na	na	na	Gamma
UCL method[2]	KM H	na	na	na	na	95% Adjusted Gamma
UCL value[2]	**0.065**	na	na	na	na	52.7

Table 1f - Summary of Statistical Evaluation for COCs, Groundwater Monitoring Well OM-1
The Landing - Old Mill Section
Mount Shasta, California

Constituent	Pb	Hg	DRO	ORO	PCP	TEQ
Unit	mg/L	mg/L	ug/L	ug/L	ug/L	pg/L
Population	3	3	3	3	3	3
Detections	3	0	1	1	0	3
Max Non-Detect	na	0.2	50	50	1.0	na
Min Non-Detect	na	0.2	50	50	0.1	na
% Non-Detect	0	100	67	67	100	0
Minimum[1]	0.02	na	70	80	na	5.61
Maximum[1]	**0.084**	na	**70**	**80**	na	**348**
Mean Detect	0.046	na	na	na	na	152
Distribution[2]	na	na	na	na	na	na
UCL method[2]	na	na	na	na	na	na
UCL value[2]	na	na	na	na	na	na

Notes:
Distribution, UCL method and UCL calculations by ProUCL 5.1 (USEPA, 2016).
EPC = exposure point concentration
mg/L = milligram per liter
ug/L = microgram per liter
pg/L = picogram per liter

Table 2 - Summary of Inorganic COC Selection
The Landing - Old Mill Section
Mount Shasta, California

Constituent	CAS No.	Unit	Max Detect	EPC[1]	EPC Source	BTV[1]	BTV Source	Does the EPC exceed the Site background range?	Does the Max Detect exceed the Site background range?	Is the constituent considered a COPC?
Antimony	7440-36-0	mg/kg	4.8	2.19	UCL	4.8	Upper Range Bkg	no	no	no
Arsenic	7440-38-2	mg/kg	8.0	2.51	UCL	4.5	Upper Range Bkg	no	yes	no
Barium	7440-39-3	mg/kg	610	231	UCL	429	Upper Range Bkg	no	yes	no
Beryllium	7440-41-7	mg/kg	1.5	0.79	UCL	1.5	Upper Range Bkg	no	no	no
Cadmium	7440-43-9	mg/kg	0.93	0.47	UCL	0.93	Upper Range Bkg	no	no	no
Chromium	16065-83-1	mg/kg	80.5	38.6	UCL	80.5	Upper Range Bkg	no	no	no
Cobalt	7440-48-4	mg/kg	17.3	7.0	UCL	17.3	Upper Range Bkg	no	no	no
Copper	7440-50-8	mg/kg	82.6	35.4	UCL	50.0	Upper Range Bkg	no	yes	no
Lead	7439-92-1	mg/kg	70.3	17.4	UCL	27.5	Upper Range Bkg	no	yes	**yes**
Mercury	7439-97-6	mg/kg	8.0	0.92	UCL	0.14	Upper Range Bkg	yes	yes	**yes**
Molybdenum	7439-98-7	mg/kg	1.2	1.2	Site Max	1.2	Upper Range Bkg	no	no	no
Nickel	7440-02-0	mg/kg	89.8	41.4	UCL	89.8	Upper Range Bkg	no	no	no
Selenium	7782-49-2	mg/kg	2.3	2.3	Site Max	2.3	Upper Range Bkg	no	no	no
Silver	7440-22-4	mg/kg	0.62	0.62	Site Max	0.62	Upper Range Bkg	no	no	no
Thallium	7440-28-0	mg/kg	ND	na	na	na	na	no	no	no
Vanadium	7440-62-2	mg/kg	134	65.26	UCL	134	Upper Range Bkg	no	no	no
Zinc	7440-66-6	mg/kg	109	43.95	UCL	109	Upper Range Bkg	no	no	no
Chromium VI	18540-29-9	mg/kg	0.2	0.2	Site Max	na	na	no	no	no

Notes:
1 Statistical evaluation performed using ProUCL 5.0 (USEPA, 2013). See Section 4 and ProUCL output in Appendix A.
BTV = background threshold value
COC = constituent of potential concern
EPC = exposure point concentration
mg/kg = milligrams per kilogram soil
na = not applicable
ND = not detected
UCL = 95% upper confidence limit on arithmetic mean value

Table 3 - Toxicity Values
The Landing - Old Mill Section
Mount Shasta, California

Analyte	CAS No.	**RfDo** (mg/kg-day)		**RfDi** (mg/kg-day)			**SFo** (mg/kg-day)$^{-1}$		**SFi** (mg/kg-day)$^{-1}$			**Kp** (cm/hr)	**ABS**
		value	source	RfCi (mg/m^3)	source	value	value	source	IUR (ug/m^3)$^{-1}$	source	value		
Antimony, metallic	7440-36-0	4.0.E-04	IRIS	--	--	--	--	--	--	--	--	1.0.E-03	0.01
Arsenic, inorganic	7440-38-2	3.5E-06	OEHHA	1.5E-05	OEHHA	3.8E-06	9.5E+00	OEHHA PHG	3.3E-03	OEHHA	1.3E+01	1.0.E-03	0.03
Barium	7440-39-3	2.0E-01	IRIS	5.0E-04	HEAST	1.3E-04	--	--	--	--	--	1.0.E-03	0.01
Beryllium and compounds	7440-41-7	2.0E-04	OEHHA PHG	7.0E-06	OEHHA	1.8E-06	--	--	2.4E-03	IRIS	9.6E+00	1.0.E-03	0.01
Cadmium, diet	7440-43-9	6.3E-06	OEHHA PHG	1.0E-05	ATSDR	2.5E-06	--	--	1.8E-03	IRIS	7.2E+00	1.0.E-03	0.001
Chromium (III), insoluble salts	16065-83-1	1.5E+00	IRIS	--	--	--	--	--	--	--	--	1.0.E-03	0.01
Cobalt	7440-48-4	3.0E-04	PPRTV	6.0E-06	PPRTV	1.5E-06	--	--	9.0E-03	PPRTV	3.6E+01	4.0.E-04	0.01
Copper	7440-50-8	4.0E-02	HEAST	--	--	--	--	--	--	--	--	1.0.E-03	0.01
Lead and compounds	7439-92-1	Lead is evaluated using the LeadSpread 8 model (DTSC, 2011)											
Mercury, elemental	7439-97-6	1.6E-04	OEHHA	3.0E-05	OEHHA	7.5E-06	--	--	--	--	--	1.0.E-03	0.01
Molybdenum	7439-98-7	5.0E-03	IRIS	--	--	--	--	--	--	--	--	1.0.E-03	0.01
Nickel, soluble salts	7440-02-0	1.1E-02	OEHHA	1.4E-05	OEHHA	3.5E-06	--	--	2.6E-04	OEHHA	1.0E+00	2.0.E-04	0.01
Selenium	7782-49-2	5.0E-03	IRIS	2.0E-02	CalEPA	5.0E-03	--	--	--	--	--	1.0.E-03	0.01
Silver	7440-22-4	5.0E-03	IRIS	--	--	--	--	--	--	--	--	6.0.E-04	0.01
Thallium, soluble salts	7440-28-0	1.0E-05	PPRTV*	--	--	--	--	--	--	--	--	1.0.E-03	0.01
Vanadium and compounds	7440-62-2	5.0E-03	RSL	1.0E-04	ATSDR	2.5E-05	--	--	--	--	--	1.0.E-03	0.01
Zinc and compounds	7440-66-6	3.0E-01	IRIS	--	--	--	--	--	--	--	--	6.0.E-04	0.01
DRO (TPH aromatic medium)	E1790674	4.0E-03	PPRTV	3.0E-03	PPRTV	7.5E-04	--	--	--	--	--	6.9.E-02	0.1
ORO (TPH aliphatic low)	E1790672	2.0E+00	DTSC	8.0.E+00	DTSC	2.3E+00	--	--	--	--	--	2.0.E-01	0.1
Pentachlorophenol	87-86-5	5.0E-03	IRIS	--	--	--	4.0.E-01	IRIS	5.1E-06	CalEPA	2.0E-02	1.3.E-01	0.25
2,3,7,8-TCDD	1746-01-6	7.0E-10	IRIS	4.E-08	CalEPA	1.0E-08	1.3.E+05	CalEPA	3.8.E+01	CalEPA	1.5E+05	8.1.E-01	0.03

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
ATSDR = Agency for Toxic Substances and Disease Registry
Conversions per Supplemental Guidance to RAGS: Region 4 Bulletins Human Health Risk Assessment (US EPA, November 1995), with updated body weight (DTSC, 2014)
DRO = diesel range organics
ORO = motor oil range organics
HEAST = US EPA Office of Research and Development, Health Effects Assessment Summary Tables
IRIS = US EPA Integrated Risk Information System (http://www.epa.gov/iris/)
IUR = inhalation unit risk
OEHHA = CalEPA Office of Environmental Health Hazard Assessment
PPRTV = Provisional Peer Reviewed Toxicity Values, US EPA OSWER Office of Superfund Remediation Technology Inovation (OSRTI)
RfCi = reference concentraton for inhalation exposure
RfDi = reference dose for chronic inhalation exposure: RfDi [mg/kg-day] = RfCi [mg/m^3] * (20 m^3/day) * (80 kg)$^{-1}$
RfDo = reference dose for chronic oral exposure
RSL = USEPA Region IX RSL user guide Section 5: Value is based on IRIS oral RfD for Vanadium Pentoxide, factoring out the molecular weight (MW) of the oxide ion.
SFi = cancer slope factor for inhalation exposure: SFi [(mg/kg-day)$^{-1}$] = IUR [(ug/m^3)$^{-1}$] * (10^{3}ug/mg) * (80 kg) * (20m^3/day)$^{-1}$.
SFo = cancer slope factor for oral exposure
TPH = total petroleum hydrocarbons
* Appendix PPRTV Screen (see USEPA FAQ #27, http://www.epa.gov/region9/superfund/prg/)

Table 4a - Summary of Risk/Hazard Calculations for Standard Exposure Scenario (Unrestricted Land Use), All Detected Constituents, Entire Site
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	Hazard$_{soil}$	Hazard$_{air}$	Hazard, soil + air	Risk$_{soil}$	Risk$_{air}$	Risk, soil + air
Antimony	UCL	4.0E-04	--	--	--	0.01	2.19	1.61E-09	7.20E-02		7.20E-02			0.00E+00
Arsenic	UCL	3.5E-06	3.8E-06	9.5E+00	1.3E+01	0.03	2.51	1.85E-09	6.30E+00	3.15E-04	6.30E+00	2.31E-05	3.00E-09	2.32E-05
Barium	UCL	2.0E-01	1.3E-04	--	--	0.01	231	1.70E-07	1.52E-02	8.69E-04	1.61E-02			0.00E+00
Beryllium	UCL	2.0E-04	1.8E-06	--	9.6E+00	0.01	0.79	5.81E-10	5.20E-02	2.12E-04	5.22E-02		6.88E-10	6.88E-10
Cadmium	UCL	6.3E-06	2.5E-06	--	7.2E+00	0.00	0.47	3.46E-10	8.95E-02	3.31E-05	8.96E-02		3.07E-10	3.07E-10
Chromium	UCL	1.5E+00	--	--	--	0.01	38.6	2.84E-08	3.39E-04		3.39E-04			0.00E+00
Cobalt	UCL	3.0E-04	1.5E-06	--	3.6E+01	0.01	6.99	5.14E-09	3.07E-01	2.19E-03	3.09E-01		2.28E-08	2.28E-08
Copper	UCL	4.0E-02	--	--	--	0.01	35.4	2.60E-08	1.16E-02		1.16E-02			0.00E+00
Mercury	UCL	1.6E-04	7.5E-06	--	--	0.01	0.92	6.76E-10	7.56E-02	8.35E-01	9.11E-01			0.00E+00
Molybdenum	Site Max	5.0E-03	--	--	--	0.01	1.2	8.82E-10	3.16E-03		3.16E-03			0.00E+00
Nickel	UCL	1.1E-02	3.5E-06	--	1.0E+00	0.01	41.4	3.04E-08	4.95E-02	5.56E-03	5.51E-02		3.90E-09	3.90E-09
Selenium	Site Max	5.0E-03	5.0E-03	--	--	0.01	2.3	1.69E-09	6.05E-03	2.16E-07	6.05E-03			0.00E+00
Silver	Site Max	5.0E-03	--	--	--	0.01	0.62	4.56E-10	1.63E-03		1.63E-03			0.00E+00
Thallium	Non Detect	1.0E-05	--	--	--	0.01		0.00E+00	0.00E+00		0.00E+00			0.00E+00
Vanadium	UCL	5.0E-03	2.5E-05	--	--	0.01	65.3	4.80E-08	1.72E-01	1.23E-03	1.73E-01			0.00E+00
Zinc	UCL	3.0E-01	--	--	--	0.01	44.0	3.24E-08	1.93E-03		1.93E-03			0.00E+00
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	1607	1.18E-06	6.63E+00	1.01E-03	6.63E+00			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	1099	8.08E-07	9.06E-03	2.25E-07	9.06E-03			0.00E+00
PCP	UCL	5.0E-03	--	4.0E-01	2.0E-02	0.25	4.7	3.45E-09	2.07E-02		2.07E-02	4.38E-06	8.67E-12	4.38E-06
TEQ	UCL	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	9.32E-05	6.85E-14	1.85E+00	4.38E-06	1.85E+00	1.87E-05	1.28E-09	1.87E-05
TOTAL									1.57E+01	8.47E-01	**1.7E+01**	4.63E-05	3.20E-08	**4.6E-05**

