FINAL
PRE-2005 HUMAN HEALTH RISK ASSESSMENT REVIEW

SPRING VALLEY FORMERLY USED DEFENSE SITE
WASHINGTON, D.C.

Contract No.: W912DR-06-D-0002, Delivery Order 0011
DERP FUDS MMRP/CWM Project No. C03DC091801 and
DERP FUDS HTRW Project No. C03DC091802

US Army Corps of Engineers®
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Prepared for:

US ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT

Prepared by:

ERT, Inc.
Laurel, MD 20707

August 19, 2013

August 19, 2013

Attn: Lan Reeser
CENAB-EN-HN
10 S. Howard Street
Baltimore, MD 21201-1715

Dear Mr. Reeser,

ERT, Inc., is pleased to present the Final Pre-2005 Human Health Risk Assessment Review for the Spring Valley FUDS Integrated Site-Wide Remedial Investigation/Feasibility Study, Washington, DC.

This final document incorporates changes based on USEPA written comments received June 20, 2013, on the Revised Draft-Final document, and USACE backcheck comments dated July 25, 26, and 31, 2013, on the Final document. CD and hard copy distribution has been made to the list below.

Please do not hesitate to call me at 301-323-1442 if you need anything more.

Sincerely,

ELECTRONIC SIGNATURE

Thomas J. Bachovchin
Project Manager

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FINAL

PRE-2005 HUMAN HEALTH RISK ASSESSMENT REVIEW

SPRING VALLEY FORMERLY USED DEFENSE SITE (SVFUDS) WASHINGTON, DC

Contract No.: W912DR-06-D-0002, Delivery Order 0011 and W912QR-08-D-0012, DA03
DERP FUDS MMRP/CWM Project No. C03DC091801 and DERP FUDS HTRW Project No. C03DC091802

Prepared for:

Baltimore District

US Army Corps of Engineers®
BUILDING STRONG®

Prepared by:

ERT, Inc.
14401 Sweitzer Lane, Suite 300
Laurel, Maryland 20707
(301) 361-0620

August 19, 2013

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Prepared by:

Amy Rosenstein

Amy B. Rosenstein Date: 8/19/13
SENIOR RISK ASSESSOR

Prepared by:

ELECTRONIC SIGNATURE

Thomas J. Bachovchin, PG Date: 8/19/13
PROJECT MANAGER

COMPLETION OF SENIOR TECHNICAL REVIEW

This document has been produced within the framework of the ERT, Inc. (ERT) quality management system. As such, a senior technical review has been conducted. This included review of all elements addressed within the document, proposed or utilized technologies and alternatives and their applications with respect to project objectives and framework of U.S. Army Corps of Engineers regulatory constraints under the current project, within which this work has been completed.

Jennifer Harlan Date: 5/15/13
SENIOR TECHNICAL REVIEWER/PROGRAM MANAGER

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TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

1.0 INTRODUCTION 1

1.1 Purpose 1

1.2 SVFUDS Background 1

1.3 Overview of Approach 1

1.4 Organization of the Document 2

1.5 Summary of Pre-2005 HHRAs 2

1.5.1 Remedial Investigation Report for the Operation Safe Removal - Formerly Used Defense Site, Washington, D.C. (OSR FUDS RI) (USACE, 1995) 3

1.5.2 Final Remedial Investigation Report for Spaulding and Captain Rankin Areas, Volumes I and II, Parsons (HHRA for Spaulding and Captain Rankin Areas) (USACE, 1996) 3

1.5.3 USEPA Region III Draft Risk Assessment Report, Army Munitions Site, Spring Valley, October 1999 (USEPA, 1999) 4

1.5.4 USEPA Region III American University Property, Spring Valley (OU3) HHRA (August 2000) (USEPA, 2000) 5

1.5.5 Revised Final Engineering Evaluation/Cost Analysis (EE/CA) - 4801, 4825, and 4835 Glenbrook Road, Spring Valley Operable Unit 3, Washington, DC (4801 HHRA) (USACE, 2000) 5

1.5.6 Engineering Evaluation/Cost Analysis for Arsenic in Soil (AUES List Sampling), Spring Valley Operable Units 4 and 5, Washington, DC (USACE, 2003) 6

2.0 SELECTION OF CHEMICALS OF POTENTIAL CONCERN 7

2.1 Overview of Screening Criteria – HHRA Review - Initial Screen 7

2.1.1 Risk-Based Screening Levels 7

2.1.2 Background Concentrations 8

2.2 Summary of COPCs Selected in Previous HHRAs and New Provisional COPCs Selected in the Initial Screen 8

2.2.1 USACE OSR FUDS HHRA (1995) 8

2.2.2 USACE HHRA Spaulding and Captain Rankin Areas (1996) 8

2.2.3 USEPA HHRA (1999) 9

2.2.4 USEPA American University Property HHRA (2000) 9

2.2.5 USACE EE/CA for 4801 Glenbrook Road HHRA (USACE, 2000) 10

2.2.6 USACE AUES List Sampling (2003) 10

2.3 Additional Screening Incorporating Other Factors 11

2.3.1 Additional Screening Steps 11

2.3.2 Organization of Tables 14

2.4 Conclusions Regarding Current Screening of COPCs 14

2.4.1 LTC Bancroft 15

2.4.2 POI 16 15
2.4.3 POI 19 16
2.4.4 POI 20 16
2.4.5 POI 39 (10/11) 16
2.4.6 POI 38 17
2.4.7 4801 Glenbrook Road 17
2.4.8 3819 48th Street 17
3.0 EXPOSURE ASSESSMENT 22
3.1 Overview of Exposure Assessment Changes 22
3.2 Exposure Assessment - USACE OSR FUDS HHRA (1995) 23
3.3 Exposure Assessment - USACE HHRA Spaulding and Captain Rankin Areas (1996) 24
3.4 Exposure Assessment - USEPA HHRA (1999) 24
3.5 Exposure Assessment - USEPA American University HHRA (2000) 24
3.6 Exposure Assessment - USACE EE/CA for 4801 Glenbrook Road HHRA (2000) 24
3.7 Conclusions Regarding Exposure Assessment 24
4.0 TOXICITY ASSESSMENT 26
4.1 Review of Previous Toxicity Assessments 26
4.2 Review of the Protectiveness of the Arsenic in Soil Cleanup Goal for the SVFUDS 26
5.0 UNCERTAINTY DISCUSSION 28
5.1 Overview of Previous HHRA Uncertainties 28
5.2 HHRA Review Uncertainties 30
6.0 CONCLUSIONS 32
7.0 RECOMMENDATIONS 34
7.1 Exposure Units 34
7.1.1 Southern AU 34
7.1.2 Spaulding-Rankin Area 35
7.1.3 AOI 9 35
7.1.4 AOI 13 35
7.1.5 Western Portion of POI 53 36
7.2 Recent Sampling 36
7.3 Recommended Approach for Further Risk Evaluation 37
8.0 REFERENCES 39

LIST OF TABLES

Table ES.1. Summary of HHRA Review ES-3
Table ES.2. Proposed EUs for Additional Risk Evaluation ES-6
Table 1.1. POIs Included in HHRA 3
Table 2.1. Summary of HHRA Review 19
Table 2.2. Sample HQ Calculation 20
Table 4.1: Risks Associated with 20 mg/kg Arsenic in Soil 27
Table 6.1. Summary of HHRA Review 33
Table 7.1 Proposed EUs for Additional Risk Evaluation 37

LIST OF APPENDICES

APPENDIX A

Table A.1: Summary - Screening of Chemicals of Potential Concern from Previous HHRAs

Table A.2: USACE OSR FUDS HHRA (1995 RI) – Screening Review

Table A.3: USACE HHRA for Spaulding and Captain Rankin Areas (RI Report, 1996) – Screening Review

Table A.4: USEPA Region III HHRA (1999) – Screening Review

Table A.5: USEPA American University HHRA (2000) - Southern AU – Screening Review

Table A.6: USACE HHRA for the 4801 Glenbrook Road Property (2000) – Screening Review

Table A.7: Screening of Comprehensive List Detections for Selected OU-4 Residences

Table A.8: Screening of Comprehensive List Detections for AU Lot 12 and CDC

Table A.9: Screening of Comprehensive List Detections for Sedgwick Trench

Table A.10 Metals Background Data

Table A.11: Summary of Exposure Assessment Changes

Table A.12: Review of Toxicity Values

APPENDIX B

Figure 1: Site Location Map

Figure 2: Areas covered by HHRAs and AUES sampling

Figure 3: Areas with at least one COPC through Initial Screen

Figure 4: COPCs Remaining through Additional Screen (Step 3b)

Figure 5: Proposed Exposure Units

APPENDIX C - SCREENING STEPS PROCEDURE - MEMORANDUM

APPENDIX D - ProUCL STATISTICAL TESTING OUTPUT **(CD only)**

LIST OF ACRONYMS AND ABBREVIATIONS

AOI	Area of Interest
AU	American University
AUES	American University Experiment Station
CENAB	United States Army Corps of Engineers, Baltimore District
COPC	Chemical of Potential Concern
CSF	Cancer Slope Factor
CTE	Central Tendency Exposure
CWM	Chemical Warfare Materiel
DERP	Defense Environmental Restoration Program
EE/CA	Engineering Evaluation/Cost Analysis
EFH	Exposure Factors Handbook
EPC	Exposure Point Concentration
ERT	ERT, Inc.
EU	Exposure Unit
FUDS	Formerly Used Defense Site
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HHRA	Human Health Risk Assessment
HQ	Hazard Quotient
IRIS	Integrated Risk Information System
Kg	Kilogram
MEC	Munitions and Explosives of Concern
mg	Milligram
NERL	National Environmental Research Laboratory
OSR	Operation Safe Removal
OU	Operable Unit
POI	Point of Interest
PPRTV	Provisional Peer-reviewed Toxicity Value
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk-Based Concentration
RfC	Reference Concentration
RfD	Reference Dose
RI/FS	Remedial Investigation and Feasibility Study
RME	Reasonable Maximum Exposure
RSL	Regional or Risk-Based Screening Level
SF	Slope Factor
SL	Screening Level
SSL	Soil Screening Level
SVFUDS	Spring Valley Formerly Used Defense Site
UCL	Upper Confidence Limit
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

This document presents a review of five pre-2005 Human Health Risk Assessments (HHRA) conducted on areas within the Spring Valley Formerly Used Defense Site (SVFUDS) in Washington, D.C. The HHRA review is based on historical information and analytical data and recommendations/conclusions presented in previous investigation reports, and follows the methodology outlined in the *Final Evaluation Document for the Spring Valley FUDS Integrated Site-Wide Remedial Investigation/Feasibility Study, Washington, DC*, June 22, 2012 (U.S. Army Corp of Engineers, 2012).

The objective is to review the procedures and conclusions of the pre-2005 HHRAs to determine whether the chemicals of potential concern (COPCs) identified, the exposure pathways considered, and the toxicity evaluations would still be appropriate when considering updated U.S. Environmental Protection Agency (USEPA) guidance and site-specific background concentrations, and to identify remaining areas that require additional risk screening and risk assessment.

In addition, a re-screening of all soil data from the SVFUDS was done using updated risk-based screening levels and background data, to ensure that any potential risks associated with soils still in place at SVFUDS are evaluated, and addressed if necessary.

Five HHRAs, completed between 1995 and 2000, addressing different objectives and different areas of the SVFUDS, are the subject of this review. In addition, approximately 50 American University Experiment Station (AUES) List soil samples collected as part of the 2003 Engineering Evaluation/Cost Analysis (EE/CA) are included in the screen against updated criteria (no discrete HHRA was completed for these).

Selection of Chemicals of Potential Concern

The five previous HHRAs determined COPCs using then-current Regional or Risk-Based screening levels (RSLs) and background concentrations, along with consideration of essential nutrients and other factors. This HHRA review updates the previous HHRA screening of all chemicals detected in soil, whether selected as COPCs in the previous HHRAs or not. The updated screening process conducted in this HHRA review consisted of an *initial screen* for all detected chemicals in soil that determined provisional COPCs using a conservative approach, and an *additional screen* incorporating other factors to identify COPCs that still remain in soil at the SVFUDS.

Updated COPC screening was conducted based on the original areas of investigation previously defined in the individual HHRAs, primarily on the Point of Interest (POI) level. The screening steps are presented in tables that also provide information from the previous HHRAs, including screening levels used, previously selected COPCs, and risk conclusions for the previous COPCs.

Initial Screen

The initial screen compared the maximum detected value of each constituent against current risk-based screening levels and current background concentrations. Provisional COPCs were identified through the initial screen when the maximum detected value was greater than both the RSL and background level (the COPCs identified in this manner would not necessarily be the

same as those derived through the original risk assessment process as presented in those HHRAs).

Because the use of the maximum detected value is a conservative approach that is not a realistic representation of the distribution of actual contamination at a site, an additional screen, incorporating other factors to make the evaluation more realistic and representative of current site conditions, was also performed.

Additional Screen

The additional screening factors used to further evaluate the provisional COPCs remaining following the initial screen comprised four steps:

Step 1: Calculate a Risk Ratio

USEPA's statistical software ProUCL was used to calculate the exposure point concentration (EPC) of each provisional COPC remaining after the initial screen. The EPC is the 95% upper confidence limit (UCL) of the mean of the data set. The risk ratio is the EPC divided by the most current RSL (adjusted down by 10 if based on a non-carcinogenic effect). If the risk ratio was less than or equal to one, that COPC dropped out; if not, it remained a COPC and the next step was applied.

Step 2: Background Comparison

A two-sample hypothesis test comparing site concentrations to background concentrations was completed using ProUCL. If the site was less than or equal to background, that COPC dropped out; if not, it remained a COPC and the next step was applied.

Step 3a: Re-Analyze Data after Removing Samples that Represent Excavated Soil

Step 3a reflects that in many areas, significant soil excavation has occurred, so it was necessary to determine whether the soil that contained the sample results used in the above analyses was still present and available to pose potential risks, that is, whether the COPCs still remained. If any of the COPCs remaining after Steps 1 and 2 were based on soil that had already been excavated, those sample results were removed from the data set, and Steps 1 and 2 were re-run to determine whether COPCs were still present.

Step 3b: Re-Analyze Data with Clean Backfill Data Added

Step 3b reflects that clean soil was used to backfill the excavations, so it was necessary to determine whether the combination of the clean backfill soil and the remaining unexcavated soil still posed potential risks, that is, whether the COPCs still remained. The data results from the clean backfill used for each area were added to the in-place unexcavated soil data for that area, and Steps 1 and 2 were re-run to determine whether COPCs were still present.

For some of the five previously conducted HHRAs and the AUES List sampling, COPCs still remain through the initial and additional screening steps. Table ES.1 organizes the remaining COPCs by POI or area of investigation.

Table ES.1. Summary of HHRA Review

POI or Area	COPCs Remaining Following Step 3b	HHRA Source	Table Reference
Southern AU	Aluminum Cobalt Iron Vanadium	USEPA 2000	A.5
POI AU	Aluminum Antimony Cobalt	USACE 1995 & USEPA 1999 USEPA 1999 USACE 1995	A.2 & A.4 A.4 A.2
POI 24	Aluminum	USEPA 1999	A.4
POI 53	Aluminum	USEPA 1999	A.4
POI 21/22/23	Aluminum Cobalt Manganese Nickel Vanadium	USACE 1995 USACE 1995 USACE 1995 & USEPA 1999 USACE 1995 USACE 1995 & USEPA 1999	A.2 A.2 A.2 & A.4 A.2 A.2 & A.4
POI 21	Antimony Manganese Thallium	USEPA 1999	A.4
POI 22	Antimony Arsenic Lead Manganese Mercury Vanadium Thallium	USEPA 1999	A.4
POI 23	Arsenic Manganese Vanadium	USACE 1996 USEPA 1999 USEPA 1999	A.3 & A.4
POI 25	Aluminum Antimony Cobalt Manganese Mercury Thallium Vanadium	USACE 1995 & USEPA 1999 USACE 1995 & USEPA 1999 USACE 1995 USEPA 1999 USACE 1995 & USEPA 1999 USACE 1995 & USEPA 1999 USACE 1995 & USEPA 1999	A.2 & A.4 A.2 & A.4 A.2 A.4 A.2 & A.4 A.2 & A.4 A.2 & A.4
POI 7	Aluminum Antimony Manganese	USEPA 1999	A.4
POI 1	Aluminum Cobalt	USEPA 1999 AUES List Data	A.4 A.9
4710Q	Cobalt Aluminum Vanadium	AUES List Data	A.7

The results of the screening also identified a few small discrete areas where only a few naturally occurring metals remained as COPCs following Step 3b. These COPCs may have been selected as a result of comparisons to an RSL that is based on uncertain toxicity data, or were naturally occurring metals (primarily aluminum) that would not be associated with potential human health risks if carried through an HHRA. In some cases, these were areas where the COPC was based on a single maximum value because there were insufficient samples to conduct statistical testing. Eight such small discrete POIs or areas of investigation were identified with a maximum of three naturally occurring metals (most had only a single COPC) at levels unlikely to pose potential human health risks; these POIs or areas will not be assessed further in a quantitative HHRA and those COPCs are not included in Table ES.1.

Exposure Assessment

The exposure scenarios selected in the previous HHRAs and the exposure assumptions used to quantify the exposure doses associated with the selected exposure scenarios were reviewed in the context of more recently published USEPA risk assessment guidance; various changes have occurred in USEPA exposure assessment guidance. For example, risk results reported in some previous HHRAs would change with the addition of dermal and inhalation pathways, and the vegetable ingestion pathway for residential locations. The magnitude of the change would depend on the degree of exposure of site receptors, the toxicity of the COPCs remaining in soil at the site, and the potential uptake of COPCs from soil to plants. However, it was concluded that the approach presented in this HHRA review, that is, the re-screening of all soil data from the SVFUDS using updated risk-based screening levels and background data, ensures that any potential risks associated with soils still in place at SVFUDS would be evaluated and addressed, if necessary, in new HHRAs.

Toxicity Assessment

Analysis of previous HHRAs was conducted to determine whether any changes occurred in the procedures or values used in the previous toxicity assessments. For the most part, the toxicity assessment procedures recommended by EPA have not changed substantially since the completion of the previous HHRAs. However, in some cases, the toxicity values (both carcinogenic risk and non-cancer health effects) used in previous HHRAs were changed or have been removed and only provisional peer-reviewed toxicity values are currently available. The HHRA review presented in this document applies appropriate toxicity factors (current RSLs that incorporate updated reference doses and slope factors) to the screening effort of all detected chemicals in soil, thereby ensuring that potential risks associated with soils still in place at SVFUDS are evaluated, and addressed if necessary.

The protectiveness of the SVFUDS arsenic in soil clean up goal of 20 mg/kg was also reviewed. A screening evaluation of this concentration for adult and child residents, using Reasonable Maximum Exposure (RME) or upper bound assumptions, was completed for this HHRA review. It was concluded that using a residential scenario with default exposure parameters, the results indicate that the Hazard Index (HI) for arsenic for children is less than one (0.88), the HI for adults is also less than one (0.12), and that incremental cancer risks are within USEPA's acceptable range (1E-04 to 1E-06). The incremental cancer risks for children and adults combined (6.1E-05) are within USEPA's acceptable range.

Conclusions

Based on this HHRA review, the following conclusions can be made:

- Some COPCs are still present in soil in selected areas (see Table ES.1).
- Changes in exposure assumptions and additional exposure scenarios would cause some changes in the estimated risks calculated in some of the previous HHRAs.
- Several toxicity values have changed since the previous HHRAs were conducted, although the screening process presented in this document uses RSLs that incorporate updated toxicity values.
- The screening process presented in this document could potentially result in new HHRAs that would utilize current updated exposure scenarios and assumptions, as well as updated toxicity values, addressing the changes described above.

Recommendations

Recommendations to address the remaining COPCs focus on identifying larger exposure units (EUs), integrating the pre-2005 HHRA samples with more recent samples (collected in 2012), and conducting risk evaluations on a single data set for each EU. The POIs or areas of investigation with remaining COPCs have been grouped into EUs based on similar past practices, similar receptor populations and exposure pathways, and geography, so that an area can be assessed based on all data available, without regard as to when the data were collected.

Table ES.2 provides the proposed EUs, the POI or areas of investigation addressed, and the sample data sets that will be combined to determine COPCs in each EU.

The proposed approach for further risk evaluation is to combine older and newer sample results into a single data set for each of the EUs and screen the data following the steps described above. If no COPCs remain in an EU following the screening, that EU drops out and is not considered further. If COPCs remain following the screen, that EU will undergo a complete HHRA consisting of exposure assessment, toxicity assessment, and risk characterization steps.

Table ES.2. Proposed EUs for Additional Risk Evaluation

Proposed Exposure Unit	POI or Area Addressed	Samples to be used
Southern AU	Southern AU, POI AU, POI 53, and POI 24	Approx. 70 samples: USACE 1995 USEPA 1999 USEPA 2000 New (Evaluation Document)
Spaulding – Rankin Area	POIs 21, 22, 23, and 25	Approx. 70 samples: USACE 1995 USACE 1996 USEPA 1999 New (Evaluation Document)
AOI 9	Multiple properties including POI 1 and POI 7	Approx. 70 samples: USACE 1995 USACE 1999 USACE 2003 USACE Anomaly Investigations New (Evaluation Document)
AOI 13	Multiple properties including 4710Q	Approx. 20 samples: USACE 1995 USACE 2003 USACE Anomaly Investigations New (Evaluation Document)
Western Portion of POI 53	Part of POI 53 (Multiple properties along Glenbrook Road)	Approx. 15 samples: USACE 1995 USEPA 1999 New (Evaluation Document)

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1.0 INTRODUCTION

1.1 Purpose

This document presents a review of pre-2005 human health risk assessments (HHRAs) completed at various areas of the Spring Valley Formerly Used Defense Site (SVFUDS) in Washington, D.C. The objective of this document is to review the procedures and conclusions of the pre-2005 HHRAs to determine whether the chemicals of potential concern (COPCs) identified, the exposure pathways considered, and the toxicity evaluations, would still be appropriate when considering updated U.S. Environmental Protection Agency (USEPA) guidance and site-specific background concentrations, and to identify remaining areas that require additional risk screening and risk assessment. A re-screening of all soil data from the SVFUDS was done using updated risk-based screening levels and background data, to ensure that any potential risks associated with soils still in place at SVFUDS are evaluated, and addressed if necessary. The methodology for this review was outlined in the *Final Evaluation Document for the Spring Valley FUDS Integrated Site-Wide Remedial Investigation/Feasibility Study, Washington, DC* (USACE, 2012). This review is based on the historical information, analytical data, and recommendations/conclusions presented in the five previously conducted discrete HHRAs.

ERT, Inc. (ERT) has been contracted by the U.S. Army Corps of Engineers (USACE), Baltimore District (CENAB), to perform a Remedial Investigation and Feasibility Study (RI/FS) for the SVFUDS (Defense Environmental Restoration Program [DERP] FUDS Military Munitions Response Program/Chemical Warfare Materiel [CWM] Project No. C03DC091801 and DERP FUDS Hazardous, Toxic, and Radioactive Waste (HTRW) Project No. C03DC091802). ERT is performing activities in support of ongoing sampling and remedial investigations addressing munitions and explosives of concern (MEC) and CWM under Contract W912DR-06-D-0002, Task Order 0011.

1.2 SVFUDS Background

The SVFUDS is an area of northwest Washington, DC, that was formerly occupied by the American University Experiment Station (AUES). During World War I, the U.S. government established the AUES to investigate the testing, production, and effects of noxious gases, antidotes, and protective masks. The AUES was located on the grounds of the current American University (AU) and used additional property in the vicinity to conduct this research and development on CWM, including mustard and lewisite agents, as well as adamsite, irritants, and smokes. After the war, these activities were transferred to other locations and the site was returned to the owners. The SVFUDS location map is presented as Figure 1 (all figures are presented in Appendix B).

1.3 Overview of Approach

Five HHRAs, completed between 1995 and 2000, addressing different objectives and different areas of the SVFUDS, are the subject of this review. In addition, approximately 50 AUES List soil samples collected as part of the 2003 Engineering Evaluation/Cost Analysis (EE/CA) are included in the screen against updated criteria (no discrete HHRA was completed for those 50 AUES List samples).

This review focuses primarily on updating the screening of compounds detected in soil, but also reviews the approaches for exposure and toxicity assessment that were used in the previous HHRAs. This review also provides a discussion of the risks associated with arsenic, focusing on the human health protectiveness of the remediation endpoint for arsenic in soil at SVFUDS (20 milligrams/kilogram [mg/kg]).

The focus of this HHRA review is soil contaminants at the SVFUDS; it does not address MEC hazards.

The following five HHRAs are included in this review:

1. *Remedial Investigation Report for the Operation Safe Removal - Formerly Used Defense Site, Washington, D.C.* (USACE, 1995)
2. *Final Remedial Investigation Report for Spaulding and Captain Rankin Areas, Volumes I and II.* Parsons (USACE, 1996)
3. *USEPA Region III Draft Risk Assessment Report, Army Munitions Site, Spring Valley. October, 1999* (USEPA, 1999)
4. *USEPA Region III American University Property, Spring Valley Operable Unit (OU) 3 HHRA. August 2000* (USEPA, 2000)
5. *Revised Final Engineering Evaluation/Cost Analysis (EE/CA) - 4801, 4825, and 4835 Glenbrook Road, Spring Valley OU 3, Washington, DC* (USACE, 2000)

In addition to the review of the pre-2005 HHRAs, the AUES List sampling results (*Engineering Evaluation/Cost Analysis for Arsenic in Soil.* Volume III-Technical Memoranda and Other Supporting Data, Spring Valley Operable Units 4 and 5, Washington DC, December 17, 2003) are also reviewed, relative to updated screening levels and background data.

Figure 2 shows the areas covered by the pre-2005 HHRAs and the locations of the AUES List sampling.

1.4 Organization of the Document

This review document is organized as follows: Section 1 provides the introduction (purpose and a summary of the previous HHRAs); Section 2 summarizes previously used screening criteria, and applies an updated screen to all detected chemicals in soil to identify chemicals of potential concern (COPCs) that may currently exist in SVFUDS soils; Section 3 summarizes changes in exposure assessment approaches; Section 4 summarizes updates in the toxicity values and includes a review of the protectiveness of the arsenic soil cleanup goal; Section 5 contains the uncertainty discussion; Section 6 presents conclusions; Section 7 presents recommendations; and, Section 8 contains references. Appendix A contains the tables, Appendix B contains the figures, Appendix C provides the screening steps procedural memorandum, and Appendix D contains the ProUCL statistical output (Appendix D provided on CD only—not in hard copy).

1.5 Summary of Pre-2005 HHRAs

The objectives and site assessment activities for each pre-2005 HHRA are summarized below.

1.5.1 Remedial Investigation Report for the Operation Safe Removal - Formerly Used Defense Site, Washington, D.C. (OSR FUDS RI) (USACE, 1995)

In January 1993, a utility contractor accidentally uncovered buried ordnance at a property in Spring Valley. Following removal of the ordnance, USACE conducted the Operation Safe Removal (OSR) FUDS Remedial Investigation [OSR FUDS RI (USACE, 1995)] of the entire area within the OSR FUDS boundary. During the investigation, some 54 areas of potential hazards were identified and designated as Points of Interests (POIs). This RI included an HHRA to evaluate the potential risks to human health and the environment from residual chemical contamination resulting from historical AUES activities in the OSR FUDS. The risk assessment was conducted in accordance with USEPA guidance including the Risk Assessment Guidance for Superfund Human Health Evaluation Manual (RAGS) (USEPA, 1989) and supporting documents.

The exposure scenarios evaluated included residents exposed to surface soil and construction workers exposed to subsurface soil. The POIs and other areas of investigation included in the HHRA are shown in Table 1.1 below.