Notes:
1 Cadmium hazard evaluated per HHRA Note 3 (DTSC, 2016) considering 26-year adult exposure
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding arsenic: 1.7E+00 Risk excluding Arsenic: 2.8E-08
Arsenic Hazard Quotient: 6.3.E+00 Arsenic Risk: 2.3E-05

Site Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinog	70	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-car	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (inge	350	350	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (deri	350	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inha	350	350	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	24	24	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	200	100	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	10	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	15	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface area	2,900	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	0.2	0.07	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fact	1.360E+09	1.360E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.

Table 4b - Summary of Risk/Hazard Calculations for Standard Exposure Scenario (Unrestricted Land Use), COCs, Log Pond Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	Hazard$_{soil}$	Hazard$_{air}$	Hazard, soil + air	Risk$_{soil}$	Risk$_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	297	2.18E-07	1.22E+00	1.86E-04	1.22E+00			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	118	8.68E-08	9.73E-04	2.41E-08	9.73E-04			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	1.42E-04	1.04E-13	2.82E+00	6.67E-06	2.82E+00	2.85E-05	1.96E-09	2.85E-05
TOTAL									4.04E+00	1.93E-04	**4.0E+00**	2.85E-05	1.96E-09	**2.9E-05**

Hazard Index excluding TEQ: 1.2E+00 Risk excluding TEQ: 0.0E+00
TEQ Hazard Quotient: 2.8.E+00 TEQ Risk: 2.9.E-05

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinog	70	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-car	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (inge	350	350	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (derr	350	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhal	350	350	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	24	24	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	200	100	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	10	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	15	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface area	2,900	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	0.2	0.07	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fact	1.360E+09	1.360E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.

Table 4c - Summary of Risk/Hazard Calculations for Standard Exposure Scenario (Unrestricted Land Use), COCs, Dip Tank and Transfer Pit Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi** (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi** (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	**Hazard$_{soil}$**	**Hazard$_{air}$**	**Hazard**, soil + air	**Risk$_{soil}$**	**Risk$_{air}$**	**Risk**, soil + air
Mercury	UCL	1.6E-04	7.5E-06	--	--	0.01	2.32	1.71E-09	1.91E-01	2.11E+00	2.30E+00			0.00E+00
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	10679	7.85E-06	4.40E+01	6.69E-03	4.40E+01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	122	8.97E-08	1.01E-03	2.49E-08	1.01E-03			0.00E+00
PCP	UCL	5.0E-03	--	4.0E-01	2.0E-02	0.25	24.4	1.79E-08	1.08E-01		1.08E-01	2.28E-05	4.51E-11	2.28E-05
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	7.80E-05	5.74E-14	1.55E+00	3.67E-06	1.55E+00	1.57E-05	1.07E-09	1.57E-05
TOTAL									4.59E+01	2.11E+00	**4.8E+01**	3.85E-05	1.12E-09	**3.8E-05**

Notes:

Hazard Index excluding TEQ:	4.6E+01	Risk excluding TEQ:	2.3E-05
TEQ Hazard Quotient:	1.5.E+00	TEQ Risk:	1.6.E-05

ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinog	70	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-car	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (inge	350	350	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (deri	350	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhal	350	350	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	24	24	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	200	100	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	10	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	15	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface area	2,900	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	0.2	0.07	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fact	1.360E+09	1.360E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.

Table 4d - Summary of Risk/Hazard Calculations for Standard Exposure Scenario (Unrestricted Land Use), COCs, Boiler Room Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi** (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi** (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	**Hazard$_{soil}$**	**Hazard$_{air}$**	**Hazard**, soil + air	**Risk$_{soil}$**	**Risk$_{air}$**	**Risk**, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	540	3.97E-07	2.23E+00	3.38E-04	2.23E+00			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	1545	1.14E-06	1.27E-02	3.16E-07	1.27E-02			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	9.59E-05	7.05E-14	1.90E+00	4.51E-06	1.90E+00	1.93E-05	1.32E-09	1.93E-05
TOTAL									4.14E+00	3.43E-04	**4.1E+00**	1.93E-05	1.32E-09	**1.9E-05**

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ:	2.2E+00	Risk excluding TEQ:	0.0E+00
TEQ Hazard Quotient:	1.9.E+00	TEQ Risk:	1.9.E-05

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinog	70	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-car	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (inge	350	350	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (der	350	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhal	350	350	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	24	24	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	200	100	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	10	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	15	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface area	2,900	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	0.2	0.07	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fact	1.360E+09	1.360E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.

Table 4e - Summary of Risk/Hazard Calculations for Standard Exposure Scenario (Unrestricted Land Use), COCs, Refuse Burner Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	Hazard$_{soil}$	Hazard$_{air}$	Hazard, soil + air	Risk$_{soil}$	Risk$_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	497	3.65E-07	2.05E+00	3.11E-04	2.05E+00			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	2226	1.64E-06	1.84E-02	4.55E-07	1.84E-02			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	UCL	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	9.13E-05	6.71E-14	1.81E+00	4.29E-06	1.81E+00	1.84E-05	1.26E-09	1.84E-05
TOTAL									3.88E+00	3.16E-04	**3.9E+00**	1.84E-05	1.26E-09	**1.8E-05**

Notes:

Hazard Index excluding TEQ:	2.1E+00	Risk excluding TEQ:	0.0E+00
TEQ Hazard Quotient:	1.8.E+00	TEQ Risk:	1.8.E-05

ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinog	70	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-car	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (inge	350	350	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (derı	350	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhal	350	350	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	24	24	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	200	100	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	10	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	15	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface area	2,900	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	0.2	0.07	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fact	1.360E+09	1.360E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.

Table 5a - Summary of Risk/Hazard Calculations for Industrial Land Use, COCs, Log Pond Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi** (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi** (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	297	2.18E-07	1.40E-01	3.49E-05	1.40E-01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	118	8.68E-08	1.11E-04	4.52E-09	1.11E-04			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	1.42E-04	1.04E-13	2.37E-01	1.25E-06	2.37E-01	7.69E-06	6.79E-10	7.69E-06
TOTAL									3.77E-01	3.62E-05	**3.77E-01**	7.69E-06	6.79E-10	**7.69E-06**

Notes:

Hazard Index excluding TEQ:	1.4E-01	Risk excluding TEQ:	0.0E+00
TEQ Hazard Quotient:	2.4.E-01	TEQ Risk:	7.7.E-06

ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit
Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcin	--	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-c	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (in	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (d	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFi, exposure frequency (inl	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	--	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	--	100	mg/day	USEPA Supplemental Guidance
IRa, inhalation rate	--	14	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	--	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface ar	--	6,032	cm^2	USEPA Risk Assessment Guidance
AF, adherance factor	--	0.2	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fa	--	1.36E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

USEPA Exposure Factors Handbook (EPA/600/P-95/002Fa)
USEPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)
USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.
PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, October 2015)

Table 5b - Summary of Risk/Hazard Calculations for Industrial Land Use, COCs, Dip Tank and Transfer Pit Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi** (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi** (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	Hazard$_{soil}$	Hazard$_{air}$	Hazard, soil + air	Risk$_{soil}$	Risk$_{air}$	Risk, soil + air
Mercury	UCL	1.6E-04	7.5E-06	--	--	0.01	2.32	1.71E-09	1.39E-02	5.02E-01	5.15E-01			0.00E+00
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	10679	7.85E-06	5.04E+00	1.25E-03	5.04E+00			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	122	8.97E-08	1.15E-04	4.67E-09	1.15E-04			0.00E+00
PCP	UCL	5.0E-03	--	4.0E-01	2.0E-02	0.25	24.4	1.79E-08	1.68E-02		1.68E-02	1.20E-05	1.57E-11	1.20E-05
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	7.80E-05	5.74E-14	1.30E-01	6.87E-07	1.30E-01	4.22E-06	3.73E-10	4.22E-06
TOTAL									5.20E+00	5.03E-01	**5.71E+00**	1.62E-05	3.89E-10	**1.62E-05**

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ:	5.6E+00	Risk excluding TEQ:	1.2E-05
TEQ Hazard Quotient:	1.3.E-01	TEQ Risk:	4.2.E-06

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcin	--	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-c	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (in	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (d	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFi, exposure frequency (inl	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	--	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	--	100	mg/day	USEPA Supplemental Guidance
IRa, inhalation rate	--	14	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	--	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface ar	--	6,032	cm^2	USEPA Risk Assessment Guidance
AF, adherance factor	--	0.2	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fa	--	1.36E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

USEPA Exposure Factors Handbook (EPA/600/P-95/002Fa)
USEPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)
USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.
PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, October 2015)

Table 5c - Summary of Risk/Hazard Calculations for Industrial Land Use, COCs, Boiler Rooom Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi** (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi** (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	540	3.97E-07	2.55E-01	6.35E-05	2.55E-01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	1545	1.14E-06	1.46E-03	5.92E-08	1.46E-03			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	9.59E-05	7.05E-14	1.60E-01	8.45E-07	1.60E-01	5.19E-06	4.59E-10	5.19E-06
TOTAL									4.16E-01	6.44E-05	**4.16E-01**	5.19E-06	4.59E-10	**5.19E-06**

Notes:

ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)

Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$

Cs [mg/kg] = soil concentration

RfDo = reference dose for chronic oral exposure

RfDi = reference dose for chronic inhalation exposure

Sfo = standard oral slope factor

Sfi = standard inhalation slope factor

UCL = upper confidence limit

Hazard Index excluding TEQ: 2.6E-01

TEQ Hazard Quotient: 1.6.E-01

Risk excluding TEQ: 0.0E+00

TEQ Risk: 5.2.E-06

Max = maximum detected concentration

Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinc	--	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-c	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (in	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (d	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFi, exposure frequency (inl	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	--	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	--	100	mg/day	USEPA Supplemental Guidance
IRa, inhalation rate	--	14	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	--	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface ar	--	6,032	cm^2	USEPA Risk Assessment Guidance
AF, adherance factor	--	0.2	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fa	--	1.36E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

USEPA Exposure Factors Handbook (EPA/600/P-95/002Fa)

USEPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)

USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.

HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.

PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, October 2015)

Table 5d - Summary of Risk/Hazard Calculations for Industrial Land Use, COCs, Refuse Burner Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi** (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi** (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	497	3.65E-07	2.35E-01	5.84E-05	2.35E-01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	2226	1.64E-06	2.10E-03	8.53E-08	2.10E-03			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	UCL	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	9.13E-05	6.71E-14	1.52E-01	8.05E-07	1.52E-01	4.94E-06	4.37E-10	4.94E-06
TOTAL									3.89E-01	5.93E-05	**3.89E-01**	4.94E-06	4.37E-10	**4.94E-06**

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ:	2.4E-01	Risk excluding TEQ:	0.0E+00
TEQ Hazard Quotient:	1.5.E-01	TEQ Risk:	4.9.E-06

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcin	--	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-c	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (in	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (d	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFi, exposure frequency (inl	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	--	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	--	100	mg/day	USEPA Supplemental Guidance
IRa, inhalation rate	--	14	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	--	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface ar	--	6,032	cm^2	USEPA Risk Assessment Guidance
AF, adherance factor	--	0.2	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fa	--	1.36E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

USEPA Exposure Factors Handbook (EPA/600/P-95/002Fa)
USEPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)
USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.
PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, October 2015)

Table 6a - Summary of Risk/Hazard Calculations for Indoor Commercial Scenario, COCs, Log Pond Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	297	2.18E-07	7.37E-02	3.49E-05	7.38E-02			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	118	8.68E-08	5.86E-05	4.52E-09	5.86E-05			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	1.42E-04	1.04E-13	1.21E-01	1.25E-06	1.21E-01	3.94E-06	6.79E-10	3.94E-06
TOTAL									1.95E-01	3.62E-05	**1.95E-01**	3.94E-06	6.79E-10	**3.94E-06**

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ: 7.4E-02
TEQ Hazard Quotient: 1.2.E-01
Risk excluding TEQ: 0.0E+00
TEQ Risk: 3.9.E-06

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcin	--	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-c	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (in	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (d	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFi, exposure frequency (inl	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	--	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	--	50	mg/day	USEPA Supplemental Guidance
IRa, inhalation rate	--	14	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	--	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface ar	--	3,300	cm^2	USEPA Risk Assessment Guidance
AF, adherance factor	--	0.2	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fa	--	1.36E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

USEPA Exposure Factors Handbook (EPA/600/P-95/002Fa)
USEPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)
USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.
PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, October 2015)

Table 6b - Summary of Risk/Hazard Calculations for Indoor Commercial Scenario, COCs, Dip Tank and Transfer Pit Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi** (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi** (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Mercury	UCL	1.6E-04	7.5E-06	--	--	0.01	2.32	1.71E-09	7.03E-03	5.02E-01	5.09E-01			0.00E+00
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	10679	7.85E-06	2.65E+00	1.25E-03	2.65E+00			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	122	8.97E-08	6.06E-05	4.67E-09	6.06E-05			0.00E+00
PCP	UCL	5.0E-03	--	4.0E-01	2.0E-02	0.25	24.4	1.79E-08	8.98E-03		8.98E-03	6.42E-06	1.57E-11	6.42E-06
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	7.80E-05	5.74E-14	6.66E-02	6.87E-07	6.66E-02	2.16E-06	3.73E-10	2.16E-06
TOTAL									2.73E+00	5.03E-01	**3.24E+00**	8.58E-06	3.89E-10	**8.58E-06**

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ: 3.2E+00
TEQ Hazard Quotient: 6.7.E-02
Risk excluding TEQ: 6.4E-06
TEQ Risk: 2.2.E-06

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcin	--	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-c	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (in	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (d	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFi, exposure frequency (inl	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	--	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	--	50	mg/day	USEPA Supplemental Guidance
IRa, inhalation rate	--	14	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	--	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface ar	--	3,300	cm^2	USEPA Risk Assessment Guidance
AF, adherance factor	--	0.2	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fa	--	1.36E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

USEPA Exposure Factors Handbook (EPA/600/P-95/002Fa)
USEPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)
USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.
PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, October 2015)

Table 6c - Summary of Risk/Hazard Calculations for Indoor Commercial Scenario, COCs, Boiler Room Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	540	3.97E-07	1.34E-01	6.35E-05	1.34E-01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	1545	1.14E-06	7.67E-04	5.92E-08	7.67E-04			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	9.59E-05	7.05E-14	8.19E-02	8.45E-07	8.19E-02	2.66E-06	4.59E-10	2.66E-06
TOTAL									2.17E-01	6.44E-05	**2.17E-01**	2.66E-06	4.59E-10	**2.66E-06**

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ: 1.3E-01
TEQ Hazard Quotient: 8.2.E-02
Risk excluding TEQ: 0.0E+00
TEQ Risk: 2.7.E-06

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcin	--	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-c	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (in	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (d	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFi, exposure frequency (inl	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	--	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	--	50	mg/day	USEPA Supplemental Guidance
IRa, inhalation rate	--	14	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	--	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface ar	--	3,300	cm^2	USEPA Risk Assessment Guidance
AF, adherance factor	--	0.2	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fa	--	1.36E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

USEPA Exposure Factors Handbook (EPA/600/P-95/002Fa)
USEPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)
USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.
PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, October 2015)

Table 6d - Summary of Risk/Hazard Calculations for Indoor Commercial Scenario, COCs, Refuse Burner Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	497	3.65E-07	1.23E-01	5.84E-05	1.23E-01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	2226	1.64E-06	1.11E-03	8.53E-08	1.11E-03			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	UCL	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	9.13E-05	6.71E-14	7.79E-02	8.05E-07	7.79E-02	2.53E-06	4.37E-10	2.53E-06
TOTAL									2.02E-01	5.93E-05	**2.03E-01**	2.53E-06	4.37E-10	**2.53E-06**

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ: 1.2E-01 Risk excluding TEQ: 0.0E+00
TEQ Hazard Quotient: 7.8.E-02 TEQ Risk: 2.5.E-06

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcin	--	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-c	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (in	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (d	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFi, exposure frequency (inl	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	--	25	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	--	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	--	50	mg/day	USEPA Supplemental Guidance
IRa, inhalation rate	--	14	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	--	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface ar	--	3,300	cm^2	USEPA Risk Assessment Guidance
AF, adherance factor	--	0.2	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fa	--	1.36E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

USEPA Exposure Factors Handbook (EPA/600/P-95/002Fa)
USEPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)
USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.
PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, October 2015)

Table 7a - Summary of Risk/Hazard Calculations for Child and Adult Recreational Exposure Scenario, COCs, Log Pond Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	Hazard$_{soil}$	Hazard$_{air}$	Hazard, soil + air	Risk$_{soil}$	Risk$_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	297	2.18E-07	5.25E-01	2.66E-05	5.25E-01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	118	8.68E-08	4.17E-04	3.45E-09	4.17E-04			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	1.42E-04	1.04E-13	1.21E+00	9.54E-07	1.21E+00	1.24E-05	2.80E-10	1.24E-05
TOTAL									1.73E+00	2.75E-05	**1.7E+00**	1.24E-05	2.80E-10	**1.2E-05**

Notes:
1 Cadmium hazard evaluated per HHRA Note 3 (DTSC, 2016) considering 26-year adult exposure

Hazard Index excluding TEQ:	5.3E-01	Risk excluding TEQ:	0.0E+00
TEQ Hazard Quotient:	1.2.E+00	TEQ Risk:	1.2.E-05

ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit
Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinogen)	70	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-carcinogen)	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (ingestion)	150	150	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (dermal)	150	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhalation)	150	150	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	8	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	200	100	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	10	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	15	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface area	2,900	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	0.2	0.07	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission factor	1.360E+09	1.360E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.

Table 7b - Summary of Risk/Hazard Calculations for Child and Adult Recreational Exposure Scenario, COCs, Dip Tank and Transfer Pit Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Mercury	UCL	1.6E-04	7.5E-06	--	--	0.01	2.32	1.71E-09	8.18E-02	2.08E-05	8.18E-02			0.00E+00
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	10679	7.85E-06	1.89E+01	9.56E-04	1.89E+01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	122	8.97E-08	4.31E-04	3.56E-09	4.31E-04			0.00E+00
PCP	UCL	5.0E-03	--	4.0E-01	2.0E-02	0.25	24.4	1.79E-08	4.61E-02		4.61E-02	1.03E-05	6.45E-12	1.03E-05
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	7.80E-05	5.74E-14	6.64E-01	5.24E-07	6.64E-01	6.79E-06	1.54E-10	6.79E-06
TOTAL									1.97E+01	9.77E-04	**2.0E+01**	1.71E-05	1.60E-10	**1.7E-05**

Notes:
1 Cadmium hazard evaluated per HHRA Note 3 (DTSC, 2016) considering 26-year adult exposure
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ:	1.9E+01	Risk excluding TEQ:	1.0E-05
TEQ Hazard Quotient:	6.6.E-01	TEQ Risk:	6.8.E-06

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinogen)	70	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-carcinogen)	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (ingestion)	150	150	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (dermal)	150	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhalation)	150	150	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	8	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	200	100	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	10	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	15	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface area	2,900	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	0.2	0.07	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission factor	1.360E+09	1.360E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.

Table 7c - Summary of Risk/Hazard Calculations for Child and Adult Recreational Exposure Scenario, COCs, Boiler Room Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	Hazard$_{soil}$	Hazard$_{air}$	Hazard, soil + air	Risk$_{soil}$	Risk$_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	540	3.97E-07	9.54E-01	4.83E-05	9.54E-01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	1545	1.14E-06	5.46E-03	4.51E-08	5.46E-03			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	9.59E-05	7.05E-14	8.16E-01	6.44E-07	8.16E-01	8.35E-06	1.89E-10	8.35E-06
TOTAL									1.78E+00	4.90E-05	**1.8E+00**	8.35E-06	1.89E-10	**8.3E-06**

Notes:
1 Cadmium hazard evaluated per HHRA Note 3 (DTSC, 2016) considering 26-year adult exposure
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ: 9.6E-01 Risk excluding TEQ: 0.0E+00
TEQ Hazard Quotient: 8.2.E-01 TEQ Risk: 8.3.E-06

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinogen)	70	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-carcinogen)	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (ingestion)	150	150	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (dermal)	150	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhalation)	150	150	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	8	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	200	100	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	10	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	15	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface area	2,900	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	0.2	0.07	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission factor	1.360E+09	1.360E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.

Table 7d - Summary of Risk/Hazard Calculations for Child and Adult Recreational Exposure Scenario, COCs, Refuse Burner Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo $(mg/kg\text{-}day)^{-1}$	Sfi $(mg/kg\text{-}day)^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	497	3.65E-07	8.78E-01	4.45E-05	8.78E-01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	2226	1.64E-06	7.87E-03	6.50E-08	7.87E-03			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	UCL	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	9.13E-05	6.71E-14	7.77E-01	6.13E-07	7.77E-01	7.95E-06	1.80E-10	7.95E-06
TOTAL									1.66E+00	4.52E-05	**1.7E+00**	7.95E-06	1.80E-10	**7.9E-06**

Notes:
1 Cadmium hazard evaluated per HHRA Note 3 (DTSC, 2016) considering 26-year adult exposure
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca $[mg/m^3]$ = air concentration = Cs [mg/kg] * (PEF $[m^3/kg])^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ: 8.9E-01
TEQ Hazard Quotient: 7.8.E-01
Risk excluding TEQ: 0.0E+00
TEQ Risk: 7.9.E-06

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinogen)	70	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-carcinogen)	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (ingestion)	150	150	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (dermal)	150	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhalation)	150	150	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	6	20	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	8	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	200	100	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	10	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	15	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface area	2,900	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	0.2	0.07	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission factor	1.360E+09	1.360E+09	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)
HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.