Table 1.1. POIs Included in HHRA

Name	Description	Name	Description
POI 1	Circular Trenches	POI 23	Shell Pit
POI 7/7R	Possible Test Area	POI 24	Probable Pit
POI 10	Possible Target or Test Site	POI 25	Side-scan Borings
POI 11	Scattered Ground Scars	POI 37	Mill Creek
POI 16	Chemical Persistency Test Area	POI 38	Bradley/Major Tolman's Field
POI 19	Old Mustard Field	POI 39	Static Test Fire Area
POI 20	Ground Scar	POI 53	Baker Valley
POI 21	Shell Pit	POI AU	Southern American University
POI 22	Shell Pit	LTC Bancroft Area	OSR FUDS RI Zone 9

The HHRA identified COPCs (various metals) at POIs 21, 22, 23, 25, AU, and the LTC Bancroft Area. Note that not all POIs had samples analyzed for metals. The HHRA concluded that none of the COPCs posed unacceptable risks and that no further remedial actions were necessary due to the presence of these metals. However, the report's conclusions noted that the Captain Rankin Area (POIs 21, 22, and 23) was still under investigation (see Section 1.5.2).

1.5.2 Final Remedial Investigation Report for Spaulding and Captain Rankin Areas, Volumes I and II, Parsons (HHRA for Spaulding and Captain Rankin Areas) (USACE, 1996)

The OSR FUDS RI determined that no further action was required at the entire OSR FUDS with the exception of the Captain Rankin Area (POIs 21, 22, and 23). In June 1994, an EE/CA was performed for the Spaulding and Captain Rankin Areas (USACE, 1996) to determine the appropriate action for addressing the soil and material contained within the former shell pits (bunkers) and surrounding areas. A Streamlined Risk Evaluation in the EE/CA identified risk

from lead and arsenic in the soil within the bunkers. That soil was removed and properly disposed.

The 1996 Spaulding and Captain Rankin Area RI addressed exposures to subfloor soils and concrete and pipe drain termini at POIs 21, 22, and 23 for construction workers exposed via incidental ingestion and inhalation. The pipe drain terminus soil sampling was conducted to determine if residual contamination existed in the soils associated with pipe drain termini. (Note that the POI 23 terminus samples are actually located on the 4845 Glenbrook Road property, but these data will be included with the SCRA data set based on similar analytes and past practices).

The HHRA portion of this 1996 RI determined that while arsenic was a COPC, it did not pose any unacceptable risks. In the June 1996 Spaulding and Captain Rankin RI Report, USACE recommended that no further action be taken at the Spaulding and Captain Rankin Areas.

1.5.3 USEPA Region III Draft Risk Assessment Report, Army Munitions Site, Spring Valley, October 1999 (USEPA, 1999)

In 1999, the USEPA prepared an HHRA for the SVFUDS. USEPA conducted an analysis of soil sampling data collected between 1993 and 1995 at sixteen locations throughout Spring Valley and American University (AU) property (splitting samples with the USACE OSR FUDS RI). The risk assessment evaluated the toxicity posed by chemical substances in soil and described the exposure routes by which humans may come into contact with these substances.

The USEPA HHRA was intended to evaluate the significance (if any) of residual chemical contamination and to determine the full nature and extent of required follow-on investigations at the SVFUDS. The HHRA was intended to be read in conjunction with the final OSR FUDS RI (USACE, 1995).

The exposure scenarios evaluated included residents, groundskeeper/lawn maintenance workers, and recreational users (representing lounging activities associated with a 4-year college student) exposed to surface soil and construction workers exposed to subsurface soil. Based on the splitting of samples from the USACE 1995 RI, the POIs included in the HHRA are all of those shown in Table 1.1, excluding POI 37 and the LTC Bancroft Area, but including the 4825 and 4835 Glenbrook Road properties.

The HHRA concluded that the non-cancer HI for all receptors were, in most instances, below USEPA's acceptable threshold HI value of 1.0 (adverse health effects are not anticipated). There were only a few POIs where concentrations of COPCs (primarily antimony and thallium) resulted in exceedances of the threshold HI value of 1.0. However, the HHRA only considered the conservative reasonable maximum exposure (RME) exposure scenarios which evaluate the upper percentile exposure scenarios. The HHRA concludes that assessment of a Central Tendency (CT) exposure scenario would be expected to reduce HI values by more than one order of magnitude, thereby eliminating all instances where HI values exceeded 1.0. Further, based on a review of available metals data and comparison between USEPA Region III and USACE soil sampling data, there was an indication that inter-laboratory bias was at least partially responsible for elevated levels of antimony and thallium.

The HHRA showed that excess lifetime cancer risks for adult/child residents and construction workers were within USEPA's acceptable risk range. While an exceedance of the acceptable cancer risk was observed for arsenic at POI 24 for the adult resident and child resident, a CT

exposure scenario was expected to reduce this estimated cancer risk to within the acceptable risk range. The HHRA further concluded that residential land use was not a realistic exposure scenario at this POI, and thus, that the HHRA results were unnecessarily conservative.

1.5.4 USEPA Region III American University Property, Spring Valley (OU3) HHRA (August 2000) (USEPA, 2000)

In 2000, the USEPA also prepared an HHRA for the southern portion of the AU Property. The focus of this HHRA was to evaluate the potential risk to human health from exposures to metals in soil at the AU property. Significant portions of the area covered under this HHRA have since been excavated based on arsenic concentrations in soil.

The area of investigation is shown in Figure 2 (green highlight). The HHRA assessed the following receptors potentially exposed to surface soils: adult trespasser, child trespasser, adult student athlete, and adult maintenance worker.

The child trespasser and construction worker non-cancer risks were greater than the target HI of 1.0, primarily due to chromium. However, these non-cancer risks were determined using the toxicity values for hexavalent chromium. The USEPA (2000) HHRA concluded that the non-cancer risks determined using the toxicity values for trivalent chromium, which were within or below USEPA's acceptable risk range, were more appropriate, and that using hexavalent toxicity values most likely overestimated non-cancer risks due to chromium concentrations on the site.

In this USEPA (2000) HHRA, the excess lifetime cancer risk to the receptors was within USEPA's acceptable risk range. In all cases, the primary cancer risk was from exposure to arsenic. However, the concentrations of arsenic found on the AU property were not found to be significantly different than the concentrations found in the background samples.

1.5.5 Revised Final Engineering Evaluation/Cost Analysis (EE/CA) - 4801, 4825, and 4835 Glenbrook Road, Spring Valley Operable Unit 3, Washington, DC (4801 HHRA) (USACE, 2000)

The scope of the EE/CA was to address potential metals contamination on a portion of the former AUES, consisting of three properties formerly used by the AUES. The locations were the grounds of the residences at 4801, 4825, and 4835 Glenbrook Road. The EE/CA evaluated data and recommended a preferred alternative to address the metals contamination in soil.

While the HHRA presented in the EE/CA addressed all three properties, the assessment of risk for the 4825 and 4835 properties in that document is superseded by the more recent risk assessments completed for 4825 (2011) and 4835 (2009) Glenbrook Road. Therefore, this HHRA review focuses on the 4801 property only.

To determine the nature and extent of the potential impact, USACE performed a site investigation of the surface and subsurface soils of 4801 Glenbrook Road. To assist in the investigation, 4801 Glenbrook Road was divided into two exposure areas. These areas were based on cut and fill analysis and the site investigation results, and were identified as the North (or undisturbed) Area and the South (or disturbed) Area.

Arsenic was identified as the COPC presenting an unacceptable risk. The analysis of the site investigation data produced results showing elevated levels or hot spots of arsenic (greater than

25 mg/kg: Note that the SVFUDS arsenic remediation endpoint of 20 mg/kg had not yet been established). A removal action was conducted at the 4801 property with the goal of ensuring that after all points identified as hot spots were removed, the remaining sample points formed a distribution that was not statistically different from background.

1.5.6 Engineering Evaluation/Cost Analysis for Arsenic in Soil (AUES List Sampling), Spring Valley Operable Units 4 and 5, Washington, DC (USACE, 2003)

Based on the findings of investigations at the Operable Unit 3 (OU-3) properties (4801, 4825, and 4835 Glenbrook Road), an expanded area was further investigated as Operable Unit 4 (OU-4). This investigation indicated arsenic concentrations above risk-based concentrations and above background levels. In consultation with the USEPA and the DDOE, USACE then undertook an extensive characterization of the remaining Spring Valley FUDS, some 577 acres, designated as OU-5.

The 2003 EE/CA primarily focused on arsenic in soil. However, some soil sampling was also performed to assess for the presence of the AUES list of chemicals (approximately 200 chemicals or compounds with documented usage at the AUES). Sampling was performed at different areas, reflecting different types of sites and past practices, including POI-1 (the Sedgwick Trench Area), the AU Child Development Center, and four OU-4 residences: 3819 48th Street, 4710 Quebec Street, 4625 and 4633 Rockwood Parkway. Approximately 50 soil samples were collected from varying depths and analyzed for the AUES List parameters. Detected concentrations were screened against the then-current risk-based screening levels, but no HHRA was conducted on these data.

2.0 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

This section presents both the procedures used in previous HHRAs to select COPCs and the updated screening process used to identify current COPCs in soil in this HHRA review. The five previous HHRAs selected COPCs using then-current risk-based screening levels and background concentrations, along with consideration of essential nutrients and other factors. The updated screening process described in this report consists of an initial screen for all detected chemicals in soil that selects provisional COPCs (Sections 2.1 and 2.2) using a conservative approach, and an additional screen incorporating other factors to identify remaining COPCs (Section 2.3).

COPC screening in this HHRA review was conducted based on the original areas of investigation previously defined in the individual HHRAs, primarily on the POI level. For example, COPCs were determined for POI 53 in the USACE 1995 HHRA and POI 23 in the USACE 1996 HHRA, although, in some cases, such as the USEPA 2000 HHRA that evaluated southern AU, the area included overlapping POIs (e.g., POI AU, POI 53, POI 24, etc).

Tables A.2 through A.9 of Appendix A provide the detail of the screening steps described below. The tables also provide information from the previous HHRAs, including screening levels used, previously selected COPCs, and risk conclusions for the previous COPCs. This HHRA review updates the previous HHRA screening of all chemicals detected in soil, whether selected as COPCs in the previous HHRAs or not. Table A.1 presents a summary of all of these tables.

2.1 Overview of Screening Criteria – HHRA Review - Initial Screen

For this HHRA review, an initial screen of all detected chemicals in soil was conducted using current criteria. The initial screen compared the maximum detected value of each constituent against current risk-based screening levels and current background concentrations. The use of the maximum detected value for this initial screen is a conservative approach because the use of a single maximum concentration is not a realistic representation of the distribution of actual contamination at a site. Therefore, an additional screen, incorporating other factors to make the evaluation more realistic and representative of current site conditions, was also performed, as described in Section 2.3.

This section describes the screening criteria used in the initial screen in this HHRA review, which resulted in the identification of provisional COPCs.

2.1.1 <u>Risk-Based Screening Levels</u>

For this HHRA review, the November 2012 USEPA Regional or Risk-Based Screening Levels (RSLs) (USEPA, 2012a) were used to select COPCs in the initial screen, using the maximum detected concentration. USEPA RSLs reflect current toxicity values from sources used in the USEPA's toxicity hierarchy, and thus are updated by USEPA over time, if necessary, based on their review of newly published toxicity research. The USEPA RSLs are developed based on multiple exposure pathways and for chemicals with both carcinogenic and non-carcinogenic effects. RSLs correspond to either a 10^{-6} risk level for carcinogens or a Hazard Quotient (HQ) of 1 for non-carcinogens. The RSLs for non-cancer endpoints were adjusted to an HQ of 0.1 for the re-screening of COPCs in this HHRA review; this approach is commonly taken in an initial screening step to account for potential cumulative effects of non-carcinogens.

2.1.2 Background Concentrations

For this HHRA review, the current 2008 SVFUDS soil background data, not available at the time of the previous HHRAs, were used (*Background Soil Sampling Report for SVFUDS*, USACE, 2008). In general, COPCs may be eliminated from quantitative evaluation in the HHRA if the maximum detected concentration is less than the background concentration. Comparison to background to determine which COPCs are elevated over background is consistent with USEPA (1989, 1992b, 2002) guidance.

The background data used for screening metals COPCs in all previous HHRAs are shown in Tables A.2 through A. 9, and are also summarized in Table A.10 and below.

2.2 Summary of COPCs Selected in Previous HHRAs and New Provisional COPCs Selected in the Initial Screen

The following subsections describe for each previous HHRA, first, the procedures used for selecting COPCs in the previous HHRAs, and second, the results of the initial screen of all detected chemicals in soil conducted in this HHRA review.

2.2.1 USACE OSR FUDS HHRA (1995)

In the 1995 OSR FUDS HHRA, the following criteria were used to screen COPCs:

- Risk-Based Concentrations (RBCs): USEPA Region III Risk-Based Table for residential soil (April, 1994), corresponding to a 1.0×10^{-6} excess cancer risk and non-carcinogens corresponding to a target hazard quotient of 0.1.
- Essential nutrients: chemicals that are essential human nutrients or are toxic only at high doses were not considered as COPCs, including calcium, iron, magnesium, potassium, and sodium.
- Background: Twelve soil samples (three from each of the four soil associations present at the OSR FUDS) were collected from background areas during the site investigation. Metals that exceeded both background concentrations and RBCs were considered COPCs.

In this HHRA review, the initial screen compared the maximum detected value of each detected chemical in soil against current RSLs and 2008 background levels. Through the initial screen, as shown in Table A.2 and as summarized in Table A.1, for multiple chemicals in four areas (POIs 21/22/23, 25, AU, and LTC Bancroft), the maximum detected value was greater than both the RSL and background level, and therefore these were identified as provisional COPCs in this HHRA review.

2.2.2 USACE HHRA Spaulding and Captain Rankin Areas (1996)

In the USACE 1996 HHRA, the following criteria were used to screen COPCs:

- RBCs: USEPA Table for residential soil (April, 1994), the same as those used for the OSR FUDS HHRA, 1995.
- The 95 percent upper confidence limit of background data.

- The HHRA used USEPA Region III screening RBCs and background soil concentrations.

The 1996 HHRA identified arsenic in soil as the COPC. Additionally, because there are no screening RBCs for concrete, the arsenic in the concrete was considered a COPC in some areas.

In this HHRA review, the initial screen compared the maximum detected value of each detected chemical in soil against current RSLs and 2008 background levels. Through the initial screen, as shown in Table A.3 and as summarized in Table A.1, for arsenic in two POIs (POI 22-Spaulding subfloor, and POI 23-pipe drain debris), the maximum detected value was greater than both the RSL and background level, and therefore arsenic was identified as a provisional COPC in this HHRA review.

2.2.3 USEPA HHRA (1999)

In the USEPA 1999 HHRA, the following three steps were used to screen COPCs:

- Screened against RBCs from USEPA Table for residential soil dated April 1, 1998. For lead, screened against 400 ppm, as recommended by USEPA for residential land use (USEPA, 1994), and removed these essential nutrients as COPCs: calcium, iron, magnesium, potassium and sodium.
- Using both the OSR FUDS RI background data (USACE, 1995) and the USEPA split samples taken from the same background locations (reported in USEPA, 1999), a statistical comparison between site data and background data was conducted by USEPA's National Environmental Research Laboratory (NERL). NERL's analysis of site versus background concentrations concluded that certain metals were not significantly different from background and these metals were excluded from the 1999 HHRA.
- Subsequently, an additional, separate, evaluation (shown in a second attachment to the 1999 HHRA), identified technical considerations that were used to further eliminate metals from the 1999 HHRA.

In this HHRA review, the initial screen compared the maximum detected value of each detected chemical in soil against current RSLs and 2008 background levels. Through the initial screen, as shown in Table A.4 and as summarized in Table A.1, for multiple chemicals in 16 POIs or areas of investigation, the maximum detected value was greater than both the RSL and background level, and therefore these were identified as provisional COPCs in this HHRA review.

2.2.4 USEPA American University Property HHRA (2000)

In the USEPA 2000 AU HHRA, the following criteria were used to screen COPCs:

- RBCs for residential soil from USEPA Table from October 27, 1999. Chemicals which are considered essential nutrients were not retained as COPCs. For lead: the screening level was 400 ppm, as recommended by USEPA Headquarters for residential land use (USEPA, 1994).
- Background values were those outlined in Appendix D of the USEPA AU 2000 HHRA (data collected in August and September 1999).

In this HHRA review, the initial screen compared the maximum detected value of each detected

chemical in soil against current RSLs and the 2008 background data. Through the initial screen, as shown in Table A.5 and as summarized in Table A.1, for multiple metals in the area of investigation in both surface and subsurface soil, the maximum detected value was greater than both the screening level and background level, and therefore these were identified as provisional COPCs in this HHRA review.

2.2.5 USACE EE/CA for 4801 Glenbrook Road HHRA (USACE, 2000)

In the USACE 2000 HHRA for 4801 Glenbrook Road, the following criteria were used to screen COPCs:

- RBCs for residential soil from the USEPA Table dated October 27, 1999; since only four noncarcinogenic compounds were identified as potential COPCs, and the four compounds have different toxicological endpoints, the RBCs were not adjusted for the noncarcinogenic compounds.
- Chemicals which are considered essential nutrients were not retained as COPCs.
- For lead, the screening level was 400 ppm, as recommended by USEPA Headquarters for residential land use (USEPA, 1994).
- For construction workers, RBCs were calculated using the USEPA soil screening level (SSL) methodology (as shown in Appendix B of the 2000 HHRA). The maximum concentration of arsenic observed at depths greater than 2 feet bgs did not exceed the construction worker SSL of 41.4 mg/kg.

The initial screen conducted in this HHRA review compared the maximum detected value of each chemical in soil against current risk-based screening levels and 2008 background concentrations. Through the initial screen, as shown in Table A.6 and as summarized in Table A.1, for arsenic and vanadium in the area of investigation, the maximum detected value was greater than both the screening level and background level, and therefore these were identified as provisional COPCs in this HHRA review.

2.2.6 USACE AUES List Sampling (2003)

Soil sampling was performed at several areas to assess for the presence of the AUES list of chemicals. Approximately 50 soil samples from different geographical areas were collected from varying depths and analyzed for the AUES List parameters. The results were screened against the April 2003 USEPA Residential RBCs. No HHRA was conducted using these data.

For this HHRA review, Tables A.7, A.8, and A.9 summarize the comparison of the USEPA November 2012 RSLs and the 2008 background concentrations to the maximum detected AUES soil sampling results. Through the initial screen, as shown in Tables A.7, A.8, and A.9, and as summarized in Table A.1, for multiple chemicals at four residential properties, the AU CDC, and the Sedgwick Trench area, the maximum detected value was greater than both the screening level and background level, and therefore these were identified as provisional COPCs in this HHRA review.

Combining the initial screen conclusions for all of the HHRA reviews, the areas (POIs and AOIs) with at least one provisional COPC are shown in Figure 3.

2.3 Additional Screening Incorporating Other Factors

2.3.1 Additional Screening Steps

Sections 2.1 and 2.2 describe the process used in this HHRA review for the initial screening of chemicals detected in soil. This section describes the additional screening factors used to further evaluate the provisional COPCs remaining following that initial screen.

The additional screen comprised four steps performed on the provisional COPCs. A memorandum providing the detailed procedures for each step described below is contained in Appendix C. Following the detail presented below, Exhibit 1 provides a screening process flow chart to capture all the steps conducted for this review.

Step 1: Calculate a Risk Ratio

Assuming a sufficient quantity of samples (5 or greater) was available, USEPA's statistical software ProUCL (USEPA, 2011b) was used to calculate the exposure point concentration (EPC) of each remaining provisional COPC. The EPC is the 95% upper confidence limit (UCL) of the mean of the data set, with a few exceptions as follows: if a data set consisted of fewer than 5 samples, the maximum detected concentration was used as the EPC; if a data set was all non-detect results, the EPC was assumed to be one-half of the average detection limit; the maximum detected value was used if the ProUCL-calculated EPC was greater than the maximum.

The risk ratio is the EPC divided by the most current RSL (adjusted down by 10 if based on a non-carcinogenic effect). This Step 1 screening process will result in one of two outcomes:

- If the risk ratio is less than or equal to one, the EPC does not exceed the RSL, and that COPC drops out.
- If the risk ratio is greater than one, the EPC exceeds the RSL, then proceed to Step 2 (statistical comparison to background).

Step 2: Background Comparison

Assuming a sufficient quantity of samples (5 or greater) was available, a two-sample hypothesis test comparing site concentrations to background concentrations was completed using ProUCL-recommended procedures, as follows:

For sample sets without nondetects (i.e., all results are detected values), the Student's t (pooled test) (assumes equal variances), or the Welch-Satterthwaite (W-S) test (assumes unequal variances) was used.

For sample sets with nondetects (either some or all non-detects), the Wilcoxon-Mann-Whitney (WMW) test (ProUCL enters in the minimum detection limit and the maximum detection limit to do the comparison) was used.

This Step 2 screening process results in one of two outcomes:

- If ProUCL determines that site concentrations are less than background, then the COPC drops out.
- If ProUCL determines that site concentrations are greater than background, proceed to

Step 3.

The detailed output of the ProUCL calculations for all steps is presented in Appendix D.

Step 3a: Re-Analyze Data after Removing Samples that Represent Excavated Soil

Step 3a reflects that in many areas, significant soil excavation has occurred. The objective of this step was to determine whether the soil that contained the sample results used in the above analyses was still present and available to pose potential risks, that is, whether the COPCs still remain. While the excavations were primarily driven by removal of arsenic-contaminated soil, in many cases, those excavations also removed soil associated with the samples that were collected for the HHRAs.

First, it was determined whether any of the COPCs remaining after Additional Steps 1 and 2 were based on soil that has already been excavated (noting the depths of the samples removed). If so, those samples were removed from the data set, then Additional Steps 1 and 2 were re-run (i.e., re-calculated the risk ratio and the statistical comparison to background using only those samples that remain in place, assuming sufficient sample quantity is available).

This process results in one of two outcomes:

- If ProUCL determines for the in-place unexcavated soil data that *either* the risk ratio is less than or equal to one, *or* site concentrations are less than background, the COPC drops out.
- If ProUCL determines for the in-place unexcavated soil data, that the risk ratio is greater than one *and* the site concentrations are greater than background, proceed to Step 3b.

Step 3b: Re-Analyze Data with Clean Backfill Data Added

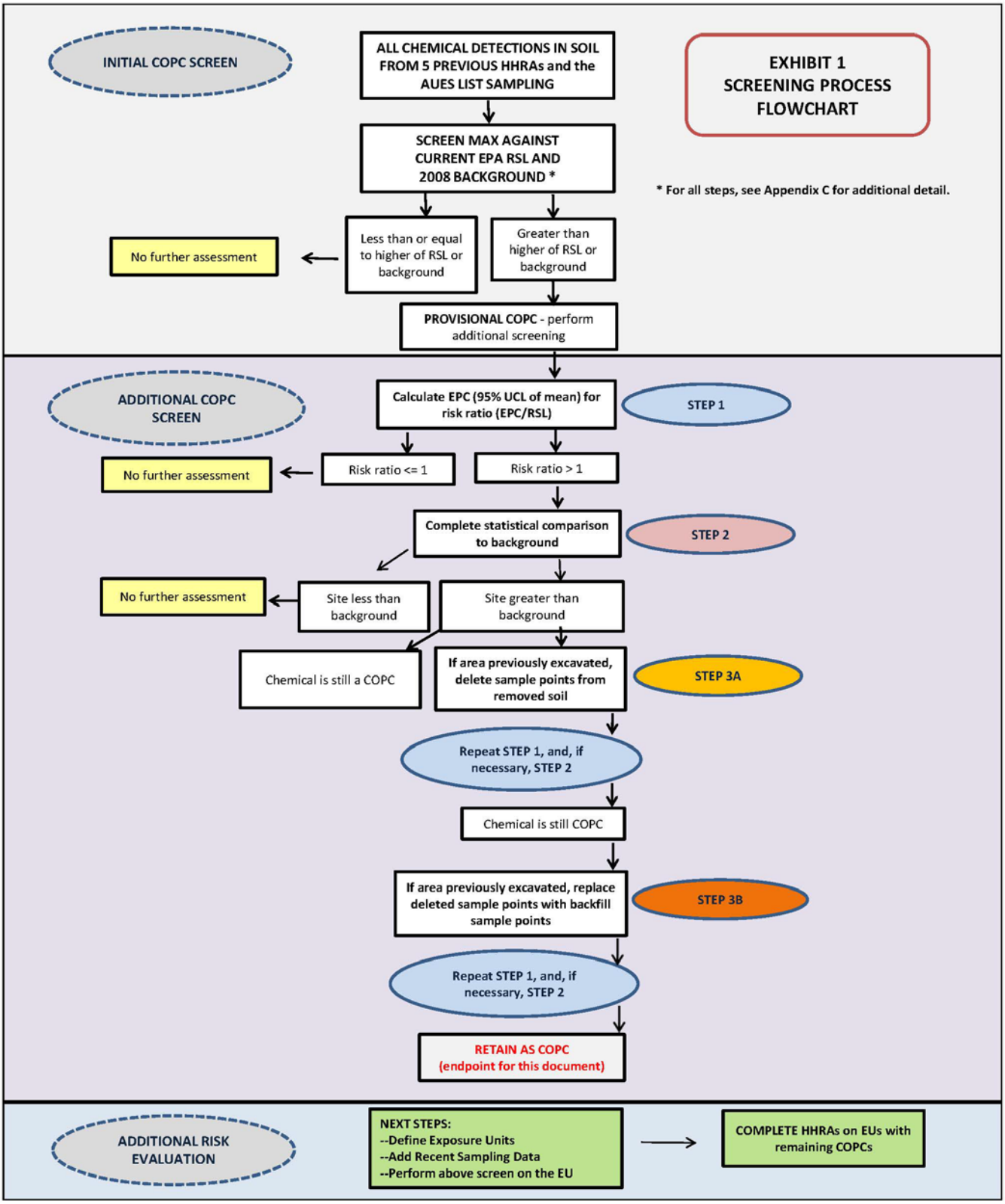
Step 3b reflects that clean soil was used to backfill the excavations. The objective of this step was to determine whether currently existing soil concentrations, which consist of a combination of the clean backfill soil and the remaining unexcavated soil, still contain COPCs.

The data results from the clean backfill used for each area were added to the in-place unexcavated soil data for that area, then Additional Steps 1 and 2 were re-run (i.e., re-calculated the risk ratio and the statistical comparison to background using the combined data set, assuming sufficient sample quantity is available). When there were both composite and discrete samples in the backfill data set, the composite sample was treated as a single value; the procedure was to, first, take an average of the discrete samples, then average the composite sample and the average of the discrete samples.

This process results in one of two outcomes:

- If ProUCL determines for the in-place unexcavated soil plus the backfill soil, that *either* the risk ratio is less than or equal to one, *or* site concentrations are less than background, the COPC drops out.
- If ProUCL determines for the in-place unexcavated soil plus the backfill soil, that the risk ratio is greater than one *and* the site concentrations are greater than background, the COPC is retained.

Exhibit 1: Screening Process Flow Chart



2.3.2 Organization of Tables

The analysis of COPCs using all of the steps described above is organized in tables specific to each previous HHRA (and specific to each POI or area of investigation within that HHRA). Tables A.2 through A.9 show the steps as applied per each of the previous HHRAs and the areas covered under the AUES List sampling. These tables show all chemicals analyzed in the pre-2005 HHRAs, whether selected as COPCs originally or not. Table A.1 is a summary of A.2 through A.9, showing only those chemicals determined to be provisional COPCs through the initial screen in this HHRA review, as described in Sections 2.1 and 2.2, then further highlighting final COPCs as determined through the additional steps.

On all tables, individual chemicals that remain COPCs following all initial and additional screening steps are highlighted in orange.

2.4 Conclusions Regarding Current Screening of COPCs

As summarized in Table A.1, for some of the five previously conducted HHRAs and the AUES List sampling, COPCs still remain through the initial and additional screening steps. Table 2.1 at the end of this section organizes the remaining COPCs by POI or area of investigation.