Table 8a - Summary of Risk/Hazard Calculations for Construction Scenario, COCs, Log Pond Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	297	2.97E-04	5.17E-01	6.78E-02	5.84E-01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	118	1.18E-04	4.10E-04	8.78E-06	4.19E-04			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	1.42E-04	1.42E-10	8.25E-01	2.43E-03	8.27E-01	1.07E-06	5.28E-08	1.12E-06
TOTAL									1.34E+00	7.02E-02	**1.41E+00**	1.07E-06	5.28E-08	**1.12E-06**

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ: 5.8E-01 | Risk excluding TEQ: 0.0E+00
TEQ Hazard Quotient: 8.3.E-01 | TEQ Risk: 1.1.E-06

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinog	--	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-ca	--	1	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (ing	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (de	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFi, exposure frequency (inha	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	--	1	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	--	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	--	330	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	--	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	--	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface are	--	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	--	0.8	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fac	--	1.0E+06	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.
PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, October 2015)

Table 8b - Summary of Risk/Hazard Calculations for Construction Scenario, COCs, Dip Tank and Transfer Pit Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi** (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi** (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Mercury	UCL	1.6E-04	7.5E-06	--	--	0.01	2.32	2.32E-06	4.70E-02	5.02E-01	5.49E-01			0.00E+00
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	10679	1.07E-02	1.86E+01	2.44E+00	2.10E+01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	122	1.22E-04	4.24E-04	9.08E-06	4.33E-04			0.00E+00
PCP	UCL	5.0E-03	--	4.0E-01	2.0E-02	0.25	24.4	2.44E-05	6.42E-02		6.42E-02	1.83E-06	1.22E-09	1.84E-06
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	7.80E-05	7.80E-11	4.53E-01	1.34E-03	4.54E-01	5.89E-07	2.90E-08	6.18E-07
TOTAL									1.91E+01	2.94E+00	**2.21E+01**	2.42E-06	3.02E-08	**2.45E-06**

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ:	2.2E+01	Risk excluding TEQ:	1.8E-06
TEQ Hazard Quotient:	4.5.E-01	TEQ Risk:	6.2.E-07

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinog	--	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-ca	--	1	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (ing	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (der	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFi, exposure frequency (inha	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	--	1	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	--	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	--	330	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	--	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	--	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface are	--	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	--	0.8	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fact	--	1.0E+06	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.
PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, October 2015)

Table 8c - Summary of Risk/Hazard Calculations for Construction Scenario, COCs, Boiler Room Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	540	5.40E-04	9.39E-01	1.23E-01	1.06E+00			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	1545	1.55E-03	5.37E-03	1.15E-04	5.49E-03			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	Max	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	9.59E-05	9.59E-11	5.57E-01	1.64E-03	5.59E-01	7.24E-07	3.57E-08	7.60E-07
TOTAL									1.50E+00	1.25E-01	**1.63E+00**	7.24E-07	3.57E-08	**7.60E-07**

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ: 1.1E+00 Risk excluding TEQ: 0.0E+00
TEQ Hazard Quotient: 5.6.E-01 TEQ Risk: 7.6.E-07

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinog	--	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-ca	--	1	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (ing	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (de	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFi, exposure frequency (inha	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	--	1	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	--	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	--	330	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	--	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	--	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface are	--	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	--	0.8	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fac	--	1.0E+06	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.
PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, October 2015)

Table 8d - Summary of Risk/Hazard Calculations for Construction Scenario, COCs, Refuse Burner Area
The Landing - Old Mill Section
Mount Shasta, California

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
DRO	UCL	4.0E-03	7.5E-04	--	--	0.10	497	4.97E-04	8.64E-01	1.13E-01	9.78E-01			0.00E+00
ORO	UCL	2.0E+00	2.3E+00	--	--	0.10	2226	2.23E-03	7.74E-03	1.66E-04	7.91E-03			0.00E+00
PCP	Non Detect	5.0E-03	--	4.0E-01	2.0E-02	0.25		0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00
TEQ	UCL	7.0E-10	1.0E-08	1.3E+05	1.5E+05	0.03	9.13E-05	9.13E-11	5.30E-01	1.56E-03	5.32E-01	6.89E-07	3.39E-08	7.23E-07
TOTAL									1.40E+00	1.15E-01	**1.52E+00**	6.89E-07	3.39E-08	**7.23E-07**

Notes:
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Hazard Index excluding TEQ:	9.9E-01	Risk excluding TEQ:	0.0E+00
TEQ Hazard Quotient:	5.3.E-01	TEQ Risk:	7.2.E-07

Max = maximum detected concentration
Non Detect = constituent was not detected

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinog	--	70	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ATnc, averaging time (non-ca	--	1	yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFs, exposure frequency (ing	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFd, exposure frequency (der	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
EFi, exposure frequency (inha	--	250	days/yr	HERO HHRA Note No. 1 (DTSC, 2014)
ED, exposure duration	--	1	yr	HERO HHRA Note No. 1 (DTSC, 2014)
ET, exposure time	--	8	hr/day	HERO HHRA Note No. 3 (DTSC, 2016)
IRs, soil ingestion rate	--	330	mg/day	HERO HHRA Note No. 1 (DTSC, 2014)
IRa, inhalation rate	--	20	m^3/day	HERO HHRA Note No. 1 (DTSC, 2014)
BW, body weight	--	80	kg	HERO HHRA Note No. 1 (DTSC, 2014)
SA, exposed skin surface are	--	6,032	cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
AF, adherance factor	--	0.8	mg/cm^2	HERO HHRA Note No. 1 (DTSC, 2014)
PEF, particulate emission fac	--	1.0E+06	m^3/kg	HERO HHRA Note No. 1 (DTSC, 2014)

HERO Human Health Risk Assessment Note No. 1, Recommended DTSC Default Exposure Factors for Use in Risk Assessment, DTSC, September 30, 2014.
PEA Guidance Manual = Preliminary Endangermant Assessment Guidance Manual (DTSC, October 2015)

Table 9 - Summary of Human Health Risk Assessment, Soil and Air Pathways
The Landing - Old Mill Section
Mount Shasta, California

Assessment Area	Constituents	Exposure Scenario													
		Residential (Unrestricted)		Industrial		Commercial Indoor		Child and Adult Recreational		Adult Recreational Runner		Routine Child Visitation		Construction Worker	
		Hazard	Risk	Hazard	Risk	Hazard	Risk	Hazard	Risk	Hazard	Risk	Hazard	Risk	Hazard	Risk
Log Pond Area	All COCs	**4.0**	**2.9E-05**	0.4	**7.7E-06**	0.2	**3.9E-06**	**1.7**	**1.2E-05**	0.0	6.8E-07	**1.5**	**1.3E-05**	**1.4**	1.1E-06
	Excluding TEQ	**1.2**	0.0E+00	0.1	0.0E+00	0.1	0.0E+00	0.5	0.0E+00	0.0	0.0E+00	0.4	0.0E+00	0.6	0.0E+00
	TEQ Only	**2.8**	**2.9E-05**	0.2	**7.7E-06**	0.1	**3.9E-06**	**1.2**	**1.2E-05**	0.0	6.8E-07	1.0	**1.3E-05**	0.8	1.1E-06
	Key COCs	**DRO**,TEQ	TEQ	none	TEQ	none	TEQ	TEQ	TEQ	none	none	TEQ	TEQ	TEQ	TEQ
Dip Tank and Transfer Pit Area	All COCs	**48**	**3.8E-05**	**5.7**	**1.6E-05**	**3.2**	**8.6E-06**	**19.7**	**1.7E-05**	0.8	1.4E-06	**16.8**	**1.8E-05**	**22**	**2.5E-06**
	Excluding TEQ	**46**	**2.3E-05**	**5.6**	**1.2E-05**	**3.2**	**6.4E-06**	**19.0**	**1.0E-05**	0.8	1.0E-06	**16.2**	**1.1E-05**	**22**	**1.8E-06**
	TEQ Only	**1.5**	**1.6E-05**	0.1	**4.2E-06**	0.1	**2.2E-06**	0.7	**6.8E-06**	0.0	3.7E-07	0.6	**7.3E-06**	0.5	6.2E-07
	Key COCs	**Hg,DRO**,TEQ	**PCP**,TEQ	**DRO**	**PCP**,TEQ	**DRO**	**PCP**,TEQ	**DRO**	**PCP**,TEQ	none	none	**DRO**	**PCP**,TEQ	**DRO**,TEQ	**PCP**
Boiler Room Area	All COCs	**4.1**	**1.9E-05**	0.4	**5.2E-06**	0.2	**2.7E-06**	**1.8**	**8.3E-06**	0.0	4.6E-07	**1.5**	**8.9E-06**	**1.6**	7.6E-07
	Excluding TEQ	**2.2**	0.0E+00	0.3	0.0E+00	0.1	0.0E+00	1.0	0.0E+00	0.0	0.0E+00	0.8	0.0E+00	**1.1**	0.0E+00
	TEQ Only	**1.9**	**1.9E-05**	0.2	**5.2E-06**	0.1	**2.7E-06**	0.8	**8.3E-06**	0.0	3.7E-07	0.7	**8.9E-06**	0.6	7.6E-07
	Key COCs	**DRO**,TEQ	TEQ	none	TEQ	none	TEQ	TEQ	TEQ	none	none	TEQ	TEQ	**DRO**	none
Refuse Burner Area	All COCs	**3.9**	**1.8E-05**	0.4	**4.9E-06**	0.2	**2.5E-06**	**1.7**	**7.9E-06**	0.0	4.4E-07	**1.4**	**8.5E-06**	**1.5**	7.2E-07
	Excluding TEQ	**2.1**	0.0E+00	0.2	0.0E+00	0.1	0.0E+00	0.9	0.0E+00	0.0	0.0E+00	0.7	0.0E+00	1.0	0.0E+00
	TEQ Only	**1.8**	**1.8E-05**	0.2	**4.9E-06**	0.1	**2.5E-06**	0.8	**7.9E-06**	0.0	4.4E-07	0.7	**8.5E-06**	0.5	7.2E-07
	Key COCs	**DRO**,TEQ	TEQ	none	TEQ	none	TEQ	TEQ	TEQ	none	none	TEQ	TEQ	**DRO**	none

Notes:
COC = Constituent of Concern
Hazard = chronic health hazard index. Hazard values in **bold** font exceed one.
Risk = excess lifetime cancer risk. Risk values in **bold** font exceed one-per-million.
COCs in **bold red** font are expected to play a key role in remedial action decision making.

Table 10 - Summary of Lead Hazard Assessment, Entire Site
The Landing - Old Mill Section
Mount Shasta, California

Reasonable Maximum Exposure				Maximum Detection		
EPC (mg/kg)	**EPC Source**	**90th Percentile Estimate of Blood Lead** (ug/dl)		**Maximum Detected Concentration** (mg/kg)	**90th Percentile Estimate of Blood Lead** (ug/dl)	
		Non-Pica Child	Adult Worker		Non-Pica Child	Adult Worker
17.4	UCL	0.2	0.0	70.3	0.9	0.1

Notes:
EPC = exposure point concentration
UCL = upper confidence limit on the arithmetic mean
ug/L = micrograms per decileter
Lead hazards are assessed using the Lead Risk Assessment Spreadsheet Version 8 (LeadSpread 8; DTSC, 2011) for child exposure, and the Modified USEPA Adult Lead Model (Modified ALM; DTSC, 2011) for adult exposure.