Figure 4 shows each of these areas and their associated COPCs. The recommended next steps for evaluating the potential risks associated with these remaining COPCs in soil are discussed in Section 7.

A weight-of-evidence approach may be used in HHRAs at decision points, when next steps are considered. Various lines of evidence can be used to help make decisions and to focus efforts on areas where the most significant risks may exist. This approach is particularly applicable at a site such as the SVFUDS, which is not an NPL site, and which comprises many different POIs or areas of investigation that have been identified over many years of previous investigations, based on past site history.

The results of the screening identified a few small discrete areas where only a few naturally occurring metals remained as COPCs. These COPCs may have been selected based on comparisons to an RSL that is based on uncertain toxicity data, or were naturally occurring metals (primarily aluminum) that would not be associated with potential human health risks if carried through an HHRA. In some cases, these were areas where the COPC was based on a single maximum value because there were insufficient samples to conduct statistical testing.

Specifically, eight small discrete POIs or areas of investigation were identified with a maximum of three naturally occurring metals (most of these eight areas had only a single COPC) at levels unlikely to pose potential human health risks. The discussions in Sections 2.4.1 through 2.4.8 below consider these factors in evaluating whether these areas can reasonably be eliminated from further assessment in a quantitative HHRA. Although this differs from the standard screening of COPCs approach used at typical NPL sites, based on professional judgment and the practical considerations of the SVFUDS, it is a reasonable means to focus efforts on more significant areas.

Table 2.2, at the end of this section, provides the procedure used to support the statements concerning HQ values as discussed in the paragraphs below, and illustrates one example using

aluminum. The procedure used to calculate the HQs is a standard EPA approach for residential receptors as follows: Risks for a residential receptor were evaluated assuming that the resident would be exposed to soil via the incidental soil ingestion route. The dermal pathway was not included because EPA recommends that only those COPCs with dermal absorption fractions listed in USEPA (2004) be quantified for the dermal pathway; none of the inorganic COPCs discussed in this section have recommended dermal absorption values. The inhalation route provides a very small additional HQ for non-cancer effects, and does not change the conclusions of the paragraphs below; therefore it is not discussed further. The assumptions and the equations used to assess the incidental soil ingestion pathway to calculate non-cancer HQs are shown in Table 2.2. Note that for the discussions below, the COPCs either impact different target organs, or if they impact the same target organ, the cumulative HQ is still less than or equal to one.

2.4.1 LTC Bancroft

Using the 1995 OSR FUDS HHRA data for the LTC Bancroft area, aluminum, cadmium, and thallium are shown as COPCs (see Table A.2). These chemicals were selected based on a very limited data set (one sample).

For aluminum, the single sample result of 27,783 mg/kg is greater than both the background value (19,100 mg/kg) and the adjusted RSL (7,700 mg/kg). However, the RSL for aluminum is based on a provisional toxicity value (PPRTV), reference dose (RfD) of 1 mg/kg-day, which is not included in EPA's approved toxicity value database (the Integrated Risk Information Service, IRIS), and the PPRTV is presented as having "low confidence" in the EPA support document (EPA, 2006b). Further, applying the PPRTV and the procedure shown in Table 2.2, if residential non-cancer risks were calculated for aluminum, the HQ would be less than one.

For cadmium, the single sample result of 29 mg/kg exceeds the background value (2.36 mg/kg), and the adjusted RSL (7 mg/kg). However, if residential non-cancer risks were calculated for cadmium using the IRIS RfD of 1.00E-3 mg/kg-day, and the procedure shown in Table 2.2, this concentration in soil would result in an HQ less than one.

For thallium, the single sample result of 8 mg/kg is greater than the adjusted non-cancer RSL of 0.078 mg/kg and greater than the background value of 2.2 mg/kg. However, the toxicity value for thallium is a PPRTV, and is based on an uncertain data set. The EPA reviewed the available toxicity studies of thallium and concluded that the available toxicity database for thallium contains studies that are generally of poor quality (USEPA, 2012b). In addition, when thallium was detected at POI AU (see Table A.2, 1995 USACE HHRA) at higher concentrations (a maximum of 28.56 mg/kg and a 95% UCL of the mean of 10.45 mg/kg), it was eliminated as a COPC, based on the additional screen of a statistical comparison to background, which could not be accomplished at LTC Bancroft due to the limited number of samples available.

Due to there being only one sample at LTC Bancroft, the uncertainties associated with the toxicity values used as the basis of the RSLs for two of the three COPCs, and that these chemicals are unlikely to cause unacceptable risks at these concentrations at this single small discrete area, the elimination of these metals in soil as COPCs is supported. Therefore, the LTC Bancroft area will not be further considered in a quantitative HHRA.

2.4.2 POI 16

Using the 1999 USEPA HHRA data for POI 16, aluminum was the only metal selected as a COPC, based on a maximum detected value of 23,800 mg/kg, which exceeded both the background value of 19,100 mg/kg and an adjusted RSL of 7,700 mg/kg (see Table A.4). However, the RSL for aluminum is based on a PPRTV, which is not included in EPA's approved toxicity value database (IRIS), and the PPRTV (an RfD of 1 mg/kg-day) is presented as having "low confidence" in the EPA support document (EPA, 2006b). Further, if residential non-cancer risks were calculated for aluminum at this POI using the PPRTV and the procedure shown in Table 2.2, the HQ would be less than one. Therefore, POI 16 will not be further considered in a quantitative HHRA.

2.4.3 POI 19

Similar to POI 16, aluminum was the only COPC selected at POI 19, based on the 1999 USEPA HHRA data set (see Table A.4). This selection was based on the fact that the maximum detected value of aluminum (33,900 mg/kg) exceeded background and the RSL. As described above, aluminum is generally considered to be of low toxicity and the RSL is based on a toxicity data set the EPA has determined is "low confidence." Further, if residential non-cancer risks were calculated for aluminum at this POI using the PPRTV of 1 mg/kg-day and the procedure shown in Table 2.2, the HQ would be less than one. Therefore, POI 19 will not be further considered in a quantitative HHRA.

2.4.4 POI 20

In POI 20, using the 1999 EPA HHRA data set, aluminum was selected as a COPC based on a maximum detected concentration of 36,400 mg/kg and vanadium was selected based on a maximum concentration of 112 mg/kg (see Table A.4).

Similar to POI 16 and POI 19, as described above, aluminum is generally considered to be of low toxicity and the RSL is based on a toxicity data set the EPA has determined is "low confidence." Further, if residential non-cancer risks were calculated for aluminum at this POI using the PPRTV of 1 mg/kg-day and the procedure shown in Table 2.2, the HQ would be less than one.

The vanadium RSL is based on a PPRTV, an RfD of 5.00E-3 mg/kg-day for metallic vanadium, which has been suspended by EPA, and the IRIS file for vanadium pentoxide is under review; thus, there are no current EPA-approved toxicity values for inorganic vanadium (USEPA, 2009b). However, if the PPRTV were applied to the maximum detected concentration of vanadium in a residential scenario using the procedure shown in Table 2.2, the resulting HQ would be less than one, indicating a limited potential for human health risks due to exposure to vanadium in soil.

Therefore, as these two naturally occurring metals are unlikely to pose any human health risks, POI 20 will not be further considered in a quantitative HHRA.

2.4.5 POI 39 (10/11)

For POI 39, using the 1999 EPA HHRA data, aluminum and manganese were selected as COPCs based on RSL and background exceedances (see Table A.4). Aluminum was found at a maximum detect of 28,400 mg/kg. However, as described above, aluminum is generally

considered to be of low toxicity and the RSL is based on a toxicity data set the EPA has determined is "low confidence." Further, if residential non-cancer risks were calculated for aluminum at this POI using the PPRTV of 1 mg/kg-day and the procedure shown in Table 2.2, the HQ would be less than one.

Similarly, for manganese, if residential non-cancer risks were calculated using the maximum detection of 2,580 mg/kg, the IRIS RfD of 1.40E-1 mg/kg-day, and the procedure shown in Table 2.2, the HQ would be less than one for adult and child residents.

Therefore, as these two naturally occurring metals are unlikely to pose any human health risks, POI 39 (10/11) will not be further considered in a quantitative HHRA.

2.4.6 POI 38

For POI 38, based on data from the 1999 EPA HHRA data set, only aluminum was selected as a COPC; aluminum had a maximum detected concentration of 30,400 mg/kg (see Table A.4). However, as described above for multiple other POIs, aluminum is generally considered to be of low toxicity and the RSL is based on a toxicity data set the EPA has determined is "low confidence." Further, if residential non-cancer risks were calculated for aluminum using the PPRTV of 1 mg/kg-day and the procedure shown in Table 2.2, the HQ would be less than one. Therefore, POI 38 will not be further considered in a quantitative HHRA.

2.4.7 4801 Glenbrook Road

At 4801 Glenbrook Road, only one metal, vanadium, was selected as a COPC, using data from the USACE 2000 HHRA (see Table A.6). The maximum detected concentration of vanadium (192 mg/kg) exceeded both background (75.5 mg/kg) and the adjusted RSL (39 mg/kg). The vanadium RSL is based on a PPRTV, an RfD of 5.00E-3 mg/kg-dayfor metallic vanadium (USEPA, 2009b), which has been suspended by EPA, and the IRIS file for vanadium pentoxide is under review; thus there are no current EPA-approved toxicity values for inorganic vanadium. However, if the provisional toxicity value were applied to the maximum detected concentration of vanadium in a residential scenario using the PPRTV and the procedures shown in Table 2.2, the resulting HQ would be less than one, indicating a limited potential for human health risks due to exposure to vanadium in soil. Therefore, vanadium in soil at this property will not be further considered in a quantitative HHRA.

2.4.8 3819 48th Street

For the AUES List sampling at the 3819 48th Street location, aluminum, cobalt, and vanadium were selected as COPCs, based on the results of four samples (see Table A.7).

Aluminum was detected at a maximum concentration of 36,300 mg/kg exceeding both background (19,100 mg/kg) and the adjusted RSL (7,700 mg/kg). As previously mentioned, the aluminum RSL is based on a PPRTV, which has been determined by EPA to be based on a "low confidence" toxicity database. Further, if residential non-cancer risks were calculated for aluminum using the PPRTV of 1 mg/kg-day and the procedure shown in Table 2.2, the HQ would be less than one. Therefore, aluminum will not be further considered in a quantitative HHRA for 3819 48th Street.

The maximum detected concentration of cobalt (27.9 mg/kg) exceeded background (17.8 mg/kg) and the adjusted RSL (2.3 mg/kg). The RSL for cobalt is also based on a PPRTV, an RfD of 3.00E-4 mg/kg-day, for which EPA concludes there is a low-medium confidence level (EPA, 2008b). However, using the maximum detection of cobalt along with the provisional cobalt RfD and the procedures outlined in Table 2.2 results in child and adult resident HQs < or equal to 1.

Also, note that when cobalt was detected at essentially the same maximum concentration (27.8 mg/kg) at the AU CDC area of investigation (see Table A.8), it was eliminated as a COPC, based on the additional screen of a statistical comparison to background, which could not be accomplished at 3819 48th Street due to the limited number of samples available. Therefore, cobalt in soil at 3819 48th Street will not be further considered in a quantitative HHRA.

Vanadium was selected as a COPC using the maximum detected concentration of 108 mg/kg, which exceeded both background concentration (75.5 mg/kg) and the adjusted RSL (39 mg/kg). As described previously, the vanadium RSL is based on a PPRTV, an RfD of 5.00E-3 mg/kg-day for metallic vanadium (USEPA, 2009b), which has been suspended by EPA, and the IRIS file for vanadium pentoxide is under review; thus there are no current EPA-approved toxicity values for inorganic vanadium. However, if the provisional toxicity value were applied to the maximum detected concentration of vanadium in a residential scenario using the procedures shown in Table 2.2, the resulting HQ would be less than one, indicating a limited potential for human health risks due to exposure to vanadium in soil. Therefore, vanadium in soil at 3819 48th Street will not be further considered in a quantitative HHRA.

Table 2.1. Summary of HHRA Review

POI or Area	COPCs Remaining Following Step 3b	HHRA Source	Table Reference
Southern AU	Aluminum Cobalt Iron Vanadium	USEPA 2000	A.5
POI AU	Aluminum Antimony Cobalt	USACE 1995 & USEPA 1999 USEPA 1999 USACE 1995	A.2 & A.4 A.4 A.2
POI 24	Aluminum	USEPA 1999	A.4
POI 53	Aluminum	USEPA 1999	A.4
POI 21/22/23	Aluminum Cobalt Manganese Nickel Vanadium	USACE 1995 USACE 1995 USACE 1995 & USEPA 1999 USACE 1995 USACE 1995 & USEPA 1999	A.2 A.2 A.2 & A.4 A.2 A.2 & A.4
POI 21	Antimony Manganese Thallium	USEPA 1999	A.4
POI 22	Antimony Arsenic Lead Manganese Mercury Vanadium Thallium	USEPA 1999	A.4
POI 23	Arsenic Manganese Vanadium	USACE 1996 USEPA 1999 USEPA 1999	A.3 & A.4
POI 25	Aluminum Antimony Cobalt Manganese Mercury Thallium Vanadium	USACE 1995 & USEPA 1999 USACE 1995 & USEPA 1999 USACE 1995 USEPA 1999 USACE 1995 & USEPA 1999 USACE 1995 & USEPA 1999 USACE 1995 & USEPA 1999	A.2 & A.4 A.2 & A.4 A.2 A.4 A.2 & A.4 A.2 & A.4 A.2 & A.4
POI 7	Aluminum Antimony Manganese	USEPA 1999	A.4
POI 1	Aluminum Cobalt	USEPA 1999 AUES List Data	A.4 A.9
4710Q	Cobalt Aluminum Vanadium	AUES List Data	A.7

Table 2.2. Sample HQ Calculation

Sample Chemical of Potential Concern	Example Soil Concentration (mg/kg) ***(2)***	Chronic Reference Dose (RfD) (mg/kg-day) ***(3)***	**Non-Cancer Hazard Quotient (HQ)**
Incidental Soil Ingestion, Child Resident ***(1)***			
Aluminum	36,400	1.00E+00	**0.5**
Incidental Soil Ingestion, Adult Resident ***(1)***			
Aluminum	36,400	1.00E+00	**0.05**

Notes:
1. Risks for a residential receptor were evaluated for the incidental soil ingestion route using the assumptions and equations shown below. Only those COPCs with EPA-recommended dermal absorption fractions are quantified for the dermal pathway. Currently, USEPA (2004) provides recommended dermal absorption factors for ten chemicals in soil, including only the inorganics arsenic and cadmium.

Incidental Ingestion CDI (mg/kg/day) =

(CS x IR x FI x EF x ED x CF) / (BW x AT)

Dermal Contact CDI (mg/kg/day) =

(CS x SA x AF x DA x EF x ED x CF) / (BW x AT)

To estimate non-cancer risks:

HQ = CDI/RfD

HQ = Hazard Quotient

CDI = Chronic Daily Intake

RfD = Reference Dose (toxicity value)

Acronym	**Definition**	**Value Used**
CS	Chemical Concentration in Soil	mg/kg in soil, as shown above
IR	Ingestion Rate	100 mg/day for child, 50 mg/day for adult
FI	Fraction Ingested from Site	100%
EF	Exposure Frequency	350 days/year
ED	Exposure Duration	33 years for adult, 6 years for child
BW	Body Weight	70 kg for adult, 15 kg for child
AT	Averaging Time	12,045 days for adult, 2,190 days for child
CF	Conversion Factor	0.000001 kg/mg

2. Sample concentration shown is the maximum detection of aluminum from POI 20 (but 95%UCL of mean should be used if available).

3. The toxicity value for aluminum is a provisional peer-reviewed toxicity reference value (PPRTV) (EPA RSL table May 2013).

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3.0 EXPOSURE ASSESSMENT

In the exposure assessment section of an HHRA, first, potential exposure scenarios consisting of potentially exposed populations and exposure routes are listed. The exposure scenarios selected in the previous HHRAs and potential additional exposure scenarios are summarized below. Second, exposure assumptions used to quantify the exposure doses associated with the selected exposure scenarios were reviewed in the context of more recently published USEPA risk assessment guidance. The *Exposure Factors Handbook 2011 Edition (Final)* (2011 EFH) (USEPA, 2011a) has been reviewed to determine if any changes are applicable to the SVFUDS HHRAs. The 2011 EFH provides information on various physiological and behavioral factors commonly used in assessing exposure to environmental chemicals. Each chapter presents recommended values for various exposure factors, as well as a discussion of the underlying data used in developing the recommendations. The EFH was first published in 1989 and was updated in 1997. The updated edition incorporates new data available from 1997 up to July 2011, and reflects the revisions made to the *Child-Specific Exposure Factors Handbook* (USEPA, 2008a). The 2011 EFH supersedes the information presented in the 2008 *Child-Specific Exposure Factors Handbook.*

An overview of exposure assessment changes, and the specific exposure scenarios and assumptions used in the previous HHRAs are reviewed in the sections below.

3.1 Overview of Exposure Assessment Changes

A general summary for each of the changes in exposure parameters is provided below, and is summarized in Table A.11. The key exposure parameters for each pathway are discussed in this section. Other parameters, such as exposure frequency, exposure duration, body weight, and averaging time generally have not changed since the publication of the previous HHRAs.

Incidental Soil Ingestion

For the residential soil contact scenario for both children and adults, the USEPA guidance with respect to incidental soil ingestion has not changed since the previous HHRAs were published. However, based on an earlier USEPA guidance document, the RME incidental soil ingestion rate for the construction worker scenario has been lowered from 480 mg/day to 330 mg/day (USEPA, 2002), which would lower the estimated RME soil ingestion risks previously calculated for construction workers. The previous Central Tendency Exposure (CTE) soil ingestion rate of 100 mg/day would currently be increased to 330 mg/day, increasing the estimated CTE risks.

Dermal Contact with Soil

In several of the previous HHRAs, the dermal exposure pathway was only discussed qualitatively, because dermal absorption values were not previously recommended by the USEPA. Currently, USEPA 2004, provides recommended dermal absorption factors for ten chemicals in soil, including polynuclear aromatic hydrocarbons, arsenic, and cadmium. For those previous HHRAs that did not include the dermal pathway, the addition of this pathway would increase the risk estimates, as discussed in more detail in the following sections for each HHRA.

In addition, certain dermal exposure assumptions have changed, as listed below. These changes may be found in both the EPA's *Risk Assessment Guidance for Superfund (RAGS), Volume I:*

Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final July 2004 (USEPA, 2004), and the 2011 EFH. These changes include:

- Activity-specific soil adherence factors have been increased for some receptors and decreased for other receptors
- Recommended values for exposed skin surface area have changed for both adults and children

Ingestion of Homegrown Vegetables

Recent USEPA guidance (USEPA, 2011) presents per capita (average over the whole population) and consumer-only ingestion rates for all fruits and vegetables, combining both homegrown and commercially purchased. Several of the previous HHRAs did not quantify this potential exposure pathway, stating that the COPCs are not likely to be taken up to a significant degree by plants. If the HHRAs were to be conducted currently, it is likely that this pathway would be evaluated.

Particulate Inhalation

Inhalation exposure assumptions were reviewed based on the USEPA guidance document: *Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual. (Part F, Supplemental Guidance for Inhalation Risk Assessment)* (USEPA, 2009). The recommended inhalation rates have changed slightly (the average inhalation rate for moderate activity has increased, while the RME inhalation rate has decreased), which would result in an increase in the CTE risk estimate and a decrease in the RME risk estimate.

In more recent HHRAs (e.g., the 4825 Glenbrook HHRA), for inhalation exposures, the intake-based approach has been replaced by a new approach which compares air concentrations estimated at a site to acceptable air concentrations (which are Reference Concentrations for non-cancer effects and Inhalation Unit Risk values for cancer endpoints). Thus, for current HHRAs, many of the exposure assumptions for this pathway, such as inhalation rate, are no longer necessary.

In conclusion, various changes have occurred in USEPA exposure assessment guidance. For example, risk results would change with the addition of the dermal and inhalation pathways, and the vegetable ingestion pathway for residential locations. The magnitude of the change would depend on the degree of exposure of site receptors, the toxicity of the COPCs remaining in soil at the site, and the potential uptake of COPCs from soil to plants. However, the approach presented in this HHRA review, that is, the re-screening of all soil data from the SVFUDS using updated risk-based screening levels and background data, ensures that any potential risks associated with soils still in place at SVFUDS would be evaluated and addressed, if necessary, in new HHRAs.

3.2 Exposure Assessment - USACE OSR FUDS HHRA (1995)

The exposure scenarios and pathways that were considered in the 1995 HHRA include residents and construction worker exposures to soils. Exposure pathways that were quantified included incidental soil ingestion for residents, and incidental soil ingestion and particulate inhalation for construction workers. For residents, the dermal exposure, the inhalation of particulates, and the homegrown vegetable ingestion pathways were qualitatively evaluated, that is, risks were not

calculated for these pathways. For the construction workers, dermal risks were not quantified.

3.3 Exposure Assessment - USACE HHRA Spaulding and Captain Rankin Areas (1996)

The exposure scenarios considered in the 1996 HHRA included only construction workers. The exposure pathways included the following: for POI 22 Spaulding Area, exposure to subfloor soil via incidental ingestion and inhalation of particulates; and for POIs 21 and 23, Captain Rankin Area, exposure during demolition of the structure via incidental ingestion of concrete particulates and inhalation of airborne concrete particulates.

3.4 Exposure Assessment - USEPA HHRA (1999)

The exposure scenarios and pathways that were considered in the 1999 HHRA included residents, construction workers, recreational users (representing lounging activities associated with a 4-year college student), and outdoor (groundskeeper) workers. Residential exposure pathways included incidental soil ingestion, dermal contact, and ingestion of homegrown vegetables. For construction workers, exposure to subsurface soil was quantified for incidental soil ingestion and dermal contact.

3.5 Exposure Assessment - USEPA American University HHRA (2000)

The exposure scenarios and pathways that were considered in the 2000 HHRA included: adult and child trespasser and adult maintenance worker, incidental soil ingestion and dermal contact; and adult student athlete and adult construction worker, incidental soil ingestion, dermal contact, and inhalation. The exposure scenario of the adult student athlete, who might live at the university for four years, was considered an appropriate receptor for an active university campus. The residential scenario was not evaluated, because USEPA determined it was not applicable to the university locations assessed in this HHRA.

3.6 Exposure Assessment - USACE EE/CA for 4801 Glenbrook Road HHRA (2000)

Only the residential scenario was quantified in this 2000 HHRA. Residential exposure pathways considered included incidental soil ingestion, dermal contact, and inhalation of particulates. The residential vegetable ingestion pathway was not quantified, because, as stated in this HHRA, the previous HHRA conducted by USEPA (1999) concluded that consumption of home-grown produce is an insignificant contributor to risk. A qualitative assessment was carried out for outdoor workers exposed to surface soil, and for future construction workers exposure to subsurface soil.

3.7 Conclusions Regarding Exposure Assessment

Since the previous HHRAs, changes in exposure assessment guidance and practice have occurred. These changes could change the risks that were previously calculated. However, the approach used in this HHRA review ensures that potential risks associated with soils still in place at SVFUDS are evaluated and addressed, if necessary, in new HHRAs, and, as discussed in Sections 7 and 8, current EPA exposure assessment guidelines would be taken into account.

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4.0 TOXICITY ASSESSMENT

This section presents a review of toxicity assessments conducted as part of the previous HHRAs, and a review of the protectiveness of the arsenic soil cleanup goal for the SVFUDS.

4.1 Review of Previous Toxicity Assessments

Analysis of previous HHRAs was conducted in this HHRA review to determine whether any changes occurred in the procedures or values used in the toxicity assessment (Table A.12). The purpose of the toxicity assessment is to weigh available evidence regarding the potential for particular contaminants to cause adverse effects in exposed individuals and to estimate, where possible, the relationship between the extent of exposure to a contaminant and the increased likelihood and/or severity of adverse effects. For the COPCs at the SVFUDS, the toxicity assessment procedures recommended by USEPA have not changed substantially since the completion of the previous HHRAs.

The on-line USEPA Integrated Risk Information System (IRIS) database and the November 2012 RSL table were consulted to compile the most up-to-date, peer-reviewed toxicity values. The toxicity values used in previous HHRAs were changed in some cases, and in other cases, have been removed from IRIS and only provisional peer-reviewed toxicity values (PPRTVs) are currently available. For aluminum, beryllium, chromium, iron, manganese, mercury, and thallium, for some of the previous HHRAs, a change in the reference doses (RfDs) has occurred. Although these changes could affect the conclusions of the previous HHRAs, the HHRA review presented in this document applies current RSLs that incorporate updated RfDs and slope factors in the screening of all detected chemicals in soil, thereby ensuring that potential risks associated with soils still in place at SVFUDS are evaluated, and addressed if necessary.

As described in Section 2, USEPA RSLs reflect current toxicity values, and are updated by EPA over time if necessary, based on their review of newly published toxicity research. For this HHRA review, the use in the initial COPC screen of the up-to-date RSLs, which incorporate the most recent EPA toxicity values, for all detected chemicals in soil, ensures that the most recent toxicity data are being used to evaluate COPCs in soil at SVFUDS.

4.2 Review of the Protectiveness of the Arsenic in Soil Cleanup Goal for the SVFUDS

The SVFUDS arsenic clean up goal of 20 mg/kg was developed jointly by the Spring Valley Partners (USACE, USEPA, and the District of Columbia Department of the Environment). A screening evaluation of this concentration for adult and child residents, using RME (upper bound) assumptions was completed for this HHRA review.

Using a residential scenario with default exposure parameters (Table 4.1), the results indicate that the HI for arsenic for children is less than one (0.88), the HI for adults is also less than one (0.12), and incremental cancer risks for children (3.4E-05) and adults (2.7E-05) are within USEPA's acceptable range of 1E-04 to 1E-06. The incremental cancer risks for children and adults combined (6.1E-05) are within USEPA's acceptable range of 1E-04 to 1E-06.

Table 4.1: Risks Associated with 20 mg/kg Arsenic in Soil

Non-Cancer Hazard				Estimated Cancer Risk	
Resident Adult	Soil Exposure Concentration (mg/kg)	Chronic RfD (mg/kg-day)	RME Hazard Quotient	Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	RME Incremental Cancer Risks
Incidental Ingestion Pathway					
Arsenic	20	3.00E-04	0.091	1.50E+00	1.94E-05
Dermal Pathway	20	Absorbed RFD for Dermal Pathway (mg/kg-day) 4.00E-04	RME Hazard Quotient 0.024	Adjusted Cancer Slope Factor for Dermal Pathway $(mg/kg\text{-}day)^{-1}$ 1.50E+00	RME Incremental Cancer Risks 6.83E-06
Inhalation Pathway	Air Concentration (mg/m^3) NA	Inhalation Chronic RfC (mg/m^3) NA	RME Hazard Quotient NA	Inhalation Unit Risk Factor $(mg/m^3)^{-1}$ 2.00E+01	RME Incremental Cancer Risks 1.14E-06
		Adult HI Total =	**0.12**	**Adult Incremental Cancer Risk Total =**	**2.7E-05**

Resident Child	Soil Exposure Concentration (mg/kg)	Chronic RfD (mg/kg-day)	RME Hazard Quotient	Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	RME Incremental Cancer Risks
Incidental Ingestion Pathway					
Arsenic	20	3.00E-04	0.85	1.50E+00	3.3E-05
Dermal Pathway	20	Absorbed RFD for Dermal Pathway (mg/kg-day) 3.00E-04	RME Hazard Quotient 0.03	Adjusted Cancer Slope Factor for Dermal Pathway $(mg/kg\text{-}day)^{-1}$ 1.50E+00	RME Incremental Cancer Risks 1.1E-06
Inhalation Pathway	Air Concentration (mg/m^3) 1.57E-08	Inhalation Chronic RfC (mg/m^3) NA	RME Hazard Quotient NA	Inhalation Unit Risk Factor $(mg/m^3)^{-1}$ 4.30E-03	RME Incremental Cancer Risks 4.5E-11
		Child HI Total =	**0.88**	**Child Incremental Cancer Risk Total =**	**3.4E-05**

Notes:
NA=not applicable to pathway
Child exposure factors used:

Parameter Definition	Units	RME Value	Reference
Incidental Soil Ingestion Rate	mg/day	100	USEPA 2011
Fraction Ingested from Site	unitless	100%	Assumed
Exposure Frequency	day/yr	350	USEPA 1991
Exposure Duration	yr	6	Assumed
Body Weight	kg	15	USEPA 1991
Surface Area for Contact	cm^2/event	4,070	USEPA 2011
Adherence Factor	mg/cm^2	0.054	USEPA 2011

Adult exposure factors used:

Parameter Definition	Units	RME Value	Reference
Incidental Soil Ingestion Rate	mg/kg	100	Assumed
Fraction Ingested from Site	unitless	100%	Assumed
Exposure Frequency	day/yr	350	USEPA 1991
Exposure Duration	yr	33	USEPA 2011
Body Weight	kg	70	USEPA 1989
Surface Area for Contact	cm^2/event	15,474	USEPA 2011
Adherence Factor	mg/cm^2	0.07592	USEPA 2011
Air Exposure Time	Hrs/dy	8	Assumed

5.0 UNCERTAINTY DISCUSSION

All HHRAs involve the use of assumptions, judgments, and imperfect data to varying degrees, resulting in uncertainties in the final estimates of risk. These uncertainties are generally associated with each step of the HHRA process (data evaluation and identification of COPCs, exposure assessment, toxicity assessment, and risk characterization) (USEPA, 1989). The parameters used in the five previous HHRAs conducted within the SVFUDS were characteristically conservative and tended to over-estimate potential site-related risks. This uncertainty section provides an overview of the inherent uncertainties generally associated with conducting an HHRA, along with the uncertainties associated with the conclusions of this HHRA review.