Table 11 - Summary of Risk/Hazard Calculations for Residential Groundwater Use, Wells OM-2 through OM-5
The Landing - Old Mill Section
Mount Shasta, California

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfCi** (mg/m3)	**RfDi** (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**IUR** (ug/m^3)$^{-1}$	**Kp** (cm/hr)	**Cw** (mg/L)	**Hazard**, water	**Risk**, water
Mercury	Max	1.6E-04	3.0E-05	7.5E-06	--	--	1.0E-03	4.20E-01	6.84E+03	
DRO	Max	4.0E-03	3.0E-03	7.5E-04	--	--	6.9E-02	1.70E-01	2.99E+01	
ORO	Max	2.0E+00	8.0E+00	2.3E+00	--	--	2.0E-01	1.70E-01	1.82E-02	
PCP	Non Detect	5.0E-03	--	--	--	5.1E-06	1.3E-01		0.00E+00	
TEQ	UCL	7.0E-10	4.0E-08	1.0E-08	4.0E-01	3.8E+01	8.1E-01	5.27E-08	1.78E+01	3.56E-04
TOTAL									**6.9E+03**	**3.6E-04**

Notes:
Cw [mg/kg] = water concentration
Kp = dermal permeability coefficient from water
Max = maximum detected concentration
Non Detect = constituent was not detected
RfDo = reference dose for chronic oral exposure
Sfo = standard oral slope factor
UCL = upper confidence limit

Parameter	Value, child	Value, adult	Units	
ATc, averaging time (carcinogen)	70	70	yr	DTSC 2015
ATnc, averaging time (non-carcinogen)	6	20	yr	DTSC 2015
EFs, exposure frequency (ingestion)	350	350	days/yr	DTSC 2015
EFd, exposure frequency (dermal)	350	350	days/yr	DTSC 2015
EFi, exposure frequency (inhalation)	350	350	days/yr	DTSC 2015
ED, exposure duration	6	20	yr	DTSC 2015
ET, exposure time, bathing	0.54	0.71	hr/day	DTSC 2015
BW, body weight	15	80	kg	DTSC 2015
SA, exposed skin surface area	20,900	6,378	cm^2	DTSC 2015

DTSC 2015 = Preliminary Endangerment Assessment Guidance Manual

Table 12 - Summary of Risk/Hazard Calculations for Residential Groundwater Use, Upgradient Well OM-1
The Landing - Old Mill Section
Mount Shasta, California

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfCi** (mg/m3)	**RfDi** (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**IUR** (ug/m^3)$^{-1}$	**Kp** (cm/hr)	**Cw** (mg/L)	**Hazard**, water	**Risk**, water
Mercury	Non Detect	1.6E-04	3.0E-05	7.5E-06	--	--	1.0E-03		0.00E+00	
DRO	Max	4.0E-03	3.0E-03	7.5E-04	--	--	6.9E-02	7.00E-02	1.23E+01	
ORO	Max	2.0E+00	8.0E+00	2.3E+00	--	--	2.0E-01	8.00E-02	8.55E-03	
PCP	Non Detect	5.0E-03	--	--	--	5.1E-06	1.3E-01		0.00E+00	
TEQ	Max	7.0E-10	4.0E-08	1.0E-08	4.0E-01	3.8E+01	8.1E-01	3.48E-07	1.17E+02	2.35E-03
TOTAL									**1.3E+02**	**2.4E-03**

Notes:
Cw [mg/kg] = water concentration
Kp = dermal permeability coefficient from water
Max = maximum detected concentration
Non Detect = constituent was not detected
RfDo = reference dose for chronic oral exposure
Sfo = standard oral slope factor
UCL = upper confidence limit

Parameter	Value, child	Value, adult	Units	
ATc, averaging time (carcinogen)	70	70	yr	DTSC 2015
ATnc, averaging time (non-carcinogen)	6	20	yr	DTSC 2015
EFs, exposure frequency (ingestion)	350	350	days/yr	DTSC 2015
EFd, exposure frequency (dermal)	350	350	days/yr	DTSC 2015
EFi, exposure frequency (inhalation)	350	350	days/yr	DTSC 2015
ED, exposure duration	6	20	yr	DTSC 2015
ET, exposure time, bathing	0.54	0.71	hr/day	DTSC 2015
BW, body weight	15	80	kg	DTSC 2015
SA, exposed skin surface area	20,900	6,378	cm^2	DTSC 2015

DTSC 2015 = Preliminary Endangerment Assessment Guidance Manual

Table 13a - Ecological Exposure Point Concentrations, Log Pond Area
The Landing - Old Mill Section
Mount Shasta,California

Constituent	Exposure Medium	Unit	Site Investigation Data						Exposure Point Concentrations[1]		
			Number of Analyses	Number of Detections	Analysis Method	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Distribution	EPC Source (UCL or Maximum)	EPC
Lead	soil	mg/kg	na - in background range		EPA 6010B	na	na	na	na	na	na
Mercury	soil	mg/kg	na - in background range		EPA 7471A	na	na	na	na	na	na
DRO	soil	mg/kg	12	12	EPA 8015	18	594	98.7	Nonparametric	UCL	297
ORO	soil	mg/kg	11	11	EPA 8015	35	160	96.6	Normal	UCL	116
PCP	soil	mg/kg	1	0	EPA 8151A	na	na	na	na	na	ND
TEQ	soil	mg/kg	2	2	EPA 1613B	4.11E-05	1.42E-04	9.16E-05	na	Maximum	1.42E-04

Table 13b - Chemicals of Potential Ecological Concern, Lot Pond Area
The Landing - Old Mill Section
Mount Shasta,California

Constituent	Unit	EPC[1]	Background Data[1]				Eco-SSLs[2]				Does the EPC exceed SSL(s)?	Does the EPC exceed background range?	Is the constituent considered a COPEC?
			Min	Max	BTV	BTV Source[3]	Plants	Soil Inverte-brates	Avian Wildlife	Mam-malian Wildlife			
Lead	mg/kg	na	1.2	28	28	Upper Range Bkg	120	1700	11	56	yes	no	no
Mercury	mg/kg	na	0.04	0.14	0.14	Upper Range Bkg	NL	NL	NL	NL	no	no	no
DRO	mg/kg	297	na	na	na	na	NL	NL	NL	NL	no	yes	no
ORO	mg/kg	116	na	na	na	na	NL	NL	NL	NL	no	yes	no
PCP	mg/kg	ND	na	na	na	na	5.0	31	2.1	2.8	no	no	no
TEQ	mg/kg	1.42E-04	na	na	na	na	NL	NL	0.022	0.0049	no	yes	no

Notes:
1 Statistical evaluation performed using ProUCL 5.0 (USEPA, 2013)
2 Ecological screening levels (Eco-SSLs) from USEPA, 2008 (www.epa.gov/ecotox/ecossl/)
3 See Section 4.1 for background evaluation.
BTV = background threshold value
EPC = exposure point concentration
mg/kg = milligrams per kilogram soil
na = not available
ND = not detected
ne = not evaluated
NL = not listed
UCL = upper confidence limit on the arithmetic mean

Table 14a - Ecological Exposure Point Concentrations, Dip Tank and Transfer Pit Area
The Landing - Old Mill Section
Mount Shasta,California

Constituent	Exposure Medium	Unit	Site Investigation Data						Exposure Point Concentrations[1]		
			Number of Analyses	Number of Detections	Analysis Method	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Distribution	EPC Source (UCL or Maximum)	EPC
Lead	soil	mg/kg	22	22	EPA 6010B	2	70	14.1	Nonparametric	UCL	28
Mercury	soil	mg/kg	22	12	EPA 7471A	0.04	8.0	1.1	Nonparametric	UCL	2.32
DRO	soil	mg/kg	32	27	EPA 8015	1.6	47000	1755	Nonparametric	UCL	10679
ORO	soil	mg/kg	31	27	EPA 8015	1.6	520	48.8	Nonparametric	UCL	122
PCP	soil	mg/kg	67	24	EPA 8151A	0.07	150	22.6	Nonparametric	UCL	24.4
TEQ	soil	mg/kg	1	1	EPA 1613B	7.80E-05	7.80E-05	na	na	Maximum	7.80E-05

Table 14b - Chemicals of Potential Ecological Concern, Dip Tank and Transfer Pit Area
The Landing - Old Mill Section
Mount Shasta,California

Constituent	Unit	EPC[1]	Background Data[1]				Eco-SSLs[2]				Does the EPC exceed SSL(s)?	Does the EPC exceed background range?	Is the constituent considered a COPEC?
			Min	Max	BTV	BTV Source[3]	Plants	Soil Inverte-brates	Avian Wildlife	Mam-malian Wildlife			
Lead	mg/kg	28	1.2	28	28	Upper Range Bkg	120	1700	11	56	yes	no	no
Mercury	mg/kg	2.32	0.04	0.14	0.14	Upper Range Bkg	NL	NL	NL	NL	no	yes	**yes**
DRO	mg/kg	10679	na	na	na	na	NL	NL	NL	NL	no	yes	no
ORO	mg/kg	122	na	na	na	na	NL	NL	NL	NL	no	yes	no
PCP	mg/kg	24.4	na	na	na	na	5.0	31	2.1	2.8	yes	yes	**yes**
TEQ	mg/kg	7.80E-05	na	na	na	na	NL	NL	0.022	0.0049	no	yes	no

Notes:
1 Statistical evaluation performed using ProUCL 5.0 (USEPA, 2013)
2 Ecological screening levels (Eco-SSLs) from USEPA, 2008 (www.epa.gov/ecotox/ecossl/)
3 See Section 4.1 for background evaluation.
BTV = background threshold value
EPC = exposure point concentration
mg/kg = milligrams per kilogram soil
na = not available
ND = not detected
ne = not evaluated
NL = not listed
UCL = upper confidence limit on the arithmetic mean

Table 15a - Ecological Exposure Point Concentrations, Boiler Room Area
The Landing - Old Mill Section
Mount Shasta,California

Constituent	Exposure Medium	Unit	Site Investigation Data						Exposure Point Concentrations[1]		
			Number of Analyses	Number of Detections	Analysis Method	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Distribution	EPC Source (UCL or Maximum)	EPC
Lead	soil	mg/kg	na - in background range		EPA 6010B	na	na	na	na	na	na
Mercury	soil	mg/kg	na - in background range		EPA 7471A	na	na	na	na	na	na
DRO	soil	mg/kg	46	46	EPA 8015	3.8	5000	373	Gamma	UCL	540
ORO	soil	mg/kg	45	45	EPA 8015	3.1	14000	1036	Gamma	UCL	1545
PCP	soil	mg/kg	1	0	EPA 8151A	ND	ND	ND	na	na	ND
TEQ	soil	mg/kg	3	3	EPA 1613B	5.14E-05	9.59E-05	6.91E-05	na	Maximum	9.59E-05

Table 15b - Chemicals of Potential Ecological Concern, Boiler Room Area
The Landing - Old Mill Section
Mount Shasta,California

Constituent	Unit	EPC[1]	Background Data[1]				Eco-SSLs[2]				Does the EPC exceed SSL(s)?	Does the EPC exceed background range?	Is the constituent considered a COPEC?
			Min	Max	BTV	BTV Source[3]	Plants	Soil Inverte-brates	Avian Wildlife	Mam-malian Wildlife			
Lead	mg/kg	na	1.2	28	28	Upper Range Bkg	120	1700	11	56	yes	no	no
Mercury	mg/kg	na	0.04	0.14	0.14	Upper Range Bkg	NL	NL	NL	NL	no	no	no
DRO	mg/kg	540	na	na	na	na	NL	NL	NL	NL	no	yes	no
ORO	mg/kg	1545	na	na	na	na	NL	NL	NL	NL	no	yes	no
PCP	mg/kg	ND	na	na	na	na	5.0	31	2.1	2.8	no	no	no
TEQ	mg/kg	9.59E-05	na	na	na	na	NL	NL	0.022	0.0049	no	yes	no

Notes:
1 Statistical evaluation performed using ProUCL 5.0 (USEPA, 2013)
2 Ecological screening levels (Eco-SSLs) from USEPA, 2008 (www.epa.gov/ecotox/ecossl/)
3 See Section 4.1 for background evaluation.
BTV = background threshold value
EPC = exposure point concentration
mg/kg = milligrams per kilogram soil
na = not available
ND = not detected
ne = not evaluated
NL = not listed
UCL = upper confidence limit on the arithmetic mean

Table 16a - Ecological Exposure Point Concentrations, Refuse Burner Area
The Landing - Old Mill Section
Mount Shasta,California