5.1 Overview of Previous HHRA Uncertainties

In general, there are uncertainties associated with all HHRAs, such as the following:

1. **Data Evaluation and Identification of COPCs:**
   - Screening levels are not available for all detected analytes.
   - Generic screening levels are based on conservative exposure assumptions that may not be appropriate for a site, possibly resulting in a greater number of analytes selected as COPCs.
   - In previous HHRAs, when the maximum detected concentration was used as a comparison value, this is a conservative approach, because this value does not necessarily accurately reflect the actual range of site contamination to which a receptor would be exposed.
2. **Exposure Assessment:**
   - Generally, the selection of conservative exposure assumptions for HHRAs, in particular, for the RME scenario, may result in over-estimates of risk.
   - The exclusion of certain exposure pathways would potentially under-estimate site risks.
3. **Toxicity Assessment:**
   - USEPA's published toxicity values, although they have been peer-reviewed and are based on available data, have uncertainty associated with the selection of the toxic effect level and the application of uncertainty factors to that effect level.
   - In the previous HHRAs, there were several selected COPCs without USEPA-approved toxicity values at that time, including thallium and vanadium:
     - For thallium compounds, the only toxicity values available from the hierarchy of toxicity sources were developed by California EPA for public health goals for chemical substances in drinking water. However, the principal study used by California EPA was reviewed by the IRIS program and found to be inappropriate for the development of toxicity values. Therefore, there are no toxicity values

available for thallium. The primary targets of thallium toxicity are the nervous, integumentary, and reproductive systems. Human and animal chronic exposures result in alterations of the brain, spinal cord, and peripheral nerves. In both humans and animals, alopecia is the most common indicator of long-term thallium poisoning (ORNL RAIS, 1994).

  - For vanadium compounds, the provisional RfD (i.e., PPRTV) for metallic vanadium has been suspended, and the IRIS file for vanadium pentoxide is under review. Therefore, there are no toxicity values for vanadium. Based on occupational exposure studies, human experimental studies, and studies in laboratory animals, the respiratory tract following inhalation exposure and the gastrointestinal tract, hematological system, and developing organism following oral exposure are the primary targets of vanadium toxicity.

- The Cancer Slope Factor (CSF) for arsenic is under review by USEPA, and a change in this toxicity factor could affect the cancer risk estimates.
- Although the arsenic soil screening level for residential use is quite conservative (0.39 mg/kg), the arsenic clean up goal at SVFUDS is 20 mg/kg, as was developed jointly by the Spring Valley Partners (USACE, USEPA, and the District of Columbia Department of the Environment).
- Arsenic can exist in a variety of forms in soils. The form of arsenic in soil could influence its bioavailability, and also its toxicity. Risk assessments and regulatory guidelines make the simplifying and conservative assumption that all arsenic in soil is present as inorganic arsenic (arsenate or arsenite), estimate risks based on total arsenic content, and assume 100% bioavailability. Arsenic has reduced bioavailability in soil, thereby affecting its toxicity. This reduction in bioavailability is primarily a function of the presence of less soluble mineral phases and ionic forms that are strongly adsorbed to soil particles or coprecipitated with other elements in soil (NAVFAC, 2000). In one study, relative bioavailability measurements were obtained from five different soil samples and five animal models, with bioavailability results ranging from 11% to a high of 25%, with 25% recommended as the conservative, upper bound value (FLDEP, 2003). Arsenic bioavailability is not taken into account in this HHRA review or in previous HHRAs. That is, all arsenic in soil at the SVFUDS is assumed to be 100% bioavailable, which would tend to greatly overestimate the risk due to soil ingestion of arsenic. Note that on 31 December 2012, an OSWER Directive was released recommending a relative bioavailability factor of 60% for arsenic in soil (in the absence of site-specific data); the previous default value was 100%. That information may be considered in future risk evaluations involving arsenic in soil.

4. Risk Characterization:

- The potential for interactions between multiple chemicals, multiple pathways and other combinations was not specifically evaluated for the COPCs evaluated in previous HHRAs.

- Uncertainties are associated with summing risks or hazard indices for several substances, in particular if the substances have different toxic endpoints.

5.2 HHRA Review Uncertainties

There are also uncertainties associated with this HHRA review. The process developed in this document to screen COPCs addresses the conservatism of using the maximum detected concentration as a comparison value in the initial screen. In particular, the application of the additional screening steps, including a statistical comparison of the data to the newer 2008 background data to determine whether a constituent exceeds background, and removal of excavated soil samples and replacement with clean backfill, are more supportable approaches to select COPCs than the simple use of the maximum detected value.

In the additional screening step of calculating a risk ratio, in some cases the use of ProUCL to determine the 95% UCL of the mean was not possible, given a small number of samples. In these cases, the maximum detected concentration was used in the risk ratio, providing the same conclusion as that in the initial screen. Similarly, when fewer than five samples were available for a particular location, the statistical comparison to background could not be done. Thus, a low number of samples at some locations adds uncertainty to this analysis. Finally, in some cases 95% UCLs and/or background testing was done with the minimum number of samples. This had the effect of reducing the statistical power of the conclusions.

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6.0 CONCLUSIONS

Changes in screening levels (Section 2.0), exposure assumptions (Section 3.0), and toxicity values (Section 4.0) used in the previous HHRAs could impact the risk results and conclusions of those previous HHRAs. However, as described in this report, the process of using current criteria to re-screen all detected chemicals to identify remaining COPCs, and then evaluating any potential risks associated with the remaining COPCs in new HHRAs, if necessary (as described in Section 7.0), will effectively address any remaining risk issues at SVFUDS.

As described in Section 2.0, changes/updates in screening levels were addressed by re-screening all chemicals detected in the pre-2005 HHRAs, whether or not the chemical was previously selected as a COPC. These screens against updated RSLs and background values, along with the additional screening steps described in Section 2.3, ensure that any COPCs that are still present in soil will be evaluated for potential human health risks.

In Section 3.0, exposure scenarios and exposure parameters were reviewed relative to the previous HHRAs. Parameters that have changed will be incorporated into future Spring Valley HHRAs, if any, which may be conducted based on the recommendations in Section 7.0 of this report. In particular, exposure pathways that were not previously quantified would be added to the HHRAs. Incidental soil ingestion, dermal contact, inhalation, and vegetable ingestion pathways would be quantified, as appropriate for potentially exposed populations at specific SVFUDS sites. Receptors at residential locations would include residents, outdoor (groundskeeper) workers, and construction/utility workers, while university properties would be assessed for outdoor workers and student recreational users, and for theoretical future residential use.

In Section 4.0, all toxicity values used to quantify the potential risks associated with selected COPCs in the previous HHRAs were reviewed. Several changes had occurred in the toxicity values listed for the selected COPCs in each of the five previous HHRAs. Any future HHRAs for SVFUDS will use the most up-to-date toxicity values.

Based on this HHRA review, the following conclusions can be made:

- Some COPCs are still present in soil in selected areas.
- Changes in exposure assumptions and additional exposure scenarios would cause some changes in the estimated risks calculated in some of the previous HHRAs.
- Several toxicity values have changed since the previous HHRAs were conducted.

Based on the above discussion, if any additional HHRAs are determined to be required, current exposure approaches and toxicity values would be incorporated.

Table 6.1 is a summary of the COPCs selected in the initial and additional screening steps (through Step 3b) conducted in this HHRA review, organized by POI or area of investigation (note that this is a repeat of Table 2.1). Figure 4 shows each of these areas and their associated COPCs. Table A.1 presents the details of all the screening steps, organized by previous HHRAs.

Table 6.1. Summary of HHRA Review

POI or Area	COPCs Remaining Following Step 3b	HHRA Source	Table Reference
Southern AU	Aluminum Cobalt Iron Vanadium	USEPA 2000	A.5
POI AU	Aluminum Antimony Cobalt	USACE 1995 & USEPA 1999 USEPA 1999 USACE 1995	A.2 & A.4 A.4 A.2
POI 24	Aluminum	USEPA 1999	A.4
POI 53	Aluminum	USEPA 1999	A.4
POI 21/22/23	Aluminum Cobalt Manganese Nickel Vanadium	USACE 1995 USACE 1995 USACE 1995 & USEPA 1999 USACE 1995 USACE 1995 & USEPA 1999	A.2 A.2 A.2 & A.4 A.2 A.2 & A.4
POI 21	Antimony Manganese Thallium	USEPA 1999	A.4
POI 22	Antimony Arsenic Lead Manganese Mercury Vanadium Thallium	USEPA 1999	A.4
POI 23	Arsenic Manganese Vanadium	USACE 1996 USEPA 1999 USEPA 1999	A.3 & A.4
POI 25	Aluminum Antimony Cobalt Manganese Mercury Thallium Vanadium	USACE 1995 & USEPA 1999 USACE 1995 & USEPA 1999 USACE 1995 USEPA 1999 USACE 1995 & USEPA 1999 USACE 1995 & USEPA 1999 USACE 1995 & USEPA 1999	A.2 & A.4 A.2 & A.4 A.2 A.4 A.2 & A.4 A.2 & A.4 A.2 & A.4
POI 7	Aluminum Antimony Manganese	USEPA 1999	A.4
POI 1	Aluminum Cobalt	USEPA 1999 AUES List Data	A.4 A.9
4710Q	Cobalt Aluminum Vanadium	AUES List Data	A.7

7.0 RECOMMENDATIONS

This section discusses the next steps recommended to address the COPCs shown in Table 6.1. The approach is to identify and focus on larger exposure units (EUs), integrate the pre-2005 HHRA samples (older samples) with more recent samples (newer samples) collected in 2012, and conduct risk analysis on a single data set for each EU. An EU is a geographical area in which a receptor is randomly exposed to a contaminated medium for a relevant exposure duration (USEPA, 2001).

7.1 Exposure Units

The POIs or areas of investigation with remaining COPCs, as shown in Table 6.1, have been grouped into EUs based on similar past practices, similar receptor populations and exposure pathways, and geography. The intent is to assess an area based on all data available, without regard as to when the data were collected. An assessment of the compatibility between EU size and the exposure scenarios that are applicable at SVFUDs indicates that, because of the similar residential exposure scenarios across all of the SVFUDS, excluding the AU campus, the EU sizes are compatible with potential exposures to residents and workers in these neighborhoods. Development of larger areas of concern as EUs is not inconsistent with EPA risk assessment practice, in particular if the receptors are the same across the area. During the next steps (as discussed below) detected concentrations using both historic and more recent sampling events will be reviewed to ensure that the identified EUs do not dilute higher concentrations over the larger area.

The EUs are shown on Figure 5 and are described as follows:

7.1.1 <u>Southern AU</u>

This EU is defined by previous areas of investigation. The 'Southern AU' EU combines the area addressed in the USEPA 2000 HHRA, and POI AU and portions of POIs 24 and 53 addressed in the USACE 1995 and USEPA 1999 HHRAs. However, the southeastern reaches of the POI AU and USEPA 2000 footprints are not included as that acreage is covered under the AU Public Safety Building Human Health Risk Assessment (a separate document). The intent of this EU boundary is to integrate all previous investigations and define an area with common receptors and exposure pathways, in accordance with the USEPA definition of an EU. This is an active university campus with no full time permanent residences. Only that portion of POI 53 that covers the AU campus is included in this EU. That is, only those samples from POI 53 collected on the AU campus would be part of the further risk evaluation of this EU as discussed in Section 7.3.

The AU/CDC area and associated samples are not included in this EU for several reasons: the basis of the new EU was the USEPA 2000 HHRA footprint, which did not extend to the CDC; the CDC was a relatively small discrete area that was essentially completely excavated and backfilled, as reflected by the lack of COPCs shown in Table A.8; combining all of those samples with the larger areas addressed in the USEPA HHRA would be more confusing than helpful.

The data sets that will be used to assess this area, as shown in Table 7.1, include the various

previous investigations: USACE 1995, USEPA 1999, and USEPA 2000, and the recent sampling (Section 7.2).

7.1.2 Spaulding-Rankin Area

This EU is defined by previous areas of investigation. It is limited to a single residential property previously known as the Spaulding-Rankin area (1995 OSR FUDS RI), where the Range Fan firing point and concrete shell pits were located. The EU includes POIs 21, 22, 23, and 25 (POI 25 location as identified and as sampled for the 1995 RI). Although there are other residential properties nearby that were included in the pre-2005 HHRAs, it is recommended that this property be maintained as a discrete EU based on the differences in past activities that occurred within this EU versus the other nearby residential properties. Note that the POI 23 terminus samples are actually located on the 4845 Glenbrook Road property, but these data will be included with the SCRA data set based on similar analytes and past practices, and will not be included with the "Western Portion of POI 53" EU.

The data sets that will be used to assess this area, as shown in Table 7.1, include the various previous investigations: USACE 1995, USACE 1996, USEPA 1999, and the recent sampling (Section 7.2). Note that the mercury data from USACE 1995 (and USEPA 1999, where USEPA used USACE split data) will not be used in the risk evaluation because the inappropriate analytical method (inductively coupled plasma) had been used resulting in unrealistically high values, as has been documented in various SVFUDS presentations and discussions.

7.1.3 AOI 9

This EU is defined by AOI 9, which contains POI 1, the circular trenches where static testing of CWM munitions was conducted, and POI 7, where agent persistency testing was reportedly conducted. The 1995 RI also indicates a number of ground scars in the vicinity of POI 1 that became POIs 2, 3, 4, 5, 6, and 8. Portions of AOI 9 fall within the downrange impact areas of the Range Fan.

This EU includes multiple residential properties and the EU boundary integrates all previous POI investigations and defines an area with common receptors and exposure pathways, consistent with the USEPA definition of an EU**.**

The data sets that will be used to assess this area, as shown in Table 7.1, include the various previous investigations: USACE 1995, USEPA 1999, and USEPA 2003, the recent sampling (Section 7.2), and soil sampling associated with various anomaly investigations conducted at individual properties within this EU.

7.1.4 AOI 13

This EU is defined by AOI 13, which is located west of AU between Quebec Street and Woodway Lane. AOI 13 contains multiple 1918 ground scars, including POI 26. Three AUES buildings were located within AOI 13 and the northern edge of the Range Fan passes through a portion of it. This EU boundary includes 13 residential properties (including 4710Q) and the intent is to integrate all previous investigations and define an area with common receptors and exposure pathways, consistent with the USEPA definition of EU**.**

The data sets that will be used to assess this area, as shown in Table 7.1, include the various previous investigations: USACE 1995, USEPA 2003, the recent sampling (Section 7.2), and soil sampling associated with various anomaly investigations conducted at individual properties within this EU.

7.1.5 Western Portion of POI 53

This EU is defined by that portion of POI 53 not covered by other EUs. As more clearly shown in Figure 3, only a relatively small western portion of POI 53 is not covered under the other defined EUs (Spaulding-Rankin, Southern AU, and AOI 13). This EU comprises residential properties along Glenbrook Road with common receptors and exposure pathways, consistent with the USEPA definition of EU**.** Although no COPCs were identified for POI 53 through the initial and additional screens, recent sampling (Section 7.2) collected from some of these properties will be part of the further risk evaluation discussed below.

The data sets that will be used to assess this area, as shown in Table 7.1, include the various previous investigations: USACE 1995, USEPA 1999, and the recent sampling (Section 7.2).

7.2 Recent Sampling

The *Final Evaluation Document* (USACE, 2012) provided a plan for supplemental sampling to fill identified data gaps and ensure that areas were fully characterized to support conclusions about potential human health risks. The sampling was based on the recommendations in the Area of Interest (AOI) Memoranda (USACE 2012a) which summarized possible historical AUES impacts not addressed in ongoing investigations, or possible data gaps, and made recommendations to the partners regarding whether any additional investigation was necessary. This recent sampling was completed in the Fall-Winter of 2012. This recent sampling also included AOI 8 and AOI 11, areas not part of the previous HHRAs, but which will be included in the further risk evaluation described in Section 7.3. However, as these areas were not part of the review conducted in this document, they are not shown on Figure 5.

In addition to the Evaluation Document sampling, miscellaneous sampling efforts conducted during anomaly investigations, or other samples collected for various reasons after the previous HHRAs were completed, will be used to supplement the data set for a given EU.

Table 7.1 provides the proposed EUs, the POI or areas addressed, and the sample data sets that will be combined to determine COPCs in each EU. Table 7.1 indicates that newer sampling data exists for all five of the proposed EUs. This is also shown on Figure 5.

Table 7.1 Proposed EUs for Additional Risk Evaluation

Proposed Exposure Unit	POI or Area Addressed	Samples to be used
Southern AU	Southern AU, POI AU, POI 53, and POI 24	Approx. 70 samples: USACE 1995 USEPA 1999 USEPA 2000 New (Evaluation Document)
Spaulding – Rankin Area	POIs 21, 22, 23, and 25	Approx. 70 samples: USACE 1995 USACE 1996 USEPA 1999 New (Evaluation Document)
AOI 9	Multiple properties including POI 1 and POI 7	Approx. 70 samples: USACE 1995 USACE 1999 USACE 2003 USACE Anomaly Investigations New (Evaluation Document)
AOI 13	Multiple properties including 4710Q	Approx. 20 samples: USACE 1995 USACE 2003 USACE Anomaly Investigations New (Evaluation Document)
Western Portion of POI 53	Part of POI 53 (Multiple properties along Glenbrook Road)	Approx. 15 samples: USACE 1995 USEPA 1999 New (Evaluation Document)

7.3 Recommended Approach for Further Risk Evaluation

The proposed approach for further risk evaluation is to combine older and newer sample results into a single data set for each of the EUs, as defined above, and screen the data following the steps described in Section 2.0. The screening of the combined data sets will be completed for all chemicals in the data set, not just the COPCs shown in Table 6.1 (i.e., not just those COPCs remaining following Step 3b). If no COPCs remain in an EU following the screening, that EU drops out and is not considered further. If COPCs remain following the screen, that EU will undergo a complete HHRA consisting of exposure assessment, toxicity assessment, and risk characterization steps (this includes AOIs 8 and 11).

If complete HHRAs are required for any of these EUs, the procedures described below will be followed.

The exposure assessments will include the following receptors at residential locations: adult and child residents, outdoor (groundskeeper) workers, and construction/utility workers, while university properties will be assessed for outdoor workers, student recreational users (representing lounging activities associated with a 4-year college student), and future theoretical residential users. Exposure pathways will include incidental soil ingestion, dermal contact, inhalation, and vegetable ingestion pathways, as appropriate for each EU.

The steps of a toxicity evaluation will include:

- Gathering toxicity information for the COPCs being evaluated;
- Identifying exposure periods for which toxicity values are necessary (e.g., chronic or sub-chronic); and
- Determining toxicity values for carcinogenic and non-carcinogenic effects (i.e., carcinogenic slope factors [SFs] and inhalation unit risks for carcinogens, and RfDs and reference concentrations [RfCs] for non-carcinogens).

Toxicity information would be obtained from the following hierarchy of primary sources:

- USEPA's IRIS on-line;
- USEPA's Provisional Peer Reviewed Toxicity Values;
- Agency for Toxic Substances and Disease Registry's Minimal Risk Levels;
- Toxicity Criteria Database (CalEPA, Office of Environmental Health Hazard Assessment, 2009); and
- USEPA's Health Effects Summary Tables (USEPA 1997).

The final step of an HHRA is the risk characterization step, integrating the toxicity and exposure assessment outputs into quantitative expressions of risk. The total pathway-specific risk for a receptor will be derived by summing all the risks or hazards for all the chemicals in that pathway. The total carcinogenic risk for a receptor across all media and pathways will be derived by adding all the pathway specific risks or hazards. The acceptable incremental risk range of $1x10^{-6}$ to $1x10^{-4}$ is used to evaluate total cancer risks. The sum of HQs is referred to as a hazard index (HI). If a total receptor-specific HI exceeds one (HI > 1), there is a potential for non-cancer health effects, and the COPCs that contribute to that HI will be separated by target organ.

The conclusions of the EU-specific HHRAs, if conducted, will be taken into account in the risk management phase, when considering whether additional actions are required to protect public health at these locations.

8.0 REFERENCES

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APPENDIX A:
TABLES

Table A.1: Summary - Screening of Chemicals of Potential Concern from Previous HHRAs
Table A.2: USACE OSR FUDS HHRA (1995 RI) – Screening Review
Table A.3: USACE HHRA for Spaulding and Captain Rankin Areas (RI Report, 1996) – Screening Review
Table A.4: USEPA Region III HHRA (1999) – Screening Review
Table A.5: USEPA American University HHRA (2000) - Southern AU – Screening Review
Table A.6: USACE HHRA for the 4801 Glenbrook Road Property (2000) – Screening Review
Table A.7: Screening of Comprehensive List Detections for Selected OU-4 Residences
Table A.8: Screening of Comprehensive List Detections for AU Lot 12 and CDC
Table A.9: Screening of Comprehensive List Detections for Sedgwick Trench
Table A.10 Metals Background Data
Table A.11: Summary of Exposure Assessment Changes
Table A.12: Review of Toxicity Values

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TABLE A.1												ADDITIONAL SCREEN FOR PROVISIONAL COPCS						
Summary of COPCs from Previous HHRAs		All Units: mg/kg							INITIAL SCREEN			Step 1	Step 2	Conclusion following Additional Screening Steps 1 and 2	Step 3a	Conclusion following Step 3a	Step 3b	Conclusion following Step 3b
Area	Provisional COPC	Screening Levels Used in HHRA		USEPA Nov 2012 RSLs	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Concentration	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	Risk Ratio >1?	Statistical Comparison to Background	COPC?	Excavation of Soil (deletion of data points)	COPC?	Insert BF and re-run Steps 1 & 2	COPC?
FROM TABLE A.2 OSR FUDS RI HHRA (1995)																		
POI 21/22/23	Aluminum	23,000	NC	7,700	4,860/77,833	19,100	24,662	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels (from Sections 6.5.3.1.6 and 6.5.3.1.7 of HHRA)	YES	**Site>BG**	**YES**				
	Antimony	3.1	NC	3.1	4.67 U	5.2	ND	YES	**YES**	**ND, but DL >SL**	Unclear why originally selected as COPC	NO	--	NO				
	Cobalt	470	NC	2.3	21.70/2.39	17.8	427	NO	**YES**	**Max >SL and >BG**	SL decreased	YES	**Site>BG**	**YES**				
	Manganese	39	NC	180	851/138	968	3,248	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**				
	Nickel	160	NC	150	41.37	33.5	335	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**				
	Thallium	0.63	NC	0.078	14.29 U	2.2	7.39	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	Vanadium	55	NC	39	47.93	75.5	195	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**				
POI 25	Aluminum	23,000	NC	7,700	4,860/77,833	19,100	37,428	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**				
	Antimony	3.1	NC	3.1	4.67 U	5.2	16.45	YES	**YES**	**Max >SL and >BG**	Selected as a COPC, but risks not calculated	YES	**Site>BG**	**YES**				
	Cobalt	470	NC	2.3	21.70/2.39	17.8	80.57	NO	**YES**	**Max >SL and >BG**	SL decreased	YES	**Site>BG**	**YES**				
	Mercury	2.3	NC	1	0.07	0.25	28	NO	**YES**	**Max >SL and >BG**	No rationale provided in HHRA why not selected as a COPC (Section 6.5.4.1.1)	YES	**Site>BG**	**YES**				
	Selenium	39	NC	39	12.21 U	1.2	47	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	--	NO				
	Thallium	0.63	NC	0.078	14.29 U	2.2	75.72	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels; CT risks for construction workers <1, DL>RSL	YES	**Site>BG**	**YES**				
	Vanadium	55	NC	39	47.93	75.5	136	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**				

TABLE A.1												ADDITIONAL SCREEN FOR PROVISIONAL COPCS						
Summary of COPCs from Previous HHRAs		All Units: mg/kg							INITIAL SCREEN			Step 1	Step 2	Conclusion following Additional Screening Steps 1 and 2	Step 3a	Conclusion following Step 3a	Step 3b	Conclusion following Step 3b
Area	Provisional COPC	Screening Levels Used in HHRA		USEPA Nov 2012 RSLs	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Concentration	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	Risk Ratio >1?	Statistical Comparison to Background	COPC?	Excavation of Soil (deletion of data points)	COPC?	Insert BF and re-run Steps 1 & 2	COPC?
	Phenanthrene	NA		NA		0.4074	2	NO	**YES**	**Max >BG**	All PAHs detected in 1 sample (SV-BAKER-03) of 14	NA	Site ≤ BG	NO				
TABLE A.2 Cont.	Benzo[a] anthracene	0.88	C	0.15		0.3575	2.4	NO, based on no historical use of PAHs at the AUES	**YES**	**Max >SL and >BG**	All PAHs detected in 1 sample (SV-BAKER-03) of 14	YES	Site ≤ BG	NO				
POI AU	Benzo[b] fluoranthene	0.88	C	0.15		0.3657	1.7	NO, based on no historical use of PAHs at the AUES	**YES**	**Max >SL and >BG**	All PAHs detected in 1 sample (SV-BAKER-03) of 14	YES	Site ≤ BG	NO				
	Benzo[k] fluoranthene	8.8	C	1.5		0.3566	2.2	NO	**YES**	**Max >SL and >BG**	All PAHs detected in 1 sample (SV-BAKER-03) of 14	NO	--	NO				
	Benzo(a) pyrene	0.088	C	0.015		0.375	2	NO, based on no historical use of PAHs at the AUES	**YES**	**Max >SL and >BG**	All PAHs detected in 1 sample (SV-BAKER-03) of 14	YES	Site ≤ BG	NO				
	Aluminum	23,000	NC	7,700	4,860/77,833	19,100	56,138	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**	4 of 14 data points excavated, re-run steps 1 & 2	**YES** Site > BG	16 Fill samples averaged, then replaced 4 deleted sx	**YES Site > BG**
	Antimony	3.1	NC	3.1	4.67 U	5.2	ND	NO	**YES**	**ND, but DL >SL**		YES	Site ≤ BG	NO				
	Cobalt	470	NC	2.3	21.70/2.39	17.8	193	NO	**YES**	**Max >SL and >BG**	SL decreased	YES	**Site>BG**	**YES**	4 of 14 data points excavated, re-run steps 1 & 2	**YES** Site > BG	16 Fill samples averaged, then replaced 4 deleted sx	**YES Site > BG**
	Manganese	39	NC	180	851/138	968	3,070	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
	Mercury	2.3	NC	1	0.07	0.25	9.74	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	4 of 14 data points excavated, re-run steps 1 & 2	**YES** Site > BG	16 Fill samples averaged, then replaced 4 deleted sx	NO Site ≤ BG
	Nickel	160	NC	150	41.37	33.5	176	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	NO	--	NO				
	Thallium	0.63	NC	0.078	14.29 U	2.2	28.56	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
	Vanadium	NA	NC	39	47.93	75.5	488	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**	4 of 14 data points excavated, re-run steps 1 & 2	NO Site ≤ BG		
LTC Bancroft	Aluminum *	23,000	NC	7,700	4,860/77,833	19,100	27,783	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**	SL and BG decreased	YES	NA	**YES ***				
	Cadmium *	3.9	NC	7	1.43	2.36	29	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	NA	**YES ***				
	Thallium *	0.63	NC	0.078	14.29 U	2.2	8	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**	BG and SL decreased	YES	NA	**YES ***				
	Zinc	2,300	NC	2,300	69.76/726.56	158	2,548	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	NO	NA	NO				

TABLE A.1												ADDITIONAL SCREEN FOR PROVISIONAL COPCS						
Summary of COPCs from Previous HHRAs		All Units: mg/kg							INITIAL SCREEN			Step 1	Step 2	Conclusion following Additional Screening Steps 1 and 2	Step 3a	Conclusion following Step 3a	Step 3b	Conclusion following Step 3b
Area	Provisional COPC	Screening Levels Used in HHRA		USEPA Nov 2012 RSLs	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Concentration	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	Risk Ratio >1?	Statistical Comparison to Background	COPC?	Excavation of Soil (deletion of data points)	COPC?	Insert BF and re-run Steps 1 & 2	COPC?
FROM TABLE A.3 Spaulding/Captain Rankin Areas HHRA (1996)																		
POI 22: Spaulding subfloor	Arsenic	0.36	C	0.39	3.54	12.6	26.9	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
POI 23: Pipe drain debris	Arsenic	0.36	C	0.39	3.54	12.6	131	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	NA	**YES**				

TABLE A.1												ADDITIONAL SCREEN FOR PROVISIONAL COPCS						
Summary of COPCs from Previous HHRAs		All Units: mg/kg							INITIAL SCREEN			Step 1	Step 2	Conclusion following Additional Screening Steps 1 and 2	Step 3a	Conclusion following Step 3a	Step 3b	Conclusion following Step 3b
Area	Provisional COPC	Screening Levels Used in HHRA		USEPA Nov 2012 RSLs	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Concentration	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	Risk Ratio >1?	Statistical Comparison to Background	COPC?	Excavation of Soil (deletion of data points)	COPC?	Insert BF and re-run Steps 1 & 2	COPC?
FROM TABLE A.4 USEPA HHRA (1999)																		
4825 Glenbrook Road	Aluminum	7,800	NC	7,700	80,000	19,100	39,600	NO, based on technical considerations	**YES**	**Max >SL and >BG**		**Additional screening not done because site has been or will soon be excavated**						
	Antimony	3.1	NC	3.1	0.2	5.2	7.8	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels							
	Arsenic	0.43	C	0.39	1.8	12.6	241	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**								
	Manganese	160	NC	180	950	968	973	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**								
	Vanadium	55	NC	39	135	75.5	122	NO, based on technical considerations	**YES**	**Max >SL and >BG**								
POI 53 Baker Valley	benzo(a) anthracene	0.87	C	0.15		0.3575	3.8	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	benzo(b) fluoranthene	0.87	C	0.15		0.3657	3.4	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	benzo(a) pyrene	0.087	C	0.015		0.375	2.8	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	indeno(1,2,3-cd)pyrene	0.87	C	0.15		0.3347	2.0	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	dibenz(a,h) anthracene	0.087	C	0.015		0.51	1.1	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	aluminum	7,800	NC	7,700	80,000	19,100	43,900	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	2 of 10 data points excavated, re-run steps 1 & 2	**YES** Site > BG	16 Fill samples averaged, then replaced 2 deleted sx	**YES Site > BG**
	antimony	3.1	NC	3.1	0.2	5.2	36.3	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for child resident	YES	Site ≤ BG	NO				
	arsenic	0.43	C	0.39	1.8	12.6	13.5	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
	manganese	160	NC	180	950	968	1,380	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
	thallium	0.63	NC	0.078	0.5	2.2	ND	NO	**YES**	**ND, but DL >SL**		YES	Site ≤ BG	NO				
	vanadium	55	NC	39	135	75.5	243	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	2 of 10 data points excavated, re-run steps 1 & 2	**NO** Site < BG		
POI American University	benzo(a) anthracene	0.87	C	0.15		0.3575	3.8	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	benzo(b) fluoranthene	0.87	C	0.15		0.3657	3.4	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	benzo(a) pyrene	0.087	C	0.015		0.375	2.8	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	indeno(1,2,3-cd)pyrene	0.87	C	0.15		0.3347	2	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	dibenz(a,h) anthracene	0.087	C	0.015		0.51	1.1	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	aluminum	7,800	NC	7,700	80,000	19,100	57,700	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	3 of 13 data points excavated, re-run steps 1 & 2	**YES** Site > BG	16 Fill samples averaged, then replaced 3 deleted sx	**YES Site > BG**
	antimony	3.1	NC	3.1	0.2	5.2	40.4	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for child resident	YES	**Site>BG**	**YES**	3 of 13 data points excavated, re-run steps 1 & 2	**YES** Site > BG	16 Fill samples averaged, then replaced 3 deleted sx	**YES Site > BG**
	arsenic	0.43	C	0.39	1.8	12.6	13.5	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	3 of 13 data points excavated, new max is 11.4 ppm	NO (Max < BG)		

TABLE A.1												ADDITIONAL SCREEN FOR PROVISIONAL COPCS						
Summary of COPCs from Previous HHRAs		All Units: mg/kg							INITIAL SCREEN			Step 1	Step 2	Conclusion following Additional Screening Steps 1 and 2	Step 3a	Conclusion following Step 3a	Step 3b	Conclusion following Step 3b
Area	Provisional COPC	Screening Levels Used in HHRA		USEPA Nov 2012 RSLs	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Concentration	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	Risk Ratio >1?	Statistical Comparison to Background	COPC?	Excavation of Soil (deletion of data points)	COPC?	Insert BF and re-run Steps 1 & 2	COPC?
TABLE A.4 Cont.	manganese	160	NC	180	950	968	1,760	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
POI AU	mercury	2.3	NC	1	0.08	0.25	1.3	NO	**YES**	**Max >SL and >BG**	SL decreased	NO	--	NO				
	thallium	0.63	NC	0.078	0.5	2.2	ND	NO	**YES**	**ND, but DL >SL**		YES	Site ≤ BG	NO				
	vanadium	55	NC	39	135	75.5	627	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	3 of 13 data points excavated, re-run steps 1 & 2	NO Site ≤ BG		
POI 38 Major Tolman's Field	aluminum *	7,800	NC	7,700	80,000	19,100	30,400	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	1 of 13 data points excavated, re-run steps 1 & 2	**YES** Site > BG	4 Fill samples averaged, then replaced 1 deleted sx	**YES Site > BG ***
	antimony	3.1	NC	3.1	0.2	5.2	ND	NO	**YES**	**ND, but DL >SL**		YES	Site ≤ BG	NO				
	arsenic	0.43	C	0.39	1.8	12.6	17.1	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	thallium	0.63	NC	0.078	0.5	2.2	ND	NO	**YES**	**ND, but DL >SL**		YES	Site ≤ BG	NO				
POI 1 Sedgwick Trench	aluminum	7,800	NC	7,700	80,000	19,100	26,900	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	2 of 13 data points excavated, re-run steps 1 & 2	**YES** Site > BG	4 Fill samples averaged, then replaced 2 deleted sx	**YES Site > BG**
	antimony	3.1	NC	3.1	0.2	5.2	ND	NO	**YES**	**ND, but DL >SL**		YES	Site ≤ BG	NO				
	manganese	160	NC	180	950	968	1,100	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
POI 7	aluminum	7,800	NC	7,700	80,000	19,100	51,900	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**				
	antimony	3.1	NC	3.1	0.2	5.2	44.2	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for RME child resident	YES	**Site>BG**	**YES**				
	manganese	160	NC	180	950	968	2,040	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**				
	thallium	0.63	NC	0.078	0.5	2.2	ND	NO	**YES**	**ND, but DL >SL**		YES	Site ≤ BG	NO				
	vanadium	55	NC	39	135	75.5	307	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
POI 39 (10/11)	aluminum *	7,800	NC	7,700	80,000	19,100	28,400	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES ***				
	antimony	3.1	NC	3.1	0.2	5.2	13.5	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for child resident	YES	Site ≤ BG	NO				
	manganese *	160	NC	180	950	968	2,580	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES ***				
POI 16	benzo(a) anthracene	0.87	C	0.15		0.3575	0.56	NO	**YES**	**Max >SL**	SL decreased	NO	--	NO				
	benzo(b) fluoranthene	0.87	C	0.15		0.3657	0.39	NO	**YES**	**Max >SL**	SL decreased	NO	--	NO				
	benzo(a) pyrene	0.087	C	0.015		0.375	0.6	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	aluminum *	7,800	NC	7,700	80,000	19,100	23,800	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES ***				
	antimony	3.1	NC	3.1	0.2	5.2	ND	NO	**YES**	**ND, but DL >SL**		YES	Site ≤ BG	NO				

TABLE A.1												ADDITIONAL SCREEN FOR PROVISIONAL COPCS						
Summary of COPCs from Previous HHRAs		All Units: mg/kg							INITIAL SCREEN			Step 1	Step 2	Conclusion following Additional Screening Steps 1 and 2	Step 3a	Conclusion following Step 3a	Step 3b	Conclusion following Step 3b
Area	Provisional COPC	Screening Levels Used in HHRA		USEPA Nov 2012 RSLs	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Concentration	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	Risk Ratio >1?	Statistical Comparison to Background	COPC?	Excavation of Soil (deletion of data points)	COPC?	Insert BF and re-run Steps 1 & 2	COPC?
TABLE A.4 Cont.	aluminum *	7,800	NC	7,700	80,000	19,100	33,800	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	1 of 13 data points excavated, re-run steps 1 & 2	**YES** Site > BG	4 Fill samples averaged, then replaced 1 deleted sx	**YES Site > BG ***
POI 19	antimony	3.1	NC	3.1	0.2	5.2	5.6	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	arsenic	0.43	C	0.39	1.8	12.6	16	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
	manganese	160	NC	180	950	968	1,450	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
	vanadium	55	NC	39	135	75.5	140	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
POI 20	aluminum *	7,800	NC	7,700	80,000	19,100	36,400	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES ***				
	manganese	160	NC	180	950	968	1,550	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
	mercury	2.3	NC	1	0.08	0.25	2.9	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
	nickel	160	NC	150	75	33.5	360	NO, based on technical considerations	**YES**	**Max >SL and >BG**		NO	--	NO				
	thallium	0.63	NC	0.078	0.5	2.2	2.5	NO	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
	vanadium *	55	NC	39	135	75.5	112	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES ***				
POI 21/22/23 (4710 WL)	aluminum	7,800	NC	7,700	80,000	19,100	22,684	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	Site ≤ BG	NO				
	antimony	3.1	NC	3.1	0.2	5.2	ND	NO	**YES**	**ND, but DL >SL**		NO	--	NO				
	manganese	160	NC	180	950	968	3,248	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**				
	nickel	160	NC	150	75	33.5	335	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for child residents, non-cancer	NO	--	NO				
	thallium	0.63	NC	0.078	0.5	2.2	7.4	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for child residents, non-cancer	YES	Site ≤ BG	NO				
	vanadium	55	NC	39	135	75.5	195	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**				
POI 24	Arochlor-1260	0.319	C	0.22	NA	NA	1.3	YES	**YES**	**Max >SL**	HHRA results within acceptable levels	YES	NA	**YES**	8 of 11 data points excavated, now non-detect	NO (ND)		
	aluminum	7,800	NC	7,700	80,000	19,100	22,500	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	8 of 11 data points excavated, new max 21,500	**YES** Max > BG	32 Fill samples averaged, then replaced 8 deleted sx	**YES Site > BG**
	antimony	3.1	NC	3.1	0.2	5.2	28.6	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for child residents, non-cancer	YES	**Site>BG**	**YES**	8 of 11 data points excavated, new max 14.9	**YES** Max > BG	32 Fill samples averaged, then replaced 8 deleted sx	NO Site < BG
	arsenic	0.43	C	0.39	1.8	12.6	103	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for adult/child residents for cancer, for child residents, non-cancer	YES	**Site>BG**	**YES**	8 of 11 data points excavated, new max is 11.6 ppm	NO (Max < BG)		
	thallium	0.63	NC	0.078	0.5	2.2	ND	NO	**YES**	**ND, but DL >SL**		YES	Site ≤ BG	NO				
	vanadium	55	NC	39	135	75.5	135	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	8 of 11 data points excavated, new max is 70.1 ppm	NO (Max < BG)		

TABLE A.1												ADDITIONAL SCREEN FOR PROVISIONAL COPCS						
Summary of COPCs from Previous HHRAs		All Units: mg/kg							INITIAL SCREEN			Step 1	Step 2	Conclusion following Additional Screening Steps 1 and 2	Step 3a	Conclusion following Step 3a	Step 3b	Conclusion following Step 3b
Area	Provisional COPC	Screening Levels Used in HHRA		USEPA Nov 2012 RSLs	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Concentration	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	Risk Ratio >1?	Statistical Comparison to Background	COPC?	Excavation of Soil (deletion of data points)	COPC?	Insert BF and re-run Steps 1 & 2	COPC?
TABLE A.4 Cont.	aluminum	7,800	NC	7,700	80,000	19,100	37,428	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**				
POI 25	antimony	3.1	NC	3.1	0.2	5.2	16.5	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**				
	manganese	160	NC	180	950	968	1,564	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**				
	mercury	2.3	NC	1	0.08	0.25	28.2	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**				
	selenium	39	ND	39	NA	1.2	47.1	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	NO	--	NO				
	thallium	0.63	NC	0.078	0.5	2.2	75.7	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for construction worker	YES	**Site>BG**	**YES**				
	vanadium	55	NC	39	135	75.5	136	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**				
POI 21																		
	antimony	3.1	NC	3.1	0.2	5.2	8.7	NO	**YES**	**Max >SL and >BG**		YES	Test not possible with 4 samples	**YES**				
	manganese	160	NC	180	950	968	2,310	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	Test not possible with 4 samples	**YES**				
	thallium	0.63	NC	0.078	0.5	2.2	ND	NO	**YES**	**ND, but DL>SL**		YES	Test not possible with 4 samples	**YES**				
POI 22	antimony	3.1	NC	3.1	0.2	5.2	18.5	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Test not possible with 3 samples	**YES**				
	arsenic	0.43	C	0.39	1.8	12.6	59.1	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		YES	Test not possible with 3 samples	**YES**				
	lead	400	--	400	13	194	868		**YES**	**Max >SL and >BG**		YES	Test not possible with 3 samples	**YES**				
	manganese	160	NC	180	950	968	2,020	NO,C based on technical considerations	**YES**	**Max >SL and >BG**		YES	Test not possible with 3 samples	**YES**				
	mercury	2.3	NC	1	0.08	0.25	2.5	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	Test not possible with 3 samples	**YES**				
	thallium	0.63	NC	0.078	0.5	2.2	ND	NO	**YES**	**ND, but DL >SL**		YES	Test not possible with 3 samples	**YES**				
	vanadium	55	NC	39	135	75.5	97.9	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	Test not possible with 3 samples	**YES**				
POI 23	manganese	160	NC	180	950	968	1,120	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**				
	thallium	0.63	NC	0.078	0.5	2.2	ND	NO	**YES**	**ND, but DL >SL**		YES	Site ≤ BG	NO				
	vanadium	55	NC	39	135	75.5	86.5	NO, based on technical considerations	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**				

TABLE A.1												ADDITIONAL SCREEN FOR PROVISIONAL COPCS						
Summary of COPCs from Previous HHRAs		All Units: mg/kg							INITIAL SCREEN			Step 1	Step 2	Conclusion following Additional Screening Steps 1 and 2	Step 3a	Conclusion following Step 3a	Step 3b	Conclusion following Step 3b
Area	Provisional COPC	Screening Levels Used in HHRA		USEPA Nov 2012 RSLs	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Concentration	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	Risk Ratio >1?	Statistical Comparison to Background	COPC?	Excavation of Soil (deletion of data points)	COPC?	Insert BF and re-run Steps 1 & 2	COPC?
FROM TABLE A.5 USEPA HHRA - Southern AU (2000)																		
Surface Soils	Aluminum	7,800	NC	7,700	22,700	19,100	27,800	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	Arsenic	0.43	C	0.39	12.5	12.6	59.1	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**	9 of 31 data points excavated, re-run Steps 1 & 2	NO Site ≤ BG		
	Cobalt	470	NC	2.3	NS	17.8	121	NO	**YES**	**Max >SL and >BG**	SL decreased	YES	**Site>BG**	**YES**	9 of 31 data points excavated, re-run Steps 1 & 2	**YES** Site > BG	48 Fill samples averaged, then replaced 9 deleted sx	**YES Site > BG**
	Iron	2,300	NC	5,500	30,700	32,400	64,500	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	Lead	400	--	400	99	194	737	NO	**YES**	**Max >SL and >BG**		NO	--	NO				
	Manganese	180	NC	180	NS	968	1,390	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	Mercury	2.3	NC	1	NS	0.25	3.7	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	NO	--	NO				
	Nickel	160	NC	150	NS	33.5	170	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	NO	--	NO				
	Vanadium	55	NC	39	NS	75.5	293	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
Subsurface Soils	Aluminum	7,800	NC	7,700	22,700	19,100	26,900	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**	1 of 7 data points excavated, re-run steps 1 & 2	**YES** Site > BG	48 Fill samples averaged, then replaced 1 deleted sx	**YES Site > BG**
	Arsenic	0.43	C	0.39	12.5	12.6	141	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for construction worker; Text Table 9.5	YES	Site ≤ BG	NO				
	Beryllium	16	NC	16	NS	1.9	19	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels; DL>SL	YES	Site ≤ BG	NO				
	Cobalt	470	NC	2.3	NS	17.8	67.4	NO	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	1 of 7 data points excavated, re-run steps 1 & 2	**YES** Site > BG	48 Fill samples averaged, then replaced 1 deleted sx	**YES Site > BG**
	Iron	2,300	NC	5,500	30,700	32,400	45,600	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**	1 of 7 data points excavated, re-run steps 1 & 2	**YES** Site > BG	48 Fill samples averaged, then replaced 1 deleted sx	**YES Site > BG**
	Manganese	180	NC	180	NS	968	1,020	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	Site ≤ BG	NO				
	Mercury	2.3	NC	1	NS	0.25	1.8	NO	**YES**	**Max >SL and >BG**	SL decreased	YES	Site ≤ BG	NO				
	Vanadium	55	NC	39	NS	75.5	105	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	YES	**Site>BG**	**YES**	1 of 7 data points excavated, re-run steps 1 & 2	**YES** Site > BG	48 Fill samples averaged, then replaced 1 deleted sx	**YES Site > BG**

TABLE A.1												ADDITIONAL SCREEN FOR PROVISIONAL COPCS						
Summary of COPCs from Previous HHRAs		All Units: mg/kg							INITIAL SCREEN			Step 1	Step 2	Conclusion following Additional Screening Steps 1 and 2	Step 3a	Conclusion following Step 3a	Step 3b	Conclusion following Step 3b
Area	Provisional COPC	Screening Levels Used in HHRA		USEPA Nov 2012 RSLs	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Concentration	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	Risk Ratio >1?	Statistical Comparison to Background	COPC?	Excavation of Soil (deletion of data points)	COPC?	Insert BF and re-run Steps 1 & 2	COPC?
FROM TABLE A. 6 USACE HHRA for the 4801 Glenbrook Road Property (2000)																		
Surface Soil	Arsenic	0.43	C	0.39	12.6	12.6	1,040	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels; Text Table 2.1.1 shows N (1040 mg/kg) and S (186 mg/kg) areas	**Additional screening steps not completed because of extensive arsenic excavation.**						
	Vanadium *	550	NC	39	NA	75.5	192	NO	**YES**	**Max >SL and >BG**		YES	**Site>BG**	**YES**	10 of 244 data points excavated, re-run steps 1 & 2	**YES** Site > BG *	Note--although backfilled, there are no vanadium BF results	
Subsurface soil	Arsenic	0.43	C	0.39	NA	12.6	16	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels	**Additional screening steps not completed because of extensive arsenic excavation.**						

TABLE A.1												ADDITIONAL SCREEN FOR PROVISIONAL COPCS						
Summary of COPCs from Previous HHRAs		All Units: mg/kg							INITIAL SCREEN			Step 1	Step 2	Conclusion following Additional Screening Steps 1 and 2	Step 3a	Conclusion following Step 3a	Step 3b	Conclusion following Step 3b
Area	Provisional COPC	Screening Levels Used in HHRA		USEPA Nov 2012 RSLs	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Concentration	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	Risk Ratio >1?	Statistical Comparison to Background	COPC?	Excavation of Soil (deletion of data points)	COPC?	Insert BF and re-run Steps 1 & 2	COPC?

FROM TABLE A.7 **OU-4 Residences (AUES List Sampling)**

									ADDITIONAL SCREEN FOR INDIVIDUAL PROPERTIES									
							INITIAL SCREEN		Step 1	Step 2	Conclusion		Step 3a	Step 3a Conclusion	Step 3b - Insert Backfill Data and Re-run Steps 1 & 2			
Area	Provisional COPCs as selected in Table A.7, Part 1	Original Screening Level Used		USEPA May 2012 RSLs	2008 Background Conc.	Maximum Detected Conc.	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Risk Ratio >1?	Statistical Comparison to Background	COPC?	Notes	Excavation of Soil (deletion of data points)	COPC?	95% UCL of the mean	Risk Ratio	COPC?
4710 Q (3 samples)	Aluminum	7,800	NC	7,700	19,100	29,700	**YES**	**Max >SL and >BG**	YES	Test not possible with 3 samples	**YES, risk ratio >1**	Only 3 samples; used max detect value in risk ratio	2 of 3 data points excavated, max remains 29,700	**YES** Max > BG	Insufficient samples to re-run Steps 1 & 2			
	Cobalt	160	NC	2.3	17.8	25.7	**YES**	**Max >SL and >BG**	YES	Test not possible with 3 samples	**YES, risk ratio >1**	Only 3 samples; used max detect value in risk ratio	2 of 3 data points excavated, max remains 25.7	**YES Max > BG**	Insufficient samples to re-run Steps 1 & 2			
	Vanadium	55	NC	39	75.5	103	**YES**	**Max >SL and >BG**	YES	Test not possible with 3 samples	**YES, risk ratio >1**	Only 3 samples; used max detect value in risk ratio	2 of 3 data points excavated, max remains 103	**YES** Max > BG	Insufficient samples to re-run Steps 1 & 2			
3819 48th Str (4 samples)	Aluminum *	7,800	NC	7,700	19,100	36,300	**YES**	**Max >SL and >BG**	YES	Test not possible with 4 samples	**YES, risk ratio >1 ***	Only 4 samples; used max detect value in risk ratio						
	Cobalt *	160	NC	2.3	17.8	27.9	**YES**	**Max >SL and >BG**	YES	Test not possible with 4 samples	**YES, risk ratio >1 ***	Only 4 samples; used max detect value in risk ratio						
	Vanadium *	55	NC	39	75.5	108	**YES**	**Max >SL and >BG**	YES	Test not possible with 4 samples	**YES, risk ratio >1 ***	Only 4 samples; used max detect value in risk ratio						

TABLE A.1												ADDITIONAL SCREEN FOR PROVISIONAL COPCS						
Summary of COPCs from Previous HHRAs		All Units: mg/kg							INITIAL SCREEN			Step 1	Step 2	Conclusion following Additional Screening Steps 1 and 2	Step 3a	Conclusion following Step 3a	Step 3b	Conclusion following Step 3b
Area	Provisional COPC	Screening Levels Used in HHRA		USEPA Nov 2012 RSLs	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Concentration	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	Risk Ratio >1?	Statistical Comparison to Background	COPC?	Excavation of Soil (deletion of data points)	COPC?	Insert BF and re-run Steps 1 & 2	COPC?
FROM TABLE A.9	**Sedgwick Trench-POI 1 (AUES List Sampling)**																	
									ADDITIONAL SCREEN FOR INDIVIDUAL PROPERTIES									
							INITIAL SCREEN		Step 1		Step 2	Conclusion		Step 3a	Step 3a Conclusion	Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
Area	Provisional COPCs as selected in Table A.9	Original Screening Level Used		USEPA May 2012 RSLs	2008 Background Conc.	Maximum Detected Conc.	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Risk Ratio >1?		Statistical Comparison to Background	COPC?	Notes	Excavation of Soil (deletion of data points)	COPC?	95% UCL of the mean	Risk Ratio	COPC?
Sedgwick Trench (POI 1)	Cobalt	160	NC	2.3	17.8	21.1	**YES**	**Max >SL and >BG**	YES		**Site>BG**	**YES**		No excavation relevant to the trench samples was conducted				

Notes for all tables:

Additional detailed footnotes are contained on each specific HHRA table (A.2 through A.9).

USEPA November 2012 RSLs NC adjusted downward by factor of 10.

Statistical background comparisons using ProUCL two-sample hypothesis test to determine if site results greater than background (output provided in separate appendix).

Step 3a and 3b are completed ONLY for those compounds that are a YES after Step 2, AND which have had excavation activity; otherwise, Step 3 is left blank.