Constituent	Exposure Medium	Unit	Site Investigation Data						Exposure Point Concentrations[1]		
			Number of Analyses	Number of Detections	Analysis Method	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Distribution	EPC Source (UCL or Maximum)	EPC
Lead	soil	mg/kg	11	10	EPA 6010B	1.2	33.1	9.1	Aprx. Normal	UCL	13.6
Mercury	soil	mg/kg	na - in background range		EPA 7471A	na	na	na	na	na	na
DRO	soil	mg/kg	20	20	EPA 8015	8.1	1300	362	Aprx. Normal	UCL	497
ORO	soil	mg/kg	20	20	EPA 8015	13	4600	1167.0	Gamma	UCL	2226
PCP	soil	mg/kg	0	0	EPA 8151A	na	na	na	na	na	na
TEQ	soil	mg/kg	34	34	EPA 1613B	5.90E-07	2.01E-04	6.42E-05	Gamma	UCL	9.13E-05

Table 16b - Chemicals of Potential Ecological Concern, Refuse Burner Area
The Landing - Old Mill Section
Mount Shasta,California

Constituent	Unit	EPC[1]	Background Data[1]				Eco-SSLs[2]				Does the EPC exceed SSL(s)?	Does the EPC exceed background range?	Is the constituent considered a COPEC?
			Min	Max	BTV	BTV Source[3]	Plants	Soil Inverte-brates	Avian Wildlife	Mam-malian Wildlife			
Lead	mg/kg	13.6	1.2	28	28	Upper Range Bkg	120	1700	11	56	yes	no	no
Mercury	mg/kg	na	0.04	0.14	0.14	Upper Range Bkg	NL	NL	NL	NL	no	no	no
DRO	mg/kg	497	na	na	na	na	NL	NL	NL	NL	no	yes	no
ORO	mg/kg	2226	na	na	na	na	NL	NL	NL	NL	no	yes	no
PCP	mg/kg	na	na	na	na	na	5.0	31	2.1	2.8	no	no	no
TEQ	mg/kg	9.13E-05	na	na	na	na	NL	NL	0.022	0.0049	no	yes	no

Notes:
1 Statistical evaluation performed using ProUCL 5.0 (USEPA, 2013)
2 Ecological screening levels (Eco-SSLs) from USEPA, 2008 (www.epa.gov/ecotox/ecossl/)
3 See Section 4.1 for background evaluation.
BTV = background threshold value
EPC = exposure point concentration
mg/kg = milligrams per kilogram soil
na = not available
ND = not detected
ne = not evaluated
NL = not listed
UCL = upper confidence limit on the arithmetic mean

LEAD RISK ASSESSMENT SPREADSHEET 8
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Click here for ABBREVIATED INSTRUCTIONS FOR LEADSPREAD 8

INPUT	
MEDIUM	LEVEL
Lead in Soil/Dust (ug/g)	70.3
Respirable Dust (ug/m^3)	1.5

OUTPUT						
Percentile Estimate of Blood Pb (ug/dl						PRG-90
	50th	90th	95th	98th	99th	(ug/g)
BLOOD Pb, CHILD	0.5	0.9	1.1	1.3	1.5	77
BLOOD Pb, PICA CHILD	1.0	1.8	2.1	2.6	3.0	39

EXPOSURE PARAMETERS		
	units	children
Days per week	days/wk	7
Geometric Standard Deviation		1.6
Blood lead level of concern (ug/dl)		1
Skin area, residential	cm^2	2900
Soil adherence	ug/cm^2	200
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001
Soil ingestion	mg/day	100
Soil ingestion, pica	mg/day	200
Ingestion constant	(ug/dl)/(ug/day)	0.16
Bioavailability	unitless	0.44
Breathing rate	m^3/day	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.192

PATHWAYS						
CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.8E-5	0.00	1%		0.00	0%
Soil Ingestion	7.0E-3	0.49	99%	1.4E-2	0.99	100%
Inhalation	2.0E-6	0.00	0%		0.00	0%

Entire Site
Maximum Detection

Click here for REFERENCES

APPENDIX E

LEAD RISK ASSESSMENT SPREADSHEET 8

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Click here for ABBREVIATED INSTRUCTIONS FOR LEADSPREAD 8

INPUT	
MEDIUM	LEVEL
Lead in Soil/Dust (ug/g)	17.4
Respirable Dust (ug/m^3)	1.5

OUTPUT						
Percentile Estimate of Blood Pb (ug/dl						PRG-90
	50th	90th	95th	98th	99th	(ug/g)
BLOOD Pb, CHILD	0.1	0.2	0.3	0.3	0.4	77
BLOOD Pb, PICA CHILD	0.2	0.4	0.5	0.6	0.7	39

EXPOSURE PARAMETERS		
	units	children
Days per week	days/wk	7
Geometric Standard Deviation		1.6
Blood lead level of concern (ug/dl)		1
Skin area, residential	cm^2	2900
Soil adherence	ug/cm^2	200
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001
Soil ingestion	mg/day	100
Soil ingestion, pica	mg/day	200
Ingestion constant	(ug/dl)/(ug/day)	0.16
Bioavailability	unitless	0.44
Breathing rate	m^3/day	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.192

PATHWAYS						
CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.8E-5	0.00	1%		0.00	0%
Soil Ingestion	7.0E-3	0.12	99%	1.4E-2	0.24	100%
Inhalation	2.0E-6	0.00	0%		0.00	0%

Entire Site

Resonable maximum exposure (95% UCL)

Click here for REFERENCES

MODIFIED VERSION OF USEPA ADULT LEAD MODEL

CALCULATIONS OF BLOOD LEAD CONCENTRATIONS (PbBs) AND PRELMIINARY REMEDIATION GOAL (PRG)

EDIT RED CELL

Variable	Description of Variable	Units	
PbS	Soil lead concentration	ug/g or ppm	70.3
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	ug/dL	0.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	250
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**ug/dL**	**0.1**
$PbB_{fetal, 0.90}$	90th percentile PbB among fetuses of adult workers	ug/dL	0.2
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	**1.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.0%**

PRG90 **318** **Entire Site**

Maximum detected concentration

Click here for REFERENCES

MODIFIED VERSION OF USEPA ADULT LEAD MODEL

CALCULATIONS OF BLOOD LEAD CONCENTRATIONS (PbBs) AND PRELMIINARY REMEDIATION GOAL (PRG)

EDIT RED CELL

Variable	Description of Variable	Units	
PbS	Soil lead concentration	ug/g or ppm	17.4
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	ug/dL	0.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	250
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**ug/dL**	**0.0**
$PbB_{fetal, 0.90}$	90th percentile PbB among fetuses of adult workers	ug/dL	0.1
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	**1.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.0%**

PRG90 **318** Entire Site
Reasonable maximum exposure (95% UCL)

Click here for REFERENCES

APPENDIX F

4.7 BIOLOGICAL RESOURCES

This section evaluates the potential biological resource impacts of development of the Roseburg Commerce Park. While the site has been heavily disturbed by human activities, some forested and wetland areas still remain. The forested areas may provide habitat for species of special concern. Wetlands, in addition to providing potential habitat, fall under federal regulation. This section is based on a biological resource study of the area conducted by North State Resources.

4.7.1 SETTING

GENERAL

Roseburg Commerce Park (RCP) is located at the southern end of the City of Mt. Shasta and is bounded by a combination of residential and commercial development, open forested areas, and portions of the I-5/Union Pacific Railroad corridor. The topography of the site consists of mainly flat to gentle slopes within the western portion of the property and moderately steep slopes within the eastern portion. Several intermittent creeks and channels run through the property draining to the west, and a perennial creek traverses the northern end of the site.

The majority of the western portion of the site consists of old landings, roads, building pads and other remnant features from the old mill. An empty mill pond, perennial stream, and several springs/seeps are also located at the northern end of the western portion of the site. As a result of past activities, the majority of this half of the RCP site is very disturbed. Vegetation is very "weedy" and consists of a combination of exotic, invasive, and native plant species considered early seral or colonizing species. Large portions of the western portion of the site is barren of any vegetation.

VEGETATION

Vegetation habitats within the project area include Sierra mixed conifer, montane chaparral, and a fresh emergent wetland/montane riparian complex (**Figure 4.7-1**). Also found on the project site are barren and urban areas.

Disturbed areas left from the former mill operation occupy the majority of the western portion of the project site (**Figure 4.7-2**). Vegetation within these areas is variable and consists of a combination of trees, shrubs, and grasses and forbs. Dominant tree species include ponderosa pine (*Pinus ponderosa*), incense cedar (*Calocedrus decurrens*), Douglas fir (*Pseudotsuga menziesii*) and black oak (*Quercus kelloggii*). Shrubs are found growing in dense to sparse clumps and include green leaf manzanita (*Arctostaphylos patula*), mountain

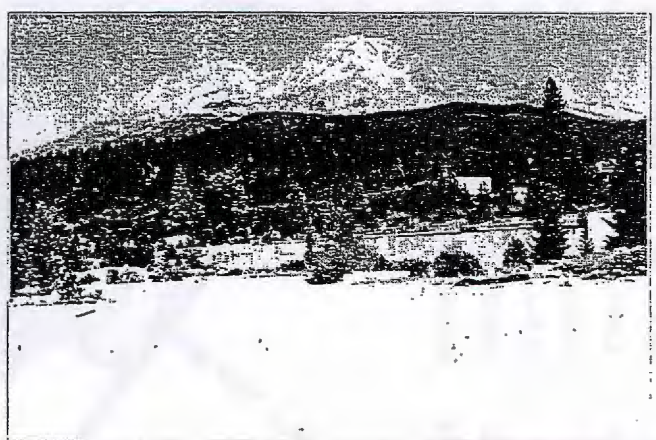
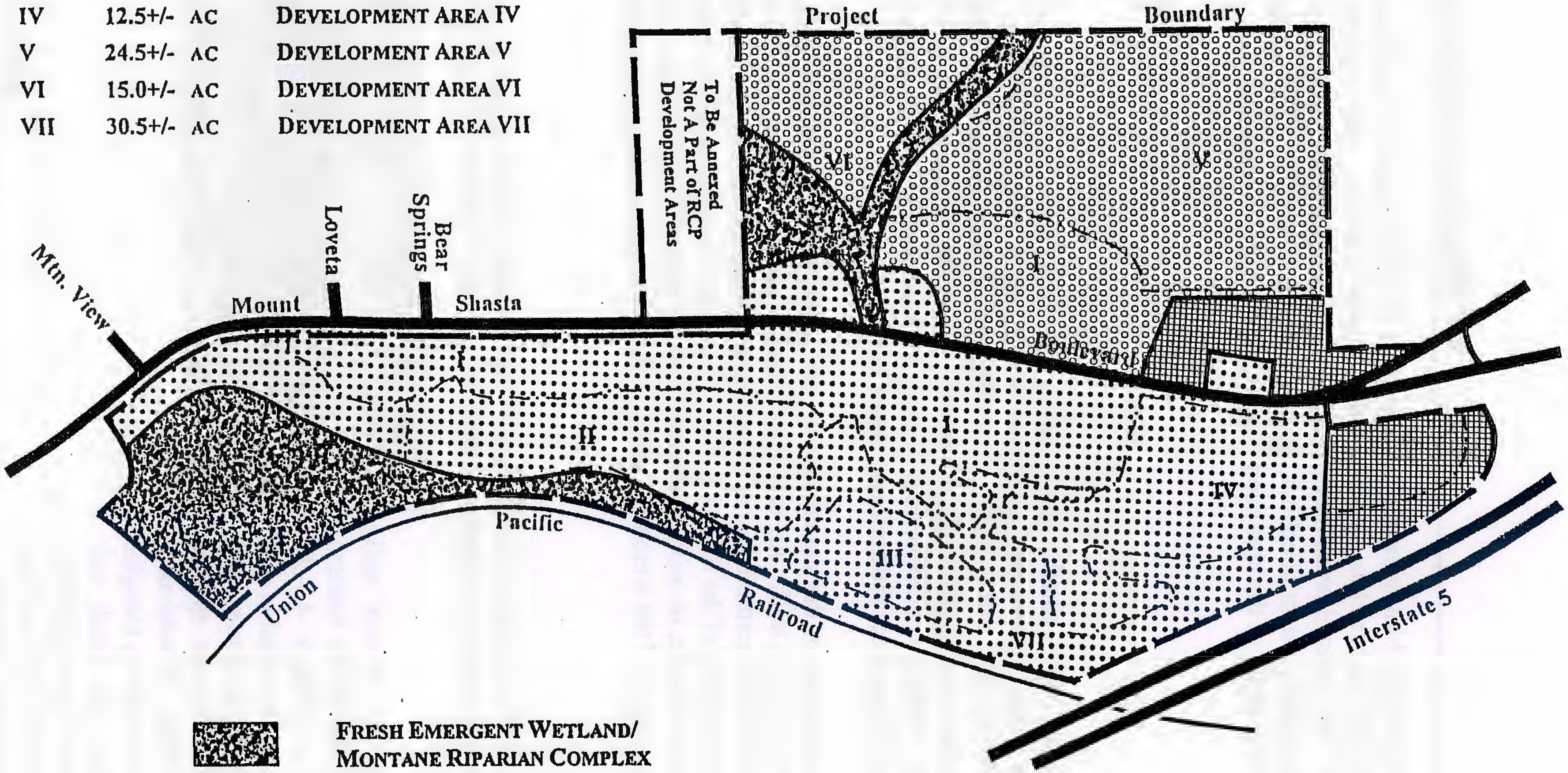


Figure 4.7-2
Disturbed Areas in Western Portion of Site

I	33.0+/-	AC	DEVELOPMENT AREA I
II	8.5+/-	AC	DEVELOPMENT AREA II
III	3.5+/-	AC	DEVELOPMENT AREA III
IV	12.5+/-	AC	DEVELOPMENT AREA IV
V	24.5+/-	AC	DEVELOPMENT AREA V
VI	15.0+/-	AC	DEVELOPMENT AREA VI
VII	30.5+/-	AC	DEVELOPMENT AREA VII



FRESH EMERGENT WETLAND/ MONTANE RIPARIAN COMPLEX

MONTANE CHAPPARRAL

SIERRA MIXED CONIFER

BARREN AND/OR DISTURBED AREAS

SCALE IN FEET

Figure 4.7-1
Habitat Types at RCP Site

whitethorn (*Ceanothus cordulatus*), tobacco brush (*C. velutinus*), rabbitbrush (*Chrysothamnus nauseosus*), bitter cherry (*Prunus emarginata*), scotch broom (*Cytisus scoparius*), and chinquapin (*Castanopsis sempervirens*). Other herbaceous growth occurs throughout the disturbed areas and includes everlasting peavine (*Lathyrus latifolius*), common mullein (*Verbascum* sp.), willow-herb (*Epilobium* sp.), bull thistle (*Cirsium* sp.) plantain (*Plantago* sp.), and various other grasses and forbs.

A complex of fresh emergent wetland/montane riparian vegetation occurs at the northern end of the site and is associated with the former mill pond, a perennial stream, and several springs and seeps (See **Figure 4.7-3**). Vegetation is moderate to dense and consists of a network of emergent wetland and riparian species. Dominant species within this area include sedges (*Carex* spp.), rushes (*Juncus* spp.), broad-leaf cattail (*Typha latifolia*), bracken fern (*Pteridium aquilinum*), doc (*Rumex* sp.), and horsetail fern (*Equisetum arvense*). Riparian vegetation is moderate to dense and includes an overstory of white alder (*Alnus rhombifolia*), willow (*Salix* spp.), and black cottonwood (*Populus trichocarpa*). Shrubs include Himalayan blackberry (*Rubus discolor*), spirea (*Spirea douglasii*), wood rose (*Rosa woodsi*), snowberry (*Symphoricarpos* sp.), and thimbleberry (*Rubus parviflorus*). The southern portion of the western half is occupied by a dense stand of montane chaparral dominated by green leaf manzanita, mountain whitethorn, bitter cherry, and chinquapin, with occasional black oaks.

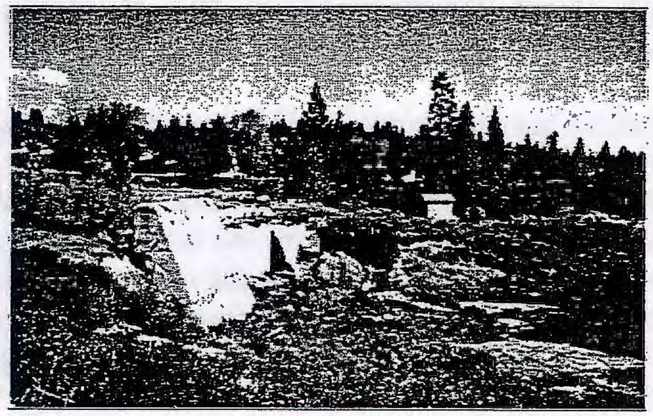


Figure 4.7-3
Former Mill Pond

A stand of Sierra mixed conifer forest occupies much of the eastern portion of the site. This forest stand consists mainly of pole-sized trees with small patches of more mature trees. The understory consists of a dense shrub layer in the younger tree stands, and is generally open in the patches of more mature forest. Dominant species include ponderosa pine, incense cedar, Douglas fir, white fir (*Abies concolor*), and sugar pine (*Pinus lambertiana*). Hardwood species include black oak and dogwood (*Cornus nuttallii*). The dominant shrubs include green leaf manzanita, bitter cherry, and whitethorn. Snowberry, bracken fern and thimbleberry occupy the forest floor in areas without dense shrub growth. In the southwestern portion of the eastern half of the site, in the vicinity of the vacant gas station and along the disturbed areas adjacent to Mt. Shasta Boulevard, vegetation is comprised primarily of montane chaparral.

SPECIAL STATUS SPECIES

Five special status plant species were found to occur in similar habitats within the general vicinity of the proposed project area. These species include Shasta chaenactis (*Chaenactis suffrutescens*), pallid bird's beak (*Cordylanthus tenuis* ssp. *pallencens*), Oregon fireweed (*Epilobium oreganum*), Aleppo avens (*Geum aleppicum*), and northern adder's-tongue (*Ophioglossum pusillum*). There are no records within the proposed project area for these species. Shasta chaenactis occurs in coniferous forests on sandy or serpentine soils. Oregon fireweed and Aleppo avens occur in meadow or bog/fen habitats. Although historical records exist of its occurrence in the Mt. Shasta area, northern adder's-tongue is considered extirpated in California. Pallid bird's-beak is known from the lower montane conifer forests in the vicinity of Black Butte and areas southwest. Potential habitat may occur within the proposed project area for pallid-bird's beak, particularly in forested areas in the eastern portion of the site. Potential habitat for the four other special status species mentioned does not occur within the project area.

Potential habitat for two amphibian and three avian special status wildlife species was found on the site. The species are the northern red-legged frog (*R. aurora aurora*), Cascades frog (*R. cascadae*), northern goshawk (*Accipiter gentilis*), Cooper's hawk (*A. cooperii*), and sharp-shinned hawk (*A. striatus*). Potential habitat for the northern red-legged and Cascades frog is located within the wetland areas found mainly at the northern portion of the project area. Both frog species are currently considered "species of special concern" by the California Department of Fish and Game (CDFG) and "species of concern" (formerly category 2 species) by the United States Fish and Wildlife Service (USFWS). The northern goshawk, and Cooper's and sharp-shinned hawks are all forest raptors. Potential habitat for these species occurs in the forested habitat at the eastern portion of the site. Generally, more extensive forest stands are preferred by these species; however, suitable stands are present within the study area. These raptor species are all currently considered species of special concern by the CDFG. The northern goshawk is also considered a species of concern by the USFWS. Additionally, these raptor species are also afforded special protection under CDFG Code Section 3503.5, which states "It is unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird".

REGULATORY FRAMEWORK

Federal Endangered Species Act

Under the Federal Endangered Species Act (FESA), the Secretary of the Interior and the Secretary of Commerce jointly have the authority to list a species as threatened or endangered (16 USC 1533[c]). Pursuant to the requirements of FESA, an agency reviewing a proposed project within its jurisdiction must determine whether any federally listed, threatened or protected species may be present in the project area and determine whether the proposed project will have a potentially significant impact on such species. In addition, the agency is required to determine whether the project is likely to jeopardize the continued existence of any species proposed to be listed under FESA or result in the destruction or adverse modification of critical habitat proposed to be designated for such species (16 USC 1536[3], [4]).

The USFWS also publishes a list of candidate species. Species on this list receive "special attention" from federal agencies during environmental review, although they are not protected otherwise under the FESA. The candidate species are taxa for which the United States Fish and Wildlife Service has sufficient biological information to support a proposal to list the species as endangered or threatened.

California Endangered Species Act

Sensitive, endangered, and threatened plants and animals of California are listed pursuant to Section 1904 (Native Plant Protection Act of 1977) and Section 2074.2 and 2077.5 (California Endangered Species Act of 1984) of the California Department of Fish and Game Code. Under the California Endangered Species Act (CESA), the California Department of Fish and Game (CDFG) has the responsibility for maintaining a list of threatened and endangered species. CDFG maintains a list of "candidate species" which are species that are being reviewed for addition to either the endangered or threatened species lists. The CDFG also maintains lists of "species of special concern" which serve as "watch lists." Pursuant to the requirements of CESA, an agency reviewing a proposed project within its jurisdiction must determine whether any State listed endangered or threatened species may be present in the project area and determine whether the proposed project will have a potentially significant impact on such species.

According to California Fish and Game Code Section 86, it is prohibited to "take" species listed as threatened or endangered under the CESA (CF&GC 2080) or as fully protected (CF&GC 3511, 4700, and 5050), which is defined by the following:

- direct mortality;
- permanent or temporary loss of occupied habitat that would result in mortality to or disruption of reproduction of at least one individual of the species; or
- avoidance by individuals of biologically important habitat for substantial periods that would result in mortality or disruption of reproduction to at least one individual of the species.

In addition, the CDFG encourages informal consultation on any proposed project which may impact a candidate species.

Special Status Species

In addition to formal listing under FESA and CESA, species may also receive additional consideration during the CEQA process. Species that may be considered for review are included on a list of "Species of Special Concern," developed by the California Department of Fish and Game. CDFG tracks species in California whose numbers, reproductive success, or habitat may be threatened.

Raptors (birds of prey), migratory birds, and other avian species are protected by a number of state and federal laws. The Federal Migratory Bird Treaty Act (MBTA) prohibits the killing, possessing, or trading of migratory birds except in accordance with regulations prescribed by the Secretary of Interior.

The California Native Plant Society (CNPS) maintains a list of plant species native to California that have low numbers, limited distribution, or are otherwise threatened with extinction. This information is published in the *Inventory of Rare and Endangered Vascular Plants of California.* Potential impacts to populations of CNPS listed plants receive consideration under CEQA review.

Waters of the United States, including Wetlands

The U.S. Army Corps of Engineers (Corps) and the U.S. Environmental Protection Agency (EPA) regulate the discharge of dredge and fill material into wetlands or other "Waters of the United States" under Section 404 of the Clean Water Act (CWA).

Riparian habitat, swale, seasonal wetlands, open water, and ephemeral drainages in a project area may fall under the jurisdiction of the Corps. Urban development that discharges fill into these wetlands is subject to provisions of CWA and may require a permit from the Corps.

The CDFG and the USFWS also consider wetlands sensitive habitats. Wetlands of all types have been reduced in extent and continue to decline in California (Fryer, et al. 1989). CDFG and USFWS consider the degradation of wetland habitat a significant impact requiring mitigation. The Corps and EPA consider fill activity in jurisdictional wetlands a significant impact requiring mitigation.