NC=non-carcinogen-based

C=carcinogen-based

CNS = Central Nervous System

COPC=chemical of potential concern

HHRA=human health risk assessment

U=not detected

NS=not sampled

NA=Not available, or insufficient samples to do test or calculation

RSL=EPA Risk-Based Screening Level

SL=screening level, DL = detection limit

DL >SL = analyte detection limit was higher than the screening level in the previous HHRA

BG=background

"--" = Step 2 (statistical comparison to background) not done because risk ratio < or = 1

***** See Section 2.4 of report for additional evaluation of this COPC.

Table A.2													ADDITIONAL SCREEN									
USACE OSR FUDS HHRA (1995 RI) - Screening Levels Review										**INITIAL SCREEN**			Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
OSR FUDS RI HHRA (1995)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Conc. Used[3]	2008 Background Conc.	Maximum Detected Value (USACE, 1995)	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 16	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
13 samples	Oxathiane		78		61			ND	NO	NO	ND											
	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Nitroglycerine		100	NC	0.61			ND	NO	NO	ND											
	Tetryl		78	NC	24			ND	NO	NO	ND											
	TNT		21	C	19			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16	C	1.6			ND	NO	NO	ND											
	2,6-Dinitrotoluene		7.8	NC	6.1			ND	NO	NO	ND											
	Nitrobenzene		3.9	C	4.8			ND	NO	NO	ND											
	Total Cyanide		160	NC	2.2			ND	NO	NO	ND											
POI 1 (Sedgwick Trench)	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
13 samples	Oxathiane		78		61			ND	NO	NO	ND											
	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Nitroglycerine		100	NC	0.61			ND	NO	NO	ND											
	Tetryl		78	NC	24			ND	NO	NO	ND											
	TNT		21	C	19			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16	C	1.6			ND	NO	NO	ND											
	2,6-Dinitrotoluene		7.8	NC	6.1			ND	NO	NO	ND											
	Nitrobenzene		3.9	C	4.8			ND	NO	NO	ND											
	Total Cyanide		160	NC	2.2	NA	0.26	1.1	NO	NO	Max <SL											
POI 7	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
13 samples	Oxathiane		78		61			ND	NO	NO	ND											
	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Nitroglycerine		100	NC	0.61			ND	NO	NO	ND											
	Tetryl		78	NC	24			ND	NO	NO	ND											
	TNT		21	C	19			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16	C	1.6			ND	NO	NO	ND											
	2,6-Dinitrotoluene		7.8	NC	6.1			ND	NO	NO	ND											
	Nitrobenzene		3.9	C	4.8			ND	NO	NO	ND											
	Total Cyanide		160	NC	2.2			ND	NO	NO	ND											
POI 39, 10/11	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
13 samples	Oxathiane		78		61			ND	NO	NO	ND											
	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Nitroglycerine		100	NC	0.61			ND	NO	NO	ND											
	Tetryl		78	NC	24			ND	NO	NO	ND											
	TNT		21	C	19			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16	C	1.6			ND	NO	NO	ND											
	2,6-Dinitrotoluene		7.8	NC	6.1			ND	NO	NO	ND											
	Nitrobenzene		3.9	C	4.8			ND	NO	NO	ND											
	Total Cyanide		160	NC	2.2			ND	NO	NO	ND											
POI 19	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
13 samples	Oxathiane		78		61			ND	NO	NO	ND											
	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Nitroglycerine		100	NC	0.61			ND	NO	NO	ND											
	Tetryl		78	NC	24			ND	NO	NO	ND											
	TNT		21	C	19			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16	C	1.6			ND	NO	NO	ND											
	2,6-Dinitrotoluene	mg/kg	7.8	NC	6.1			ND	NO	NO	ND											
	Nitrobenzene		3.9	C	4.8			ND	NO	NO	ND											
	Total Cyanide		160	NC	2.2			ND	NO	NO	ND											

Table A.2													ADDITIONAL SCREEN									
USACE OSR FUDS HHRA (1995 RI) - Screening Levels Review										**INITIAL SCREEN**			Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
OSR FUDS RI HHRA (1995)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Conc. Used[3]	2008 Background Conc.	Maximum Detected Value (USACE, 1995)	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 38	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
(Major	Oxathiane		78		61			ND	NO	NO	ND											
Tolman)	Dithiane		78	NC	61			ND	NO	NO	ND											
13 samples	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Nitroglycerine		100	NC	0.61			ND	NO	NO	ND											
	Tetryl		78	NC	24			ND	NO	NO	ND											
	TNT		21	C	19			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16	C	1.6			ND	NO	NO	ND											
	2,6-Dinitrotoluene		7.8	NC	6.1			ND	NO	NO	ND											
	Nitrobenzene		3.9	C	4.8			ND	NO	NO	ND											
	Total Cyanide		160	NC	2.2			ND	NO	NO	ND											
POI 20	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
13 samples	Oxathiane		78		61			ND	NO	NO	ND											
	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Nitroglycerine		100	NC	0.61			ND	NO	NO	ND											
	Tetryl		78	NC	24			ND	NO	NO	ND											
	TNT		21	C	19			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16	C	1.6			ND	NO	NO	ND											
	2,6-Dinitrotoluene		7.8	NC	6.1			ND	NO	NO	ND											
	Nitrobenzene		3.9	C	4.8			ND	NO	NO	ND											
	Total Cyanide		160	NC	2.2			ND	NO	NO	ND											
POI 21/22/23	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
15 samples	Oxathiane		78		61			ND	NO	NO	ND											
	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Nitroglycerine		100	NC	0.61			ND	NO	NO	ND											
	Tetryl		78	NC	24			ND	NO	NO	ND											
	TNT		21	C	19			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16	C	1.6			ND	NO	NO	ND											
	2,6-Dinitrotoluene		7.8	NC	6.1			ND	NO	NO	ND											
	Nitrobenzene		3.9	C	4.8			ND	NO	NO	ND											
	Aluminum		23,000	NC	7,700	4,860/77,833	19,100	24,662	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels (Sections 6.5.3.1.6 and 6.5.3.1.7 of HHRA)	20,597	2.7	**Site>BG**	**YES**						
	Antimony		3.1	NC	3.1	4.67 U	5.2	ND (DLs 3.25-9.03)	YES	**YES**	**ND, DL >SL**	Even though selected as a COPC, risk results for antimony are ND, and are not listed in Tables 8.6 and 8.7 of HHRA, DL >SL	2.74	0.9	--	NO	*All ND; used 1/2 of average DL as the EPC in the risk ratio.					
	Arsenic		0.36	C	0.39	3.54	12.6	8.82	NO	NO	Max <BG; DL>SL											
	Barium		550	NC	1,500	99.21	172	294	NO	NO	Max <SL											
	Beryllium		0.15	NC	16	1.82/0.26	1.9	2.76	YES	NO	Max <SL	HHRA results within acceptable levels										
	Cadmium		3.9	NC	7	1.43	2.36	2.51	NO	NO	Max <SL											
	Calcium		NA		NA	1,155	NA	43,087	NO	NO	Essential nutrient											
	Chromium		7,800	NC	12,000	101	51.3	2,067	NO	NO	Max <SL											
	Cobalt		470	NC	2.3	21.70/2.39	17.8	427	NO	**YES**	**Max >SL and >BG**	SL decreased	212	92	**Site>BG**	**YES**						
	Copper		290	NC	310	30.66/8.63	49.65	186	NO	NO	Max <SL											
	Iron	mg/kg	NA	NC	5500	29,323	32,400	140,536	NO	NO	Essential nutrient											
	Lead		500		400	77.92	194	218	NO	NO	Max <SL											
	Magnesium		NA		NA	9,539/653	6,950	12,554	NO	NO	Essential nutrient											
	Manganese		39	NC	180	851/138	968	3,248	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	1,750	9.7	**Site>BG**	**YES**						
	Mercury		2.3	NC	1	0.07	0.25	0.67	NO	NO	Max <SL											

Table A.2													ADDITIONAL SCREEN									
USACE OSR FUDS HHRA (1995 RI) - Screening Levels Review										**INITIAL SCREEN**			Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
OSR FUDS RI HHRA (1995)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Conc. Used[3]	2008 Background Conc.	Maximum Detected Value (USACE, 1995)	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 21/22/23	Nickel		160	NC	150	41.37	33.5	335	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	188.9	1.3	**Site>BG**	**YES**						
	Potassium		NA		NA	2,855/7477	NA	3246	NO	NO	Essential nutrient											
	Selenium		39	NC	39	12.21 U	1.2	19	NO	NO	Max <SL											
	Silver		39	NC	39	1.5	0.87	4	NO	NO	Max <SL											
	Sodium		NA		NA	65.32	NA	199	NO	NO	Essential nutrient											
	Thallium		0.63	NC	0.078	14.29 U	2.2	7.39	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels; 1 detect in 15 samples		95	Site ≤ BG	NO	One detect; used detected value as the EPC in the risk ratio					
	Vanadium		55	NC	39	47.93	75.5	195	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	143.6	4	**Site >BG**	**YES**						
	Zinc		2,300	NC	2,300	69.76/726.56	158	236	NO	NO	Max <SL											
	Total Cyanide		160	NC	2.2	NA	0.26	ND	NO	NO	ND											
POI 25	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
7 samples	Oxathiane		78		61			ND	NO	NO	ND											
	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	HMX		NA	NC	380			ND	NO	NO	ND											
	RDX		NA	C	5.6			ND	NO	NO	ND											
	1,3,5-TNB		3.9	NC	220			ND	NO	NO	ND											
	1,3-DNB		7.8	NC	0.61			ND	NO	NO	ND											
	Tetryl		78	NC	24			ND	NO	NO	ND											
	Nitrobenzene		3.9	NC	4.8			ND	NO	NO	ND											
	TNT		21	C	19			ND	NO	NO	ND											
	2,4- DNT		16	C	1.6			ND	NO	NO	ND											
	2,6- DNT		7.8	NC	6.1			ND	NO	NO	ND											
	2-NT (nitrotoluene)		NA	NC	0.61			ND	NO	NO	ND											
	4-NT		NA	C	2.9			ND	NO	NO	ND											
	3-NT		NA	C	30			ND	NO	NO	ND											
	Nitroglycerine		100	NC	0.61			ND	NO	NO	ND											
	Aluminum		23,000	NC	7,700	4,860/77,833	19,100	37,428	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	28,869	3.7	**Site>BG**	**YES**						
	Antimony		3.1	NC	3.1	4.67 U	5.2	16.45	YES	**YES**	**Max >SL and >BG**	Even though selected as a COPC, risk results for antimony are not listed in Tables 8.8 and 8.9 of HHRA	12.55	4.0	**Site >BG**	**YES**						
	Arsenic		0.36	C	0.39	3.54	12.6	2.93	NO, based on statistical comparison to BG	NO	Max <BG											
	Barium		550	NC	1,500	99.21	172	173.2	NO	NO	Max <SL											
	Beryllium		0.15	NC	16	1.82/0.26	1.9	2.0	NO, based on statistical comparison to BG	NO	Max <SL											
	Boron		700	NC	1,600	NA	NA	2.3	NO	NO	Max <SL											
	Cadmium		3.9	NC	7	1.43	2.36	1.1	NO	NO	Max <SL											
	Calcium		NA		NA	1,155	NA	1,079	NO	NO	Essential nutrient											
	Chromium		7,800	NC	12,000	101	51.3	721	NO	NO	Max <SL											
	Cobalt		470	NC	2.3	21.70/2.39	17.8	80.57	NO	**YES**	**Max >SL and >BG**	SL decreased	58.1	25.3	**Site >BG**	**YES**						
	Copper		290	NC	310	30.66/8.63	49.65	76	NO	NO	Max <SL											
	Iron	mg/kg	NA	NC	5,500	29,323	32,400	72,090	NO	NO	Essential nutrient											
	Lead		500		400	77.92	194	26	NO	NO	Max <SL											
	Magnesium		NA		NA	9,539/653	6,950	14,476	NO	NO	Essential nutrient											

Table A.2													ADDITIONAL SCREEN									
USACE OSR FUDS HHRA (1995 RI) - Screening Levels Review										INITIAL SCREEN			Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
OSR FUDS RI HHRA (1995)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Conc. Used[3]	2008 Background Conc.	Maximum Detected Value (USACE, 1995)	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 25	Manganese		39	NC	180	851/138	968	902	NO, based on statistical comparison to BG	NO	Max <BG	BG increased										
	Mercury		2.3	NC	1	0.07	0.25	28	NO	**YES**	**Max >SL and >BG**	No rationale provided in HHRA why not selected as a COPC (Section 6.5.4.1.1)	23.56	23.6	**Site >BG**	**YES [8]**						
	Molybdenum		39	NC	39	NA	NA	14	NO	NO	Max <BG											
	Nickel		160	NC	150	41.37	33.5	135	NO	NO	Max <SL											
	Selenium		39	NC	39	12.21 U	1.2	47	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	40.47	1.0	--	NO						
	Silver		39	NC	39	1.5	0.87	1.6	NO	NO	Max <SL											
	Sodium		NA		NA	65.32	NA	99.6	NO	NO	Essential nutrient											
	Thallium		0.63	NC	0.078	14.29 U	2.2	75.7	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels; DL>SL	56.82	728.5	**Site >BG**	**YES**						
	Tin		4,700	NC	4,700	NA	8.4	60	NO	NO	Max <SL											
	Titanium		NA		NA	NA	2,690	1,383	NO	NO	Max <BG											
	Vanadium		55	NC	39	47.93	75.5	136	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	119.1	3.1	**Site >BG**	**YES**						
	Yttrium		NA		NA	NA	NA	36	NO	NO	No SL available	Limited toxicity										
	Zinc		2,300	NC	2,300	69.76/726.56	158	134	NO	NO	Max <SL											
	Total Cyanide		160	NC	2.2			ND	NO	NO	ND											
VOCs	Chloromethane	µg/kg	49,000	N	12,000			ND	NO	NO	ND											
	Bromomethane		11,000	N	730			ND	NO	NO	ND											
	Vinyl Chloride		340	C	60			ND	NO	NO	ND											
	Chloroethane		3,100,000	N	NA			ND	NO	NO	ND											
	Methylene Chloride		85,000	C	56,000		18	74.7	NO	NO	Max <SL											
	Acetone		7,800,000	NC	6,100,000		554.7	24.3	NO	NO	Max <SL											
	Carbon Disulfide		780,000	NC	82,000			ND	NO	NO	ND											
	1,1-Dichloroethene		1,100	NC	24,000			ND	NO	NO	ND											
	1,1-Dichloroethane		780,000	C	3,300			ND	NO	NO	ND											
	1,2-Dichloroethene (total)		78,000	NC	70,000			ND	NO	NO	ND											
	Chloroform		100,000	C	290		18	21.4	NO	NO	Max <SL											
	1,2-Dichloroethane		7,000	C	430			ND	NO	NO	ND											
	2-Butanone		4,700	NC	2,800,000			ND	NO	NO	ND											
	1,1,1-Trichloroethane		700,000	NC	870,000			ND	NO	NO	ND											
	Carbon Tetrachloride		4,900	C	610			ND	NO	NO	ND											
	Bromodichloromethane		10,000	C	270			ND	NO	NO	ND											
	1,2-Dichloropropane		9,400	C	940			ND	NO	NO	ND											
	c-1,3-Dichloropropene		3,700	C	1,700			ND	NO	NO	ND											
	Trichloroethene		58,000	C	910			ND	NO	NO	ND											
	Dibromochloromethane		7,600	C	680			ND	NO	NO	ND											
	1,1,2-Trichloroethane		11,000	C	1,100			ND	NO	NO	ND											
	Benzene		22,000	C	1,100			ND	NO	NO	ND											
	t-1,3-Dichloropropene		3,700	C	1,700			ND	NO	NO	ND											
	Bromoform		81,000	C	62,000			ND	NO	NO	ND											
	4-Methyl-2-Pentanone	µg/kg	630	NC	530,000			ND	NO	NO	ND											
	2-Hexanone		NA	NC	21,000		18	18.0	NO	NO	Max <SL											
	Tetrachloroethene		12,000	C	22,000			ND	NO	NO	ND											
	1,1,2,2-Tetrachloroethane		3,200	C	560			ND	NO	NO	ND											
	Toluene		1,600,000	NC	500,000			ND	NO	NO	ND											
	Chlorobenzene		160	NC	29,000			ND	NO	NO	ND											
	Ethylbenzene		780,000	C	5,400			ND	NO	NO	ND											
	Styrene		1,600,000	NC	630,000			ND	NO	NO	ND											
	Xylenes (total)		16,000,000	NC	63,000			ND	NO	NO	ND											

Table A.2													ADDITIONAL SCREEN									
USACE OSR FUDS HHRA (1995 RI) - Screening Levels Review										INITIAL SCREEN			Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
OSR FUDS RI HHRA (1995)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Conc. Used[3]	2008 Background Conc.	Maximum Detected Value (USACE, 1995)	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 25	Phenol	mg/kg	4,700	NC	1,800			ND	NO	NO	ND											
SVOCs	Aniline		110	C	85			ND	NO	NO	ND											
	Bis(2-chloroethyl)ether		580	C	0.21			ND	NO	NO	ND											
	2-Chlorophenol		39	NC	39			ND	NO	NO	ND											
	1,3 -Dichlorobenzene		700		NA			ND	NO	NO	ND											
	1,4-Dichlorobenzene		27	C	2			ND	NO	NO	ND											
	Benzyl alcohol		2,300	NC	610			ND	NO	NO	ND											
	1,2-Dichlorobenzene		700	NC	190			ND	NO	NO	ND											
	2-Methylphenol		390		310			ND	NO	NO	ND											
	2,2'-oxybis(l-Chloropropane)		NA		NA			ND	NO	NO	ND											
	4-Methylphenol		39		610			ND	NO	NO	ND											
	N-Nitrosodi-propylamine		0.091	C	0.069			ND	NO	NO	ND											
	Hexachloroethane		46	C	12			ND	NO	NO	ND											
	Nitrobenzene		3.9	C	4.8			ND	NO	NO	ND											
	Isophorone		670	C	510			ND	NO	NO	ND											
	2-Nitrophenol		NA		NA			ND	NO	NO	ND											
	2,4-Dimethylphenol		160	C	120			ND	NO	NO	ND											
	Benzoic acid		31,000	NC	24,000			ND	NO	NO	ND											
	Bis(2-Chloroethoxy) methane		NA	NC	18			ND	NO	NO	ND											
	2,4-Dichlorophenol		23	NC	18			ND	NO	NO	ND											
	1,2,4-Trichlorobenzene		78	C	22			ND	NO	NO	ND											
	Naphthalene		310	C	3.6			ND	NO	NO	ND											
	4-Chloroaniline		31	C	2.4			ND	NO	NO	ND											
	Hexachlorobutadiene		8.2	C	6.2			ND	NO	NO	ND											
	4-Chloro-3-methylphenol		NA		NA			ND	NO	NO	ND											
	2-Methylnaphthalene		NA	NC	23			ND	NO	NO	ND											
	Hexa chlorocyclopentadiene		55	NC	37			ND	NO	NO	ND											
	2,4,6-Trichlorophenol		58	C	44			ND	NO	NO	ND											
	2,4,5-Trichlorophenol		780	NC	610			ND	NO	NO	ND											
	2-Chloronaphthalene		NA	NC	630			ND	NO	NO	ND											
	2-Nitroaniline		0.47	NC	61			ND	NO	NO	ND											
	Dimethylphthalate		78,000		NA			ND	NO	NO	ND											
	Acenaphthylene		NA		NA			ND	NO	NO	ND											
	2,6-Dinitrotoluene		7.8	NC	6.1			ND	NO	NO	ND											
	3-Nitroaniline		23		NA			ND	NO	NO	ND											
	Acenaphthene		470	NC	340			ND	NO	NO	ND											
	2,4-Dinitrophenol		16	NC	12			ND	NO	NO	ND											
	4-Nitrophenol		480		NA			ND	NO	NO	ND											
	Dibenzofuran		NA		7.8			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16		1.6			ND	NO	NO	ND											
	Diethyl phthalate		6,300	NC	4,900			ND	NO	NO	ND											
	4-Chlorophenylphenyl ether		NA		NA			ND	NO	NO	ND											
	Fluorene		310	NC	230			ND	NO	NO	ND											
	4-Nitroaniline		23	C	24			ND	NO	NO	ND											
	4,6-Dinitro-2-methylphenol		NA		NA			ND	NO	NO	ND											

Table A.2													ADDITIONAL SCREEN									
USACE OSR FUDS HHRA (1995 RI) - Screening Levels Review										**INITIAL SCREEN**			Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
OSR FUDS RI HHRA (1995)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Conc. Used[3]	2008 Background Conc.	Maximum Detected Value (USACE, 1995)	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 25	N-Nitrosodi-phenylamine		130	C	99			ND	NO	NO	ND											
	4-Bromophenylphenyl ether		450		NA			ND	NO	NO	ND											
	Hexachlorobenzene		0.4	C	0.30			ND	NO	NO	ND											
	Pentachlorophenol		5.3	C	0.89			ND	NO	NO	ND											
	Phenanthrene		NA		NA			ND	NO	NO	ND											
	Anthracene		2300	NC	1,700			ND	NO	NO	ND											
	Carbazole		32		NA			ND	NO	NO	ND											
	Di-n-butyl phthalate	mg/kg	NA	NC	610			ND	NO	NO	ND											
	Fluoranthene		310	NC	230			ND	NO	NO	ND											
	Benzidine		0.0028	C	0.0005			ND	NO	NO	ND											
	Pyrene		230	NC	170			ND	NO	NO	ND											
	Butylbenzyl phthalate		1,600	C	260			ND	NO	NO	ND											
	3,3-Dichlorobenzidine		1.4	C	1.1			ND	NO	NO	ND											
	Benzo[a]anthracene		0.88	C	0.15			ND	NO	NO	ND											
	Chrysene		88	C	15			ND	NO	NO	ND											
	Bis(2-ethylhexyl)phthalate		46	C	35			ND	NO	NO	ND											
	Di-n-octyl phthalate		160		73			ND	NO	NO	ND											
	Benzo[b]fluoranthene		0.88	C	0.15			ND	NO	NO	ND											
	Benzo[k]fluoranthene		8.8	C	1.50			ND	NO	NO	ND											
	Benzo(a)pyrene		0.088	C	0.015			ND	NO	NO	ND											
	Indeno[1,2,3-cd]pyrene		NA	C	0.15			ND	NO	NO	ND											
	Dibenz[a,h]anthracene		0.088	C	0.015			ND	NO	NO	ND											
	Benzo[g,h,i]perylene		NA		NA			ND	NO	NO	ND											
POI 53	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
(Baker Valley)	Oxathiane		78		61			ND	NO	NO	ND											
13 samples	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Total cyanide		160	NC	2.2			ND	NO	NO	ND											
POI 24	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
13 samples	Oxathiane		78		61			ND	NO	NO	ND											
	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Adamsite		1.2	C	NA			ND	NO	NO	ND											
	Nitroglycerine		100	NC	0.61			ND	NO	NO	ND											
	Tetryl		78	NC	240			ND	NO	NO	ND											
	TNT		21	C	19			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16	C	1.6			ND	NO	NO	ND											
	2,6-Dinitrotoluene		7.8	NC	6.1			ND	NO	NO	ND											
	Nitrobenzene		3.9	NC	4.8			ND	NO	NO	ND											
	Total Cyanide		160	NC	2.2			ND	NO	NO	ND											

Table A.2													ADDITIONAL SCREEN									
USACE OSR FUDS HHRA (1995 RI) - Screening Levels Review										**INITIAL SCREEN**			Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
OSR FUDS RI HHRA (1995)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Conc. Used[3]	2008 Background Conc.	Maximum Detected Value (USACE, 1995)	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI AU	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
14 samples	Oxathiane		78		61			ND	NO	NO	ND											
	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Aluminum		23,000	NC	7,700	4,860/77,833	19,100	56,138	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	34,518	4.5	**Site >BG**	**YES**		4 of 14 data points excavated 95%UCL = 38,991	**YES** Site > BG	35,268	4.6	**YES Site > BG**
	Antimony		3.1	NC	3.1	4.67 U	5.2	ND (DLs = 8.4-10.34)	NO	**YES**	**ND, but DL >SL**	Section 6.6.3.1.2, page 6-39 says antimony detected, but antimony ND on Table A.24	4.6	1.5	Site ≤ BG	NO						
	Arsenic		0.36	C	0.39	3.54	12.6	8.49	NO, based on statistical comparison to BG	NO	Max <BG											
	Barium		550	NC	1,500	99.21	172	203	NO	NO	Max <SL											
	Beryllium		0.15	NC	16	1.82/0.26	1.9	3	YES	NO	Max <SL	HHRA results within acceptable levels										
	Cadmium		3.9	NC	7	1.43	2.36	4	YES	NO	Max <SL	HHRA results within acceptable levels										
	Calcium		NA		NA	1,155	NA	1,835	NO	NO	Essential nutrient											
	Chromium		7,800	NC	12,000	101	51.3	523	NO	NO	Max <SL											
	Cobalt		470	NC	2.3	21.70/2.39	17.8	193	NO	**YES**	**Max >SL and >BG**	SL decreased	104.8	46	**Site >BG**	**YES**		4 of 14 data points excavated 95%UCL = 131.1 Risk Ratio = 57.0	**YES** Site > BG	71.14	30.9	**YES Site > BG**
	Copper		290	NC	310	30.66/8.63	49.65	181	NO	NO	Max <SL											
	Iron		NA	NC	5,500	29,323	32,400	90,475	NO	NO	Essential nutrient											
	Lead		500		400	77.92	194	40	NO	NO	Max <SL											
	Magnesium		NA		NA	9,539/653	6,950	21,639	NO	NO	Essential nutrient											
	Manganese		39	NC	180	851/138	968	3,070	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		1414	8	Site ≤ BG	NO						
	Mercury		2.3	NC	1	0.07	0.25	9.74	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		5.24	5	**Site >BG**	**YES**		4 of 14 data points excavated 95%UCL = 11.03 Risk Ratio = 11.0	**YES** Site > BG	7.67	7.7	NO Site < BG
	Nickel		160	NC	150	41.37	33.5	176	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	106.5	0.7	--	NO						
	Potassium		NA		NA	2,855/7477	NA	7,573	NO	NO	Essential nutrient											
	Selenium		39	NC	39	12.21 U	1.2	ND	NO	NO	ND											
	Silver		39	NC	39	1.5	0.87	2.34	NO	NO	Max <SL											
	Sodium		NA		NA	65.32	NA	288	NO	NO	Essential nutrient											
	Thallium		0.63	NC	0.078	14.29 U	2.2	28.56	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		10.45	134	Site ≤ BG	NO	UCL could not be calculated (2 detects). Used avg of 1/2DLs + detect concs as EPC					
	Vanadium		55	NC	39	47.93	75.5	488	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels; HHRA Text Table 8.11	198.1	5	**Site >BG**	**YES**		4 of 14 data points excavated 95%UCL = 264.1 Risk Ratio = 6.8	NO Site ≤ BG			
	Zinc		2,300	NC	2,300	69.76/726.56	158	147	NO	NO	Max <SL											
	Total Cyanide		160	NC	2.2			ND	NO	NO	ND											

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USACE OSR FUDS HHRA (1995 RI) - Screening Levels Review										**INITIAL SCREEN**			Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
OSR FUDS RI HHRA (1995)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Conc. Used[3]	2008 Background Conc.	Maximum Detected Value (USACE, 1995)	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI AU	Chloromethane	µg/kg	49,000	N	12,000			6	NO	NO	Max <SL											
VOCs	Dichlorodifluoromethane		1,600,000	N	9,400			6	NO	NO	Max <SL											
	Bromomethane		11,000	N	730			ND	NO	NO	ND											
	Vinyl Chloride		340	C	60			ND	NO	NO	ND											
	Chloroethane		3,100,000	N	NA			ND	NO	NO	ND											
	Methylene Chloride		85,000	C	56,000			68	NO	NO	Max <SL											
	Acetone		7,800,000	NC	6,100,000			16	NO	NO	Max <SL											
	Carbon Disulfide		780,000	NC	82,000			ND	NO	NO	ND											
	1,1-Dichloroethene		1,100	NC	24,000			ND	NO	NO	ND											
	1,1-Dichloroethane		780,000	C	3,300			ND	NO	NO	ND											
	1,2-Dichloroethene (total)		78,000	NC	70,000			ND	NO	NO	ND											
	Chloroform		100,000	C	290			5	NO	NO	Max <SL											
	1,2-Dichloroethane		7,000	C	430			ND	NO	NO	ND											
	2-Butanone		4,700	NC	2,800,000			6	NO	NO	Max <SL											
	1,1,1-Trichloroethane		700,000	NC	870,000			ND	NO	NO	ND											
	Carbon Tetrachloride		4,900	C	610			ND	NO	NO	ND											
	Bromodichloromethane		10,000	C	270			ND	NO	NO	ND											
	1,2-Dichloropropane		9,400	C	940			ND	NO	NO	ND											
	c-l,3-Dichloropropene		3,700	C	1,700			ND	NO	NO	ND											
	Trichloroethene		58,000	C	910			ND	NO	NO	ND											
	Dibromochloromethane		7,600	C	680			ND	NO	NO	ND											
	1,1,2-Trichloroethane		11,000	C	1,100			ND	NO	NO	ND											
	l,4-Dichloro-2-butene		NA	C	6.9			ND	NO	NO	ND											
	Benzene		22,000	C	1,100			ND	NO	NO	ND											
	l,3-Dichloropropene		3,700	C	1,700			ND	NO	NO	ND											
	Bromoform		81,000	C	62,000			ND	NO	NO	ND											
	4-Methyl-2-Pentanone		630	NC	530,000			ND	NO	NO	ND											
	2-Hexanone		NA	NC	21,000			1	NO	NO	Max <SL											
	Tetrachloroethene		12,000	C	22,000			ND	NO	NO	ND											
	1,1,2,2-Tetrachloroethane		3,200	C	560			ND	NO	NO	ND											
	Toluene		1,600,000	NC	500,000			3	NO	NO	Max <SL											
	Chlorobenzene		160	NC	29,000			ND	NO	NO	ND											
	Ethylbenzene		780,000	C	5,400			ND	NO	NO	ND											
	Styrene		1,600,000	NC	630,000			ND	NO	NO	ND											
	Xylenes (total)		16,000,000	NC	63,000			ND	NO	NO	ND											
SVOCs	Phenol	mg/kg	4,700	NC	1,800			ND	NO	NO	ND											
	Aniline		110	C	85			ND	NO	NO	ND											
	Bis(2-chloroethyl)ether		580	C	0.21			ND	NO	NO	ND											
	2-Chlorophenol		39	NC	39			ND	NO	NO	ND											
	1,3 -Dichlorobenzene		700		NA			ND	NO	NO	ND											
	1,4-Dichlorobenzene		27	C	2			ND	NO	NO	ND											
	Benzyl alcohol		2,300	NC	610			ND	NO	NO	ND											
	1,2-Dichlorobenzene		700	NC	190			ND	NO	NO	ND											
	2-Methylphenol		390		310			ND	NO	NO	ND											
	2,2'-oxybis(l-Chloropropane)		NA		NA			ND	NO	NO	ND											
	4-Methylphenol		39		610			ND	NO	NO	ND											
	N-Nitrosodipropylamine		0.091	C	0.069			ND	NO	NO	ND											
	Hexachloroethane		46	C	12			ND	NO	NO	ND											
	Nitrobenzene		3.9	C	4.8			ND	NO	NO	ND											
	Isophorone		670	C	510			ND	NO	NO	ND											
	2-Nitrophenol		NA		NA			ND	NO	NO	ND											
	2,4-Dimethylphenol		160	C	120			ND	NO	NO	ND											
	Benzoic acid		31,000	NC	24,000			ND	NO	NO	ND											

Table A.2													ADDITIONAL SCREEN									
USACE OSR FUDS HHRA (1995 RI) - Screening Levels Review										**INITIAL SCREEN**			Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
OSR FUDS RI HHRA (1995)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Conc. Used[3]	2008 Background Conc.	Maximum Detected Value (USACE, 1995)	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
	Bis(2-Chloroethoxy)methane		NA	NC	18			ND	NO	NO	ND											
	2,4-Dichlorophenol		23	NC	18			ND	NO	NO	ND											
POI AU	1,2,4-Trichlorobenzene	mg/kg	78	C	22			ND	NO	NO	ND											
	Naphthalene		310	C	3.6			ND	NO	NO	ND											
	4-Chloroaniline		31	C	2.4			ND	NO	NO	ND											
	Hexachlorobutadiene		8.2	C	6.2			ND	NO	NO	ND											
	4-Chloro-3-methylphenol		NA		NA			ND	NO	NO	ND											
	2-Methylnaphthalene		NA	NC	23			ND	NO	NO	ND											
	Hexachlorocyclo-pentadiene		55	NC	37			ND	NO	NO	ND											
	2,4,6-Trichlorophenol		58	C	44			ND	NO	NO	ND											
	2,4,5-Trichlorophenol		780	NC	610			ND	NO	NO	ND											
	2-Chloronaphthalene		NA	NC	630			ND	NO	NO	ND											
	2-Nitroaniline		0.47	NC	61			ND	NO	NO	ND											
	Dimethylphthalate		78,000		NA			ND	NO	NO	ND											
	Acenaphthylene		NA		NA			ND	NO	NO	ND											
	2,6-Dinitrotoluene		7.8	NC	6.1			ND	NO	NO	ND											
	3-Nitroaniline		23		NA			ND	NO	NO	ND											
	Acenaphthene		470	NC	340			ND	NO	NO	ND											
	2,4-Dinitrophenol		16	NC	12			ND	NO	NO	ND											
	4-Nitrophenol		480		NA			ND	NO	NO	ND											
	Dibenzofuran		NA		7.8			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16		1.6			ND	NO	NO	ND											
	Diethyl phthalate		6,300	NC	4,900			ND	NO	NO	ND											
	4-Chlorophenylphenyl ether		NA					ND	NO	NO	ND											
	Fluorene		310	NC	230			ND	NO	NO	ND											
	4-Nitroaniline		23	C	24			ND	NO	NO	ND											
	4,6-Dinitro-2-methylphenol		NA					ND	NO	NO	ND											
	N-Nitrosodiphenylamine		130	C	99			ND	NO	NO	ND											
	4-Bromophenylphenyl ether		450		NA			ND	NO	NO	ND											
	Hexachlorobenzene		0.4	C	0.30			ND	NO	NO	ND											
	Pentachlorophenol		5.3	C	0.89			ND	NO	NO	ND											
	Phenanthrene		NA		NA		0.4074	2	NO	**YES**	**Max >BG**	All PAHs detected in 1 sample (SV-BAKER-03) of 14		NO SL	Site ≤ BG	NO	Only 1 detection					
	Anthracene		2,300	NC	1,700			ND	NO	NO	ND											
	Carbazole		32		NA			ND	NO	NO	ND											
	Di-n-butyl phthalate		NA	NC	610			ND	NO	NO	ND											
	Fluoranthene		310	NC	230		0.6999	4.2	NO	NO	Max <SL											
	Benzidine		0.0028	C	0.0005			ND	NO	NO	ND											
	Pyrene		230	NC	170		0.6264	5.5	NO	NO	Max <SL											
	Butylbenzyl phthalate		1600	C	260			ND	NO	NO	ND											
	3,3-Dichlorobenzidine		1.4	C	1.1			ND	NO	NO	ND											
	Benzo[a] anthracene	mg/kg	0.88	C	0.15		0.3575	2.4	NO, based on no historical use of PAHs at the AUES	**YES**	**Max >SL and >BG**	All PAHs detected in 1 sample (SV-BAKER-03) of 14		16	Site ≤ BG	NO	Only one detect; used detect as EPC in risk ratio					

Table A.2													ADDITIONAL SCREEN									
USACE OSR FUDS HHRA (1995 RI) - Screening Levels Review										INITIAL SCREEN			Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
OSR FUDS RI HHRA (1995)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Conc. Used[3]	2008 Background Conc.	Maximum Detected Value (USACE, 1995)	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
	Chrysene		88	C	15		0.4009	2.7	NO	NO	Max <SL											
	Bis(2-ethylhexyl) phthalate		46	C	35			ND	NO	NO	ND											
	Di-n-octyl phthalate		160		73			ND	NO	NO	ND											
POI AU	Benzo[b] fluoranthene		0.88	C	0.15		0.3657	1.7	NO, based on no historical use of PAHs at the AUES	**YES**	**Max >SL and >BG**	All PAHs detected in 1 sample (SV-BAKER-03) of 14		11	Site ≤ BG	NO	Only one detect; used detect as EPC in risk ratio					
	Benzo[k] fluoranthene		8.8	C	1.5		0.3566	2.2	NO	**YES**	**Max >SL and >BG**	All PAHs detected in 1 sample (SV-BAKER-03) of 14		1	--	NO	Only one detect; used detect as EPC in risk ratio					
	Benzo(a)pyrene		0.088	C	0.015		0.375	2	NO, based on no historical use of PAHs at the AUES	**YES**	**Max >SL and >BG**	All PAHs detected in 1 sample (SV-BAKER-03) of 14		133	Site ≤ BG	NO	Only one detect; used detect as EPC in risk ratio					
	Indeno[1,2,3-cd]pyrene		NA	C	0.15			ND	NO	NO	ND											
	Dibenz[a,h]anthracene		0.088	C	0.015			ND	NO	NO	ND											
	Benzo[g,h,i]perylene		NA		NA			ND	NO	NO	ND											
POI 37	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
3 samples	Oxathiane		78		61			ND	NO	NO	ND											
	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Nitroglycerine		100	NC	0.61			ND	NO	NO	ND											
	Tetryl		78	NC	24			ND	NO	NO	ND											
	TNT		21	C	19			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16	C	1.6			ND	NO	NO	ND											
	2,6-Dinitrotoluene		7.8	NC	6.1			ND	NO	NO	ND											
	Nitrobenzene		3.9	C	4.8			ND	NO	NO	ND											
	Arsenic		0.36	C	0.39	3.54	12.6	1.04	NO	NO	Max <BG											
	Total Cyanide		160	NC	4.7			ND	NO	NO	ND											
LTC Bancroft	HD	mg/kg	NA		0.55			ND	NO	NO	ND											
1 sample	Oxathiane		78		61			ND	NO	NO	ND											
	Dithiane		78	NC	61			ND	NO	NO	ND											
	Lewisite		0.89		7.8			ND	NO	NO	ND											
	Thiodiglycol		39.1	NC	540			ND	NO	NO	ND											
	Nitroglycerine		100	NC	0.61			ND	NO	NO	ND											
	Tetryl		78	NC	24			ND	NO	NO	ND											
	TNT		21	C	19			ND	NO	NO	ND											
	2,4-Dinitrotoluene		16	C	1.6			ND	NO	NO	ND											
	2,6-Dinitrotoluene		7.8	NC	6.1			ND	NO	NO	ND											
	Nitrobenzene		3.9	C	4.8			ND	NO	NO	ND											
	Aluminum *		23,000	NC	7,700	4,860/77,833	19,100	27,783	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**	SL and BG decreased. Single sample result.	27,783	4	Test not possible (one sample)	**YES, risk ratio >1 ***	Only one sample; used detected value for risk ratio					
	Antimony		3.1	NC	3.1	4.67 U	5.2	ND (DL=1.69)	NO	NO	ND, but DL <SL and <BG											
	Arsenic	mg/kg	0.36	C	0.39	3.54	12.6	4	NO, based on statistical comparison to BG	NO	Max <BG											
	Barium		550	NC	1500	99.21	172	105	NO	NO	Max <SL											
	Beryllium		0.15	NC	16	1.82/0.26	1.9	3	YES	NO	Max <SL	HHRA results within acceptable levels										

Table A.2

USACE OSR FUDS HHRA (1995 RI) - Screening Levels Review

										INITIAL SCREEN			ADDITIONAL SCREEN									
													Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
OSR FUDS RI HHRA (1995)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Conc. Used[3]	2008 Background Conc.	Maximum Detected Value (USACE, 1995)	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
LTC Bancroft	Cadmium *		3.9	NC	7	1.43	2.36	29	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels; single sample result.	29	4	Test not possible (one sample)	**YES, risk ratio >1 ***	Only one sample; used detected value for risk ratio					
	Calcium		NA		NA	1,155	NA	441	NO	NO	Essential nutrient											
	Chromium		7,800	NC	12,000	101	51.3	43	NO	NO	Max <SL											
	Cobalt		470	NC	2.3	21.70/2.39	17.8	13	NO	NO	Max <BG											
	Copper		290	NC	310	30.66/8.63	49.65	36	NO	NO	Max <SL											
	Iron		NA	NC	5,500	29,323	32,400	32,835	NO	NO	Essential nutrient											
	Lead		500		400	77.92	194	152	NO	NO	Max <SL											
	Magnesium		NA		NA	9,539/653	6,950	6,812	NO	NO	Essential nutrient											
	Manganese		39	NC	180	851/138	968	348	NO	NO	Max <BG											
	Nickel		160	NC	150	41.37	33.5	34	NO	NO	Max <SL											
	Potassium		NA		NA	2,855/7477	NA	3,726	NO	NO	Essential nutrient											
	Selenium		39	NC	39	12.21 U	1.2	ND	NO	NO	ND											
	Silver		39	NC	39	1.5	0.87	0.73	NO	NO	Max <SL											
	Sodium		NA		NA	65.32	NA	ND	NO	NO	ND											
	Thallium *		0.63	NC	0.078	14.29 U	2.2	8	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**	SL decreased. Single sample result.	8	103	Test not possible (one sample)	**YES, risk ratio >1 ***	Only one sample; used detected value for risk ratio					
	Vanadium		55	NC	39	47.93	75.5	48	NO, based on statistical comparison to BG	NO	Max <BG	BG increased										
	Zinc		2,300	NC	2,300	69.76/726.56	158	2,548	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels; single sample result.	2,548	1	--	NO	Only one sample; used detected value for comparison					
	Total Cyanide		160	NC	2.2	NA	0.26	1	NO	NO	Max <SL											

Notes:

1. USEPA, 1994. Risk-based Concentration Table. Region III, Technical Support Section, April, adjusted downward by factor of 10 for NC.
2. USEPA November 2012 RSLs NC adjusted downward by factor of 10. Values for mustard, lewisite, and oxathiane are from USACHPPM's health based environmental screening levels.
3. When two numbers are shown, this represents data from two different soil associations.
4. Calculated using EPA's ProUCL software.
5. EPC divided by adjusted RSL. Drop out COPC if < or = 1. If insufficient sample number, then risk ratio is max value divided by adjusted RSL.
6. Statistical background comparisons using ProUCL two-sample hypothesis test to determine if site results greater than background (output provided in separate appendix).
7. Step 3a and 3b are completed ONLY for those compounds that are a YES after Step 2, AND which have had excavation activity; otherwise, Step 3 is left blank.
8. Incorrect analytical method for Mercury was used resulting in unrealistically high concentrations for this investigation.

"--" = Step 2 (statistical comparison to background) not done because risk ratio < or = 1

C = Carcinogenic-based; NC = non-carcinogenic-based, and adjusted down by 10

ND = non-detect, DL = Detection Limit

U = not detected at the detection limit shown

NA = not available

SL = screening level; BG = background

COPC = chemical of potential concern

CNS = Central Nervous System

DL >SL = analyte detection limit was higher than the screening level in the previous HHRA

Reference: OSR FUDS RI HHRA, USACE, 1995. Remedial Investigation Report for the Operation Safe Removal - Formerly Used Defense Site, Washington, D.C.

***** See Section 2.4 of report for additional evaluation of this COPC.

Table A.3																	
USACE HHRA for Spaulding and Captain Rankin Areas (RI Report, 1996)													**ADDITIONAL SCREEN**				
Screening Levels Review										**INITIAL SCREEN**			Step 1		Step 2	Conclusion following Steps 1 and 2	Step 3a & 3b
Spaulding/Captain Rankin Areas HHRA (1996)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concentration	Maximum Detected Value [3]	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Excavation & Backfill of Soil
POI 22: Spaulding subfloor (5 samples)	Arsenic	mg/kg	0.36	C	0.39	3.54	12.6	26.9	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels (HHRA Table 8.5, p. 114 of pdf)	132.1	69	Site ≤ BG	NO	**No excavation relelvant to these samples was conducted**
	Cyanide		160	NC	2.2	NA	0.26	1.86	NO	NO	Max <SL						
	No detects of CWA, ABPs, explosives, or explosives breakdown products.																
POI 21: Captain Rankin area soil debris removal	Excavated soil not evaluated - RCRA limits not exceeded in any sample; disposed in a sanitary landfill									Excavated soil not evaluated							
POI 21: Concrete samples (7 samples)	Arsenic		0.36	C	0.39	Not considered because they are concrete	12.6	5.57	YES, because there is no screening RBC for arsenic in concrete.	NO	Max <BG	HHRA results within acceptable levels (HHRA Table 8.7, p. 116 of pdf)					
	No detects of CWA, ABPs, explosives, explosives breakdown products, or cyanide.																
POI 21: Subfloor soil (1 sample)	Arsenic		0.36	C	0.39	3.54	12.6	0.32	NO	NO	Max <BG						
	No detects of CWA, ABPs, explosives, explosives breakdown products, or cyanide.																
POI 21: Pipe terminus soil (7 samples)	Arsenic		0.36	C	0.39	3.54	12.6	2.5	NO	NO	Max <BG						
	No detects of CWA, ABPs, explosives, explosives breakdown products, or cyanide.																

Table A.3

USACE HHRA for Spaulding and Captain Rankin Areas (RI Report, 1996)

Screening Levels Review

Spaulding/Captain Rankin Areas HHRA (1996)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concentration	Maximum Detected Value[3]	Selected as COPC in previous HHRA	**INITIAL SCREEN** Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	**ADDITIONAL SCREEN** Step 1: 95% UCL of the mean[4]	Step 1: Risk Ratio[5]	Step 2: Statistical Comparison to Background[6]	Conclusion following Steps 1 and 2: COPC?	Step 3a & 3b: Excavation & Backfill of Soil
POI 23: Soil debris removal samples	Excavated soil not evaluated - RCRA limits not exceeded in any sample; disposed in a sanitary landfill								NA	Excavated soil not evaluated							
POI 23: Concrete samples (7 samples)	Arsenic		0.36	C	0.39	Not considered because they are concrete	12.6	199	YES, because there is no screening RBC for arsenic in concrete.	NO	No RSL, default to acceptable levels per HHRA	HHRA results within acceptable levels (HHRA Table 8.9, p. 118 of pdf)					
	No detects of CWA, ABPs, explosives, or explosives breakdown products.																
POI 23: Pipe drain debris--beneath concrete subfloor (1 sample)	Dithiane		78	NC	61	NA	NA	0.0054	NO	NO	Max <SL						
	Arsenic		0.36	C	0.39	3.54	12.6	131	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels (HHRA Section 9.1.2.2.2 of HHRA (and Table B.12 of Appendix))	131	336	Test not possible with one sample	**YES, risk ratio >1**	
	No additional detects of CWA, ABPs, explosives, explosives breakdown products, or cyanide.											HHRA, p. 49 of appendix pdf					
POI 23: Subfloor soil (1 sample)	Arsenic		0.36	C	0.39	3.54	12.6	0.2	NO	NO	Max <BG						
	No detects of CWA, ABPs, explosives, explosives breakdown products, or cyanide.																**No excavation relevant to these samples was conducted**
POI 23: Pipe terminus soil (7 samples)	Mustard		0.19	NC	0.55	NA	NA	0.029	NO	NO	Max < SL	Mustard detection was determined to be an analytical error					
	Oxathiane		78	NC	61	NA	NA	0.008	NO	NO	Max < SL						
	Arsenic		0.36	C	0.39	3.54	12.6	1.2	NO	NO	Max <BG						
	No detects of CWA, ABPs, explosives, explosives breakdown products, or cyanide.																
RI for **POI 23**: Pipe drain terminus soil (84 samples; 2 arsenic samples)	Arsenic		0.36	C	0.39	3.54	12.6	1.06	NO	NO	Max <BG						
	No mustard or mustard ABPs were detected.																

Notes:

1. USEPA, 1994. Risk-based Concentration Table. Region III, Technical Support Section, April, adjusted downward by factor of 10 for NC.
2. USEPA November 2012 RSLs NC adjusted downward by factor of 10. Values for mustard and oxathiane are from USACHPPM's health based environmental screening levels.
3. From Appendix B of the HHRA.
4. Calculated using EPA's ProUCL software.
5. EPC divided by adjusted RSL. Drop out COPC if < or = 1. If insufficient sample number, then risk ratio is max value divided by adjusted RSL.
6. Statistical background comparisons using ProUCL two-sample hypothesis test to determine if site results greater than background (output provided in separate appendix).

NA = not available
ND = non-detect, DL = Detection Limit
C = Carcinogenic-based; NC = non-carcinogenic-based, and adjusted down by 10
SL = screening level; BG = background, COPC = chemical of potential concern
Reference: USACE, 1996. Final Remedial Investigation Report for Spaulding and Captain Rankin Areas, Volume I and Volume II. Parsons.

Table A.4

USEPA Region III HHRA (1999) - Screening Levels Review

USEPA HHRA (1999)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Value	Selected as COPC in previous HHRA[3]	INITIAL SCREEN: Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	ADDITIONAL SCREEN: Step 1: 95% UCL of the mean[4]	Step 1: Risk Ratio[5]	Step 2: Statistical Comparison to Background[6]	Conclusion following Steps 1 and 2: COPC?	Notes	Step 3a - Remove Excavated Soil Data Points: Re-run Steps 1 & 2 [7]	Step 3a: COPC?	Step 3b - Insert Backfill Data and Re-run Steps 1 & 2: 95% UCL of the mean[4]	Step 3b: Risk Ratio[5]	Step 3b: COPC?
4825 Glenbrook Road													**Additional screening not done because site has been or will soon be excavated.**									
7 samples	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	ND	NO	NO	ND											
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	ND	NO	NO	ND											
	benzo(a)pyrene		0.087	C	0.015		0.375	ND	NO	NO	ND											
	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	ND	NO	NO	ND											
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	ND	NO	NO	ND											
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											
	aluminum		7,800	NC	7,700	80,000	19,100	39,600	NO, based on technical considerations	**YES**	**Max >SL and >BG**											
	antimony		3.1	NC	3.1	0.2	5.2	7.8	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels (Section 4.4.7.1 of HHRA)										
	arsenic		0.43	C	0.39	1.8	12.6	241	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**											
	beryllium		16	NC	16	2.8	1.9	2	NO	NO	Max <SL											
	chromium		23	NC	12,000	100	51.3	418	NO, based on technical considerations	NO	Max <SL											
	lead		400	--	400	13	194	20.2	NO	NO	Max <SL											
	manganese		160	NC	180	950	968	973	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**											
	mercury		2.3	NC	1	0.08	0.25	ND	NO	NO	ND											
	nickel		160	NC	150	75	33.5	74	NO	NO	Max <SL											
	thallium		0.63	NC	0.078	0.5	2.2	0.75	NO	NO	Max < BG											
	vanadium		55	NC	39	135	75.5	122	NO, based on technical considerations	**YES**	**Max >SL and >BG**											
POI 53 Baker Valley (10 samples)																						
	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	3.8	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels (Section 4.4.4.4 of 1999 HHRA)	2.6	17.6	Site ≤ BG	NO						
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	3.4	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels (all PAHs in one sample (BAKER-03) (Appendix D of HHRA))	2.4	15.9	Site ≤ BG	NO						
	benzo(a)pyrene		0.087	C	0.015		0.375	2.8	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	2.0	131.4	Site ≤ BG	NO						
	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	2.0	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	1.4	9.4	Site ≤ BG	NO						
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	1.1	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels		73.3	Site ≤ BG	NO	Only one detect; used maximum as the EPC in the risk ratio					
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											
	aluminum		7,800	NC	7,700	80,000	19,100	43,900	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		27,326	3.5	**Site>BG**	**YES**		2 of 10 data points excavated 95%UCL = 28,088 Risk Ratio = 3.6	**YES Site > BG**	27,958	3.6	**YES Site > BG**
	antimony		3.1	NC	3.1	0.2	5.2	36.3	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for child resident	20.56	6.6	Site ≤ BG	NO						
	arsenic		0.43	C	0.39	1.8	12.6	13.5	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		7.479	19.2	Site ≤ BG	NO						

Table A.4

USEPA Region III HHRA (1999) - Screening Levels Review

										INITIAL SCREEN			ADDITIONAL SCREEN: Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
USEPA HHRA (1999)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Value	Selected as COPC in previous HHRA[3]	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
	beryllium	mg/kg	16	NC	16	2.8	1.9	3.2	NO, based on statistical comparison to BG	NO	Max <SL											
POI 53 Baker Valley	chromium		23	NC	12,000	100	51.3	383	NO, based on technical considerations	NO	Max <SL											
	lead		400	--	400	13	194	48.1	NO	NO	Max <SL											
	manganese		160	NC	180	950	968	1,380	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		848.4	4.7	Site ≤ BG	NO						
	mercury		2.3	NC	1	0.08	0.25	0.72	NO	NO	Max <SL											
	nickel		160	NC	150	75	33.5	57.3	NO	NO	Max <SL											
	thallium		0.63	NC	0.078	0.5	2.2	ND (DL = 0.82 - 1.85)	NO	**YES**	**ND, but DL >SL**		0.548	7.0	Site ≤ BG	NO						
	vanadium		55	NC	39	135	75.5	243	NO, based on technical considerations	**YES**	**Max >SL and >BG**		124.5	3.2	**Site >BG**	**YES**		2 of 10 data points excavated 95%UCL = 152.4 Risk Ratio = 3.9	NO Site ≤ BG			
POI American University (13 samples)																						
	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	3.8	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels (Section 4.4.5.1 of 1999 HHRA, and Table 4.B)	0.975	6.5	Site ≤ BG	NO						
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	3.4	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels (same PAH data as listed above in POI 53. All PAHs in one sample (BAKER-03) (Appendix D of HHRA))	0.895	6.0	Site ≤ BG	NO						
	benzo(a)pyrene		0.087	C	0.015		0.375	2.8	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	0.754	50.3	Site ≤ BG	NO						
	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	2.0	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	1.497	10	Site ≤ BG	NO						
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	1.1	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels		73.3	Site ≤ BG	NO	Only one detect; used maximum as the EPC in the risk ratio					
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											
	aluminum		7,800	NC	7,700	80,000	19,100	57,700	NO, based on technical considerations	**YES**	**Max >SL and >BG**		35,473	4.6	**Site>BG**	**YES**		3 of 13 data points excavated 95%UCL = 38,587 Risk Ratio = 5.0	**YES** Site > BG	35,672	4.6	**YES Site > BG**
	antimony		3.1	NC	3.1	0.2	5.2	40.4	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for child resident	25.58	8.3	**Site >BG**	**YES**		3 of 13 data points excavated 95%UCL = 28.51 Risk Ratio = 9.2	**YES** Site > BG	23.62	7.6	**YES Site > BG**
	arsenic		0.43	C	0.39	1.8	12.6	13.5	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		8.94	22.9	**Site >BG**	**YES**		3 of 13 data points excavated, new max is 11.4 ppm	**NO** (Max < BG)			
	beryllium		16	NC	16	2.8	1.9	3.3	NO, based on statistical comparison to BG	NO	Max <SL											
	chromium		23	NC	12,000	100	51.3	651	NO, based on technical considerations	NO	Max <SL											
	lead		400	--	400	13	194	48.1	NO	NO	Max <SL											

Table A.4

USEPA Region III HHRA (1999) - Screening Levels Review

										INITIAL SCREEN			ADDITIONAL SCREEN: Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
USEPA HHRA (1999)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Value	Selected as COPC in previous HHRA[3]	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI AU	manganese	mg/kg	160	NC	180	950	968	1,760	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		1,058	5.9	Site ≤ BG	NO						
	mercury		2.3	NC	1	0.08	0.25	1.3	NO	**YES**	**Max >SL and >BG**	SL decreased	0.50	0.5	--	NO						
	nickel		160	NC	150	75	33.5	143	NO	NO	Max <SL											
	thallium		0.63	NC	0.078	0.5	2.2	ND (DL= 1.4-17.5)	NO	**YES**	**ND, but DL >SL**		1.4	17.9	Site ≤ BG	NO	All ND; used 1/2 average DL as the EPC in the risk ratio					
	vanadium		55	NC	39	135	75.5	627	NO, based on technical considerations	**YES**	**Max >SL and >BG**		225.1	5.8	**Site >BG**	**YES**		3 of 13 data points excavated 95%UCL = 283.7 Risk Ratio = 7.3	NO Site ≤ BG			
POI 38 Major Tolman's Field																						
(13 samples)	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	ND	NO	NO	ND											
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	ND	NO	NO	ND											
	benzo(a)pyrene		0.087	C	0.015		0.375	ND	NO	NO	ND											
	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	ND	NO	NO	ND											
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	ND	NO	NO	ND											
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											
	aluminum *		7,800	NC	7,700	80,000	19,100	30,400	NO, based on technical considerations	**YES**	**Max >SL and >BG**		25,320	3.3	**Site>BG**	**YES**		1 of 13 data points excavated 95%UCL = 25,757 Risk Ratio = 3.3	**YES** Site > BG	30224	3.9	**YES Site > BG ***
	antimony		3.1	NC	3.1	0.2	5.2	ND (DL = 12.5-13.7	NO	**YES**	**ND, but DL >SL**		6.6	2.1	Site ≤ BG	NO	All ND; used 1/2 average DL as the EPC in the risk ratio					
	arsenic		0.43	C	0.39	1.8	12.6	17.1	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels (Section 4.4.2.5 of 1999 HHRA)	8.3	21.3	Site ≤ BG	NO						
	beryllium		16	NC	16	2.8	1.9	3.9	NO, based on technical considerations	NO	Max <SL											
	chromium		23	NC	12,000	100	51.3	44	NO, based on statistical comparison to BG	NO	Max <SL											
	lead		400	--	400	13	194	25.8	NO	NO	Max <SL											
	manganese		160	NC	180	950	968	686	NO, based on statistical comparison to BG	NO	Max <BG											
	mercury		2.3	NC	1	0.08	0.25	0.37	NO	NO	Max <SL											
	nickel		160	NC	150	75	33.5	48.5	NO	NO	Max <SL											
	thallium		0.63	NC	0.078	0.5	2.2	ND (DL = 1.3-1.5)	NO	**YES**	**ND, but DL >SL**		0.7	9.0	Site ≤ BG	NO	All ND; used 1/2 average DL in the risk ratio					
	vanadium		55	NC	39	135	75.5	48.9	NO	NO	Max <BG											
POI 1 Sedgwick Trench																						
(13 samples)	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	0.043	NO	NO	Max <BG											
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	0.061	NO	NO	Max <SL											
	benzo(a)pyrene		0.087	C	0.015		0.375	0.099	YES	NO	Max <BG	HHRA results within acceptable levels										
	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	0.1	NO	NO	Max <BG											
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	0.032	NO	NO	Max <BG											
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											