The Corps has developed a *Wetlands Delineation Manual* to provide users with guidelines and methods to determine whether an area is a wetland under federal jurisdiction pursuant to Section 404 of the Clean Water Act. The *Wetland Delineation Manual* prescribes three diagnostic environmental criteria as characteristic of wetland: 1) hydrophytic vegetation; 2) hydric soils; and 3) wetland hydrology. The Manual also states that, except in certain situations, evidence of a minimum of one positive wetland indicator for each parameter must be found in order to make a positive wetland determination.

<u>Hydrophitic Vegetation:</u> An area has hydrophytic vegetation when more than 50 percent of all considered species are wetland plants rather than facultative plants. Facultative plants are, "Plants with a similar likelihood (estimated probability 33% to 67%) of occurring in both wetlands and non wetlands."

<u>Hydric Soil:</u> A hydric soil is a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation. Not all areas having hydric soils will qualify as wetlands. Only when a

hydric soil supports hydrophytic vegetation and the area has indications of wetland hydrology may the soil be referred to as a "wetland" soil.

Wetland Hydrology: Recent research indicates that duration of inundation and/or soil saturation during the growing season is more influential on the plant community than the frequency of inundation/saturation during the growing season. "Areas that are inundated or saturated for a duration of less than 5% of the growing season are not wetlands; many areas inundated or saturated for a duration of 5% to 12.5% during the growing season are not wetlands."

Potential jurisdictional waters of the U.S. occur within the proposed project area in the forms of riparian and emergent wetlands, perennial and intermittent creeks, and constructed channels. The wetland areas are located mainly at the north end of the site and consist of the old mill pond and surrounding areas, and also include areas to the southwest of the pond. Another potential jurisdictional wetland area is located at the base of the hill in the forested eastern portion of the site, where an intermittent creek appears to feed a seep area at the base of the slope (See Figure 4.7-1). The remaining location of potential waters is a small drainage channel at the south end of the site.

California Wetland Definition

Unlike the federal government the California Department of Fish and Game (CDFG) has adopted the Cowardin definition of wetlands.

> *Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface of the land or is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes (at least 50% of the aerial vegetative cover); (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year* (Cowardin et al 1979).

Under normal circumstances, the federal definition of wetlands requires all three wetland identification parameters to be met, whereas the California definition requires the presence of at least one of these parameters. For this reason, identification of wetlands by CDFG consists of areas which are periodically inundated or saturated, or in which at least seasonal dominance by hydrophytes may be documented, or in which hydric soils are present. The CDFG does not normally have direct jurisdiction over wetlands unless they are subject to jurisdiction under Streambed Alteration Agreements or they support State listed endangered species.

Regulation of Activities in Wetlands

The State's authority in regulating activities in wetlands and waters at the site resides primarily with the CDFG and the State Water Resources Control Board (SWRCB). The CDFG provides comment on Corps permit actions under the Fish and Wildlife Coordination Act. CDFG is also authorized under the Fish and Game Code Sections 1600-1607 to develop mitigation measures and enter into a Stream Alteration Agreement with applicants that propose a project that would obstruct the flow or alter the bed, channel, or bank of a river or stream in which there is a fish or wildlife resource, including intermittent and ephemeral streams. The SWRCB, acting through the Regional Water Quality Control Board (RWQCB), must certify that a Corps permit action meets State water quality objectives (Section 40 1, Clean Water Act).

Riparian Habitat

Riparian habitats have been greatly reduced from their original extent in California (Katibah 1984) and are considered sensitive habitats by the CDFG and the U.S. Fish and Wildlife Service (USFWS). CDFG and USFWS consider removal of riparian vegetation a significant impact that requires mitigation. In addition, riparian vegetation may meet Corps criteria as jurisdictional wetlands.

California Forest Practice Rules

As previously described, a mixed conifer forest stand is found within the eastern portion of the project area. Planned development in this area may be subject to the California Forest Practice Rules governed by the State Board of Forestry and administered by the California Department of Forestry and Fire Protection. Development that requires removal of trees would require a Timber Harvest Plan prepared by a Registered Professional Forester that would describe the proposed action, impacts of timber harvest, and any proposed mitigation measures.

GENERAL PLAN GOALS AND POLICIES

The following General Plan Goals and Policies are applicable to the proposed project:

Goal OC-1
Conserve lands that support important fisheries or wildlife and botanical habitat.

Policy OC-1.1
Limit development on lands that provide important fisheries or wildlife and botantical habitat to agriculture and rural density residential.

Policy OC-1.2
Encourage public-private programs to conserve wildlife and botantical habitat.

Policy OC-1.3
Require flexibility in development standards to balance both private property rights with the need to conserve wildlife and botanical habitat.

Goal OC-2
Protect riparian habitat along streams in the Planning Area.

Policy OC-2.1
Require erosion control protection as a part of grading and development plans.

Goal OC-3
Conserve wetlands areas.

Policy OC-3.1
Work to satisfy state and national wetlands policy.

Policy OC-3.2
Allow property owners of lands with wetlands to design projects to avoid or mitigate wetlands impacts.

4.7.2 IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

Biological resource impacts may be considered significant if implementation of the project will result in one or more of the following:

1) Reduction in number or restriction in the range of a rare, threatened, or endangered plant or animal; or substantially affect a rare, threatened, or endangered species of animal or plant or the habitat of the species; or violate the California Fish and Game Code;

2) Substantial interference with the movement of any resident or migratory fish or wildlife species;

3) Substantial reduction in the habitat of a fish or wildlife species;

4) Threatened elimination of a plant or animal community; or

5) Loss of jurisdictional waters of the U.S., including wetlands.

METHODOLOGY

Information for this section came from a biological resource study conducted by North State Resources. The study was prepared using the following methods:

- The most current lists of special status plant and wildlife species were reviewed to confirm the present status of these species (CDFG 1994, 1996, 1997,1998; Federal Register 1996; USFWS 1995, 1996a, 1996b, 1996c).

- Searches and queries of three databases were conducted to assist in determination of potential special status floral or faunal species presence. These three databases included California Department of Fish and Game Natural Diversity Database (CNDDB), California Native Plant Society Electronic Inventory (Skinner and Pavlik 1994), and the CDFG Wildlife Habitat Relationships System (5.3 version) (Airola 1988).

- The project area was traversed on foot to characterize vegetation habitats and document features that may be considered potential habitat for special status floral and faunal species. Vegetation was classified using the classification developed for use with the WHR system (Mayer and Laudenslayer 1988). Wildlife species were identified by direct observation, by identification of vocalizations, or by observations of various animal sign. Also evaluated during the survey were features or areas for use in the Opportunities and Constraints Analysis, and a review to determine the presence and extent of potential federal jurisdictional waters, including wetlands.

PROJECT IMPACTS

Impact
4.7.1 **Development Area I-subareas H, I, and J, and Development Area V and VI are considered areas with potential habitat for special-status species. [PSM]**

Development Areas V and VI and the eastern portion of Development Area I, subareas H, I, and J (See **Figure 3-4**) contain forest stands that are potential habitat for raptors (birds of prey), including the northern goshawk, Cooper's hawk, and the sharp-shinned hawk. All of these species are species of special concern; raptor nesting sites are protected under Fish and Game Code, Section 3503.5.

In addition, this portion of the project site may be potential habitat for pallid bird's beak, a special status plant species. Pallid bird's-beak, is known to occur in the lower montane conifer forests.

This impact is considered **potentially significant and subject to mitigation.**

Mitigation

MM 4.7.1a **Prior to the issuance of a grading permit for activities in Development Area I subareas H, I, J and Development Areas V and VI, a detailed wildlife and plant survey shall be conducted to determine the presence or absence of special status species in areas with potential habitat. Surveys should be conducted using the**

methods prescribed by the CDFG (1984). Results of the surveys shall be submitted to CDFG, USFWS, and the City prior to the issuance of grading permits for these areas. If no sensitive species are located on-site, no further mitigation is necessary. If listed species are located on the property, the applicant and City shall enter into informal consultation with CDFG and USFWS and begin preparation of a Biological Assessment or Habitat Conservation Plan, as applicable.

The precise mitigation/compensation for direct and indirect impacts to sensitive species will depend on agency consultation and agreements. The project applicant shall implement all measures identified by the CDFG and USFWS to protected and mitigate impacts to listed and other special status species.

Significance After Mitigation

Project impacts would be less than significant following the prescribed mitigation measure if no special status species are found during special status species surveys. If listed species are found, the implementation of a Habitat Conservation Plan or appropriate document could reduce this impact to a less than significant level. Additional mitigation requirements may be necessary and should be developed with the CDFG and USFWS to bring impacts to **less than significant** levels.

Impact
4.7.2 **The RCP site may contain potential jurisdictional waters of the United States, including wetlands.** [PSM]

Development Area VI contains potential jurisdictional waters of the U.S., including wetlands in the south and southwestern boundary of the Development Area that are associated with a drainage and seep area. Also, Development Area VII has a large montane riparian/emergent wetland complex associated with the former mill pond, a perennial stream, and various seeps in the northern and southwestern portion of the Development Area boundary. These areas may contain jurisdictional waters of the U.S., including wetlands.

The DDP has designed the Development Areas to accommodate potential wetland areas. DA VI has been designated primarily for open space and recreational uses with minimal improvements. DA VII has been designated as public land. Permitted uses which could be developed in this Development Area include: a park and associated recreational uses, a wetland restoration and enhancement area, and a natural community creation and enhancement area. However, any proposed activities that may impact jurisdictional waters would require a detailed delineation to determine the extent and specific location(s) of the jurisdictional waters. Following an analysis of impacts from any proposed activity within areas containing jurisdictional waters, permits may be obtained from the Corps. The permits would be issued under the regulatory authority of the Corps and would likely have terms and conditions attached, which would include, but are not limited to, a mitigation and monitoring plan for all loss of waters of the U.S.

Mitigation

MM 4.7.2a **Prior to the issuance of a grading permit in areas identified as potential wetland locations, the project proponent shall conduct a detailed wetland delineation to determine the extent and specific location(s) of the jurisdictional waters and obtain written verification of the delineation from the Corps. The impact analysis shall include all project alternatives, including avoidance. If necessary, prepare a mitigation and monitoring plan for all loss of waters of the U.S. The mitigation plan should include measures for wetland habitat enhancement and creation, as appropriate for the level of impact, and be developed in coordination with the Corps.**

MM 4.7.2b **Prior to any issuance of a grading permit, the project proponent shall obtain and comply with the terms and conditions of the following permits which may be applicable to the project: a federal Section 404 Clean Water Act permit; a state Section 1601 et seq. Streambed Alteration Agreement from the Department of Fish and Game; and a Water Quality Certification (or waiver of certification) from the State Water Resources Quality Control Board.**

MM 4.7.2c **Development plans for enhancement of existing wetland habitats that impact waters of the U.S. would require the same delineation, impact analysis, and mitigation and monitoring plan (if necessary) required for direct development impacts.**

Significance After Mitigation

Impacts to jurisdictional waters of the U.S., including wetlands, would be reduced to **less than significant** levels by avoidance, or by implementation of a mitigation and monitoring plan that may include wetland enhancement and/or creation.

CUMULATIVE IMPACTS

Impact

4.7.3 **Cumulative development would contribute to the loss of natural undisturbed open space, increase human intrusion and activity levels in proximity to habitat areas, and would remove potential habitat for federally and state listed and other special-status species. [LS]**

It is likely that development of the proposed and/or anticipated projects throughout the City would result in significant impacts on vegetation and/or wildlife because they would eliminate habitat for both common and special-status species. However, the proposed project and Draft Development Plan's proposed layout for the Development Areas reduces the site-specific impacts to biological resources to less than significant levels. This would be achieved by retaining potentially sensitive areas, such as DA VI, as primarily open space and designate DA VII to be developed as parkland or recreational use, wetland enhancement areas, or natural community enhancement areas.

Because environmental review would be required as part of all future projects' in the City, mitigation would be developed for site-specific impacts at that time. Therefore, cumulative impacts on biological resources are considered **less than significant.**

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