Table A.4

USEPA Region III HHRA (1999) - Screening Levels Review

										INITIAL SCREEN			ADDITIONAL SCREEN: Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
USEPA HHRA (1999)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Value	Selected as COPC in previous HHRA[3]	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 1	aluminum	mg/kg	7,800	NC	7,700	80,000	19,100	26,900	NO, based on technical considerations	**YES**	**Max >SL and >BG**		21,549	2.8	**Site>BG**	**YES**		2 of 13 data points excavated 95%UCL = 22,210 Risk Ratio = 2.9	**YES** Site > BG	26,301	3.4	**YES Site > BG**
	antimony		3.1	NC	3.1	0.2	5.2	ND (DL= 9.5-10.9)	NO	**YES**	**ND, but DL >SL**		5.2	1.7	Site ≤ BG	NO	All ND; used 1/2 average DL in the risk ratio					
	arsenic		0.43	C	0.39	1.8	12.6	12.8	NO, based on statistical comparison to background	NO	Max similar to BG											
	beryllium		16	NC	16	2.8	1.9	3.9	NO, based on technical considerations	NO	Max <SL											
	chromium		23	NC	12,000	100	51.3	51.5	NO, based on statistical comparison to background	NO	Max <SL											
	lead		400		400	13	194	173	NO	NO	Max <SL											
	manganese		160	NC	180	950	968	1,100	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		619.5	3.4	Site ≤ BG	NO						
	mercury		2.3	NC	1	0.08	0.25	ND	NO	NO	ND											
	nickel		160	NC	150	75	33.5	38.3	NO	NO	Max <SL											
	thallium		0.63	NC	0.078	0.5	2.2	0.94	NO, based on technical considerations	NO	Max <BG											
	vanadium		55	NC	39	135	75.5	60.4	NO, based on statistical comparison to background	NO	Max <BG											
POI 7																						
(13 samples)	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	ND	NO	NO	ND											
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	ND	NO	NO	ND											
	benzo(a)pyrene		0.087	C	0.015		0.375	ND	NO	NO	ND											
	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	ND	NO	NO	ND											
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	ND	NO	NO	ND											
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											
	aluminum		7,800	NC	7,700	80,000	19,100	51,900	NO, based on technical considerations	**YES**	**Max >SL and >BG**		33,888	4.4	**Site>BG**	**YES**						
	antimony		3.1	NC	3.1	0.2	5.2	44.2	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for RME child resident	25.45	8.2	**Site >BG**	**YES**						
	arsenic		0.43	C	0.39	1.8	12.6	8.6	YES	NO	Max <BG	HHRA results within acceptable levels										
	beryllium		16	NC	16	2.8	1.9	6	NO	NO	Max <SL											
	chromium		23	NC	12,000	100	51.3	114	NO, based on statistical comparison to BG	NO	Max <SL											
	lead		400	--	400	13	194	46.2	NO	NO	Max <SL											
	manganese		160	NC	180	950	968	2,040	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		1,066	5.9	**Site >BG**	**YES**						
	mercury		2.3	NC	1	0.08	0.25	0.13	NO	NO	Max <SL											
	nickel		160	NC	150	75	33.5	73.5	NO	NO	Max <SL											
	thallium		0.63	NC	0.078	0.5	2.2	ND (DL= 1.4-2.1)	NO	**YES**	**ND, but DL >SL**		0.8	10.3	Site ≤ BG	NO						
	vanadium		55	NC	39	135	75.5	307	NO, based on statistical comparison to BG	**YES**	**Max >SL and >BG**		143.2	3.7	Site ≤ BG	NO						

Table A.4

USEPA Region III HHRA (1999) - Screening Levels Review

										INITIAL SCREEN			ADDITIONAL SCREEN									
													Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
USEPA HHRA (1999)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Value	Selected as COPC in previous HHRA[3]	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 39, 10/11																						
(13 samples)	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	ND	NO	NO	ND											
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	ND	NO	NO	ND											
	benzo(a)pyrene		0.087	C	0.015		0.375	ND	NO	NO	ND											
	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	ND	NO	NO	ND											
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	ND	NO	NO	ND											
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											
	aluminum *		7,800	NC	7,700	80,000	19,100	28,400	NO, based on technical considerations	**YES**	**Max >SL and >BG**		24,896	3.2	**Site>BG**	**YES ***						
	antimony		3.1	NC	3.1	0.2	5.2	13.5	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for child resident (Section 4.4.2.3 of HHRA)	11.8	3.8	Site ≤ BG	NO						
	arsenic		0.43	C	0.39	1.8	12.6	3.7	NO, based on statistical comparison to background	NO	Max <BG											
	beryllium		16	NC	16	2.8	1.9	3.4	NO, based on technical considerations	NO	Max <SL											
	chromium		23	NC	12000	100	51.3	43.6	NO, based on statistical comparison to background	NO	Max <SL											
	lead		400	--	400	13	194	25.2	NO	NO	Max <SL											
	manganese *		160	NC	180	950	968	2,580	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		1,197	6.7	**Site >BG**	**YES ***						
	mercury		2.3	NC	1	0.08	0.25	ND	NO	NO	ND											
	nickel		160	NC	150	75	33.5	34.7	NO	NO	Max <SL											
	thallium		0.63	NC	0.078	0.5	2.2	ND (DL= 0.22-0.27)	NO	NO	ND, and DL <SL											
	vanadium		55	NC	39	135	75.5	49.3	NO	NO	Max <BG											
POI 16																						
(13 samples)	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	0.56	NO	**YES**	**Max >SL and >BG**	SL decreased	0.17	1	--	NO						
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	0.39	NO	**YES**	**Max >SL and >BG**	SL decreased	0.21	1	--	NO						
	benzo(a)pyrene		0.087	C	0.015		0.375	0.6	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels (Section 4.4.1.1 of 1999 HHRA)	0.19	12.7	Site ≤ BG	NO						
	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	0.25	NO	NO	Max <BG	SL decreased										
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	0.11	YES	NO	Max <BG	HHRA results within acceptable levels										
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											
	aluminum *		7,800	NC	7,700	80,000	19,100	23,800	NO, based on technical considerations	**YES**	**Max >SL and >BG**		20,552	2.7	**Site>BG**	**YES ***						
	antimony		3.1	NC	3.1	0.2	5.2	ND (DL= 9.1-11.1)	NO	**YES**	**ND, but DL >SL**		5.1	1.6	Site ≤ BG	NO	All ND; used 1/2 average DL in the risk ratio					

Table A.4

USEPA Region III HHRA (1999) - Screening Levels Review

													ADDITIONAL SCREEN									
										INITIAL SCREEN			Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
USEPA HHRA (1999)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Value	Selected as COPC in previous HHRA[3]	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 16	arsenic		0.43	C	0.39	1.8	12.6	2.2	NO, based on statistical comparison to background	NO	Max <BG											
	beryllium		16	NC	16	2.8	1.9	2.7	NO, based on technical considerations	NO	Max <SL											
	chromium		23	NC	12000	100	51.3	28.1	NO, based on statistical comparison to background	NO	Max <SL											
	lead		400		400	13	194	55.7	NO	NO	Max <SL											
	manganese	mg/kg	160	NC	180	950	968	937	NO, based on statistical comparison to background	NO	Max <BG											
	mercury		2.3	NC	1	0.08	0.25	ND	NO	NO	ND											
	nickel		160	NC	150	75	33.5	32.6	NO	NO	Max <SL											
	thallium		0.63	NC	0.078	0.5	2.2	0.56	NO	NO	Max <BG											
	vanadium		55	NC	39	135	75.5	36.5	NO	NO	Max <SL											
POI 19																						
(13 samples)	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	0.14	NO	NO	Max <BG											
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	0.17	NO	NO	Max <SL											
	benzo(a)pyrene		0.087	C	0.015		0.375	ND	NO	NO	ND											
	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	ND	NO	NO	ND											
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	ND	NO	NO	ND											
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											
	aluminum *		7,800	NC	7,700	80,000	19,100	33,900	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		23,965	3.1	**Site>BG**	**YES**		1 of 13 data points excavated 95%UCL = 22,725 Risk Ratio = 3.0	**YES** Site > BG	22,133	2.9	**YES Site > BG ***
	antimony		3.1	NC	3.1	0.2	5.2	5.6	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels		1.8	Site ≤ BG	NO	Only one detect; used maximum as the EPC in the risk ratio					
	arsenic		0.43	C	0.39	1.8	12.6	16	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		8.638	22.1	Site ≤ BG	NO						
	beryllium		16	NC	16	2.8	1.9	3.5	NO, based on statistical comparison to background	NO	Max <SL											
	chromium		23	NC	12,000	100	51.3	119	NO, based on technical considerations	NO	Max <SL											
	lead		400	--	400	13	194	31.3	NO	NO	Max <SL											
	manganese		160	NC	180	950	968	1,450	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		691.1	3.8	Site ≤ BG	NO						
	mercury		2.3	NC	1	0.08	0.25	ND	NO	NO	ND											
	nickel		160	NC	150	75	33.5	32.2	NO	NO	Max <SL											
	thallium		0.63	NC	0.078	0.5	2.2	2.1	NO, based on technical considerations	NO	Max <BG											
	vanadium		55	NC	39	135	75.5	140	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		76.54	2.0	Site ≤ BG	NO						

Table A.4

USEPA Region III HHRA (1999) - Screening Levels Review

										INITIAL SCREEN			ADDITIONAL SCREEN									
													Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
USEPA HHRA (1999)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Value	Selected as COPC in previous HHRA[3]	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 20																						
(13 samples)	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	ND	NO	NO	ND											
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	ND	NO	NO	ND											
	benzo(a)pyrene		0.087	C	0.015		0.375	ND	NO	NO	ND											
	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	ND	NO	NO	ND											
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	ND	NO	NO	ND											
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											
	aluminum *		7,800	NC	7,700	80,000	19,100	36,400	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		19,886	2.6	**Site>BG**	**YES ***						
	antimony		3.1	NC	3.1	0.2	5.2	4.8	YES	NO	Max < BG	HHRA results within acceptable levels										
	arsenic		0.43	C	0.39	1.8	12.6	5.6	NO, based on statistical comparison to background	NO	Max <BG											
	beryllium		16	NC	16	2.8	1.9	1.3	NO	NO	Max <SL											
	chromium	mg/kg	23	NC	12000	100	51.3	733	NO, based on technical considerations	NO	Max <SL											
	lead		400	--	400	13	194	19.9	NO	NO	Max <SL											
	manganese		160	NC	180	950	968	1,550	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		706.7	3.9	Site ≤ BG	NO						
	mercury		2.3	NC	1	0.08	0.25	2.9	NO, based on technical considerations	**YES**	**Max >SL and >BG**			2.9	Site ≤ BG	NO	Only one detect; used maximum as the EPC in the risk ratio					
	nickel		160	NC	150	75	33.5	360	NO, based on technical considerations	**YES**	**Max >SL and >BG**		154.3	1	--	NO						
	thallium		0.63	NC	0.078	0.5	2.2	2.5	NO	**YES**	**Max >SL and >BG**			32.1	Site ≤ BG	NO	Only one detect; used maximum as the EPC in the risk ratio					
	vanadium *		55	NC	39	135	75.5	112	NO, based on technical considerations	**YES**	**Max >SL and >BG**		82.39	2.1	**Site >BG**	**YES ***						
POI 21/22/23 (4710 WL)																						
15 samples	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	ND	NO	NO	ND											
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	ND	NO	NO	ND											
	benzo(a)pyrene		0.087	C	0.015		0.375	ND	NO	NO	ND											
	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	ND	NO	NO	ND											
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	ND	NO	NO	ND											
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											
	aluminum		7,800	NC	7,700	80,000	19,100	22,684	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		17,571	2.3	Site ≤ BG	NO						
	antimony		3.1	NC	3.1	0.2	5.2	ND DL = 3.25-10.4)	NO	**YES**	**ND, but DL >SL**		3.41	1	--	NO	All ND; used 1/2 average DL in the risk ratio					
	arsenic		0.43	C	0.39	1.8	12.6	6.8	NO, based on statistical comparison to background	NO	Max <BG											
	beryllium		16	NC	16	2.8	1.9	1.4	NO, based on statistical comparison to background	NO	Max <SL											

Table A.4

USEPA Region III HHRA (1999) - Screening Levels Review

										INITIAL SCREEN			ADDITIONAL SCREEN: Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
USEPA HHRA (1999)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Value	Selected as COPC in previous HHRA[3]	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
	chromium		23	NC	12,000	100	51.3	1,794	NO	NO	Max <SL											
POI 21/22/23	lead		400	--	400	13	194	55.4	NO	NO	Max <SL											
	manganese		160	NC	180	950	968	3,248	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		1,644	9.1	**Site >BG**	**YES**						
	mercury		2.3	NC	1	0.08	0.25	0.67	NO	NO	Max <SL											
	nickel		160	NC	150	75	33.5	335	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for child residents, non-cancer (Section 4.4.4.2 of 1999 HHRA)	168	1	--	NO						
	thallium		0.63	NC	0.078	0.5	2.2	7.4	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for child residents, non-cancer	5.6	72.4	Site ≤ BG	NO						
	vanadium		55	NC	39	135	75.5	195	NO, based on technical considerations	**YES**	**Max >SL and >BG**		117.3	3.0	**Site >BG**	**YES**						
POI 24																						
(11 samples)	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	0.087	NO	NO	Max <BG											
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	0.093	NO	NO	Max <SL											
	benzo(a)pyrene		0.087	C	0.015		0.375	0.09	YES	NO	Max <BG	HHRA results within acceptable levels										
	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	0.034	NO	NO	Max <BG											
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	ND	NO	NO	ND											
	Arochlor-1260		0.319	C	0.22		NS	1.3	YES	**YES**	**Max >SL**	HHRA results within acceptable levels	0.502	2.3	NA	**YES, risk ratio >1**	Aroclors weren't developed until after AUES (~1930)	8 of 11 data points excavated, now non-detect [8]	**NO** (ND)			
	aluminum		7,800	NC	7,700	80,000	19,100	22,500	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**		21,025	2.7	**Site>BG**	**YES**		8 of 11 data points excavated, new max 21,500 [8]	**YES** Max > BG	15,755	2.0	**YES Site > BG**
	antimony		3.1	NC	3.1	0.2	5.2	28.6	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for child residents, non-cancer (Section 4.4.5.2 of 1999 HHRA)	19.95	6.4	**Site >BG**	**YES**		8 of 11 data points excavated, new max 14.9 [8]	**YES** Max > BG	19	6.1	NO Site ≤ BG
	arsenic		0.43	C	0.39	1.8	12.6	103	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for adult/child residents for cancer, for child residents, non-cancer	72.38	186	**Site >BG**	**YES**		8 of 11 data points excavated, new max is 11.6 ppm [8]	**NO** (Max < BG)			
	beryllium		16	NC	16	2.8	1.9	2	NO	NO	Max <SL											
	chromium		23	NC	12,000	100	51.3	515	NO, based on technical considerations	NO	Max <SL											
	lead		400	--	400	13	194	86.5	NO	NO	Max <SL											
	manganese		160	NC	180	950	968	692	NO, based on statistical comparison to background	NO	Max <BG											
	mercury		2.3	NC	1	0.08	0.25	0.26	NO	NO	Max <SL											
	nickel		160	NC	150	75	33.5	133	NO	NO	Max <SL											
	thallium		0.63	NC	0.078	0.5	2.2	ND (DL = 10-17.5)	NO	**YES**	**ND, but DL >SL**		5.34	68	Site ≤ BG	NO						
	vanadium		55	NC	39	135	75.5	135	NO, based on technical considerations	**YES**	**Max >SL and >BG**		95.7	2.5	**Site >BG**	**YES**		8 of 11 data points excavated, new max is 70.1 ppm [8]	**NO** (Max < BG)			

Table A.4

USEPA Region III HHRA (1999) - Screening Levels Review

										INITIAL SCREEN			ADDITIONAL SCREEN									
													Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
USEPA HHRA (1999)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Value	Selected as COPC in previous HHRA[3]	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 25																						
7 samples	aluminum	mg/kg	7,800	NC	7,700	80,000	19,100	37,428	NO, based on technical considerations	**YES**	**Max >SL and >BG**		28,869	4	**Site>BG**	**YES**						
	antimony		3.1	NC	3.1	0.2	5.2	16.5	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	12.58	4	**Site >BG**	**YES**						
	arsenic		0.43	C	0.39	1.8	12.6	2.9	NO, based on statistical comparison to background	NO	Max <BG											
	beryllium		16	NC	16	2.8	1.9	2	NO, based on technical considerations	NO	Max <SL											
	chromium		23	NC	12,000	100	51.3	721	NO, based on technical considerations	NO	Max <SL											
	lead		400	--	400	13	194	26	NO	NO	Max <SL											
	manganese		160	NC	180	950	968	1,564	NO, based on technical considerations	**YES**	**Max >SL and >BG**		1,140	6	**Site >BG**	**YES**						
	mercury		2.3	NC	1	0.08	0.25	28.2	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	23.55	24	**Site >BG**	**YES [9]**						
	nickel		160	NC	150	75	33.5	135	NO	NO	Max <SL											
	selenium		39	NC	39	NA	1.2	47.1	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	40.48	1	--	NO						
	thallium	mg/kg	0.63	NC	0.078	0.5	2.2	75.7	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for construction worker (Section 4.4.4.3 of 1999 HHRA and Table 4.B (and p. 122 of pdf))	56.81	728	**Site >BG**	**YES**						
	vanadium		55	NC	39	135	75.5	136	NO, based on technical considerations	**YES**	**Max >SL and >BG**		119.2	3	**Site >BG**	**YES**						
POI 21																						
(4 samples)	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	ND	NO	NO	ND											
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	ND	NO	NO	ND											
	benzo(a)pyrene		0.087	C	0.015		0.375	ND	NO	NO	ND											
drain pipe terminus	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	ND	NO	NO	ND											
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	ND	NO	NO	ND											
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											
	aluminum		7,800	NC	7,700	80,000	19,100	11,000	NO, based on statistical comparison to background	NO	Max <BG											
	antimony		3.1	NC	3.1	0.2	5.2	8.7	NO	**YES**	**Max >SL and >BG**			2.8	Test not possible with 4 samples	**YES, risk ratio >1**	Only 4 samples; used max for comparison in risk ratio					
	arsenic		0.43	C	0.39	1.8	12.6	3	NO, based on statistical comparison to background	NO	Max <BG											
	beryllium		16	NC	16	2.8	1.9	0.85	NO, based on statistical comparison to background	NO	Max <SL											

Table A.4

USEPA Region III HHRA (1999) - Screening Levels Review

										INITIAL SCREEN			ADDITIONAL SCREEN: Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
USEPA HHRA (1999)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Value	Selected as COPC in previous HHRA[3]	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 21	chromium		23	NC	12,000	100	51.3	718	NO, based on technical considerations	NO	Max <SL											
	lead		400	--	400	13	194	19.6	NO	NO	Max <SL											
	manganese		160	NC	180	950	968	2,310	NO, based on technical considerations	**YES**	**Max >SL and >BG**			12.8	Test not possible with 4 samples	**YES, risk ratio >1**	Only 4 samples; used max for comparison in risk ratio					
	mercury		2.3	NC	1	0.08	0.25	0.17	NO	NO	Max <SL											
	nickel		160	NC	150	75	33.5	142	NO	NO	Max <SL											
	thallium		0.63	NC	0.078	0.5	2.2	ND (DL = 1.0-1.3)	NO	**YES**	**ND, but DL >SL**			16.7	Test not possible with 4 samples	**YES, risk ratio >1**	Only 4 samples; used max DL for comparison in risk ratio					
	vanadium		55	NC	39	135	75.5	74	NO, based on technical considerations	NO	Max <BG											
POI 22																						
(4 samples)	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	ND	NO	NO	ND											
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	ND	NO	NO	ND											
subfloor	benzo(a)pyrene		0.087	C	0.015		0.375	ND	NO	NO	ND											
samples	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	ND	NO	NO	ND											
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	ND	NO	NO	ND											
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND											
	aluminum		7,800	NC	7,700	80,000	19,100	10,200	NO, based on statistical comparison to background	NO	Max <BG											
	antimony		3.1	NC	3.1	0.2	5.2	18.5	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels		6.0	Test not possible with 4 samples	**YES, risk ratio >1**	used max in risk ratio					
	arsenic	mg/kg	0.43	C	0.39	1.8	12.6	59.1	NO, based on statistical comparison to background	**YES**	**Max >SL and >BG**			151.5	Test not possible with 4 samples	**YES, risk ratio >1**	used max in risk ratio					
	beryllium		16	NC	16	2.8	1.9	0.79	NO, based on statistical comparison to background	NO	Max <SL											
	chromium		23	NC	12,000	100	51.3	646	NO, based on technical considerations	NO	Max <SL											
	lead		400	--	400	13	194	868	NO	**YES**	**Max >SL and >BG**			2.2	Test not possible with 4 samples	**YES, risk ratio >1**	used max in risk ratio					
	manganese		160	NC	180	950	968	2,020	NO, based on technical considerations	**YES**	**Max >SL and >BG**			11.2	Test not possible with 4 samples	**YES, risk ratio >1**	used max in risk ratio					
	mercury		2.3	NC	1	0.08	0.25	2.5	NO, based on technical considerations	**YES**	**Max >SL and >BG**			2.5	Test not possible with 4 samples	**YES, risk ratio >1**	used max in risk ratio					
	nickel		160	NC	150	75	33.5	105	NO	NO	Max <SL											
	thallium		0.63	NC	0.078	0.5	2.2	ND (DL = 0.95-1.1)	NO	**YES**	**ND, but DL >SL**			14.1	Test not possible with 4 samples	**YES, risk ratio >1**	used max DL in risk ratio					
	vanadium		55	NC	39	135	75.5	97.9	NO, based on technical considerations	**YES**	**Max >SL and >BG**			2.5	Test not possible with 4 samples	**YES, risk ratio >1**	used max in risk ratio					

Table A.4

USEPA Region III HHRA (1999) - Screening Levels Review

													ADDITIONAL SCREEN										
										INITIAL SCREEN			Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
USEPA HHRA (1999)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concs Used in HHRA	2008 Background Concs	Maximum Detected Value	Selected as COPC in previous HHRA[3]	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
POI 23																							
5 samples	benzo(a)anthracene	mg/kg	0.87	C	0.15		0.3575	ND	NO	NO	ND												
	benzo(b)fluoranthene		0.87	C	0.15		0.3657	ND	NO	NO	ND												
subfloor	benzo(a)pyrene		0.087	C	0.015		0.375	ND	NO	NO	ND												
samples	indeno(1,2,3-cd)pyrene		0.87	C	0.15		0.3347	ND	NO	NO	ND												
	dibenz(a,h)anthracene		0.087	C	0.015		0.51	ND	NO	NO	ND												
	Arochlor-1260		0.319	C	0.22		NS	ND	NO	NO	ND												
	aluminum		7,800	NC	7,700	80,000	19,100	13,500	NO, based on statistical comparison to background	NO	Max <BG												
	antimony		3.1	NC	3.1	0.2	5.2	3.7	YES	NO	Max <BG	HHRA results within acceptable levels											
	arsenic		0.43	C	0.39	1.8	12.6	1.3	NO, based on statistical comparison to background	NO	Max <BG												
	beryllium		16	NC	16	2.8	1.9	0.98	NO, based on statistical comparison to background	NO	Max <SL												
	chromium		23	NC	12,000	100	51.3	670	NO, based on technical considerations	NO	Max <SL												
	lead		400	--	400	13	194	11.8	NO	NO	Max <SL												
	manganese		160	NC	180	950	968	1,120	NO, based on technical considerations	**YES**	**Max >SL and >BG**		955.1	5.3	**Site >BG**	**YES**							
	mercury		2.3	NC	1	0.08	0.25	ND	NO	NO	ND												
	nickel		160	NC	150	75	33.5	96.7	NO	NO	Max <SL												
	thallium		0.63	NC	0.078	0.5	2.2	ND (DL = 0.41-1.3)	NO	**YES**	**ND, but DL >SL**		0.278	3.6	Site ≤ BG	NO	Average of 1/2 DLs						
	vanadium		55	NC	39	135	75.5	86.5	NO, based on technical considerations	**YES**	**Max >SL and >BG**		85.02	2.2	**Site >BG**	**YES**							

Notes:

1. EPA RBCs for residential soil from October 27, 1999. RBCs for non-carcinogens corresponded to a target HQ of 0.1 (adjusted downward by factor of 10). Essential nutrients were not retained as COPCs.
2. USEPA November 2012 RSLs NC adjusted downward by factor of 10.
3. Selected as COPC in previous HHRA after the final (third) screening step; "technical considerations" included comparisons to background.
4. Calculated using EPA's ProUCL software.
5. EPC divided by adjusted RSL. Drop out COPC if < or = 1. If insufficient sample number, then risk ratio is max value divided by adjusted RSL.
6. Statistical background comparisons using ProUCL two-sample hypothesis test to determine if site results greater than background (output provided in separate appendix).
7. Step 3a and 3b are completed ONLY for those compounds that are a YES after Step 2, AND which have had excavation activity; otherwise, Step 3 is left blank.
8. Insufficient sample quantity to re-run Step 1 & 2 tests.
9. Incorrect analytical method for Mercury was used resulting in unrealistically high concentrations for this investigation.

List of POIs in the order shown in Appendix D of the HHRA. Note that the tables in Appendix D list the COPCs selected following the first screening step; these were not necessarily carried through the HHRA.

"--" = Step 2 (statistical comparison to background) not done because risk ratio <1

C = Carcinogenic-based; NC = non-carcinogenic-based, and adjusted down by 10. Lead SL was developed based on blood lead levels.

ND = non-detect, DL = Detection Limit

NA=not available

SL = screening level; BG = background

COPC = chemical of potential concern

DL >SL = analyte detection limit was higher than the screening level in the previous HHRA

Reference: USEPA, 1999. USEPA Region III Draft Risk Assessment Report, Army Munitions Site, Spring Valley. October.

***** See Section 2.4 of report for additional evaluation of this COPC.

Table A.5

USEPA American University HHRA (2000) - Southern AU

Screening Levels Review

USEPA HHRA - Southern AU (2000)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs [2]	Background Metals Concs Used [3]	2008 Background Concs	Maximum Detected Value (from Tables 2.1 and 2.2, USEPA, 2000)	Selected as COPC in previous HHRA	INITIAL SCREEN: Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	ADDITIONAL SCREEN: Step 1: 95% UCL of the mean[4]	Step 1: Risk Ratio[5]	Step 2: Statistical Comparison to Background[6]	Conclusion following Steps 1 and 2: COPC?	Step 3a - Remove Excavated Soil Data Points: Re-run Steps 1 & 2 [7]	Step 3a: COPC?	Step 3b - Insert Backfill Data and Re-run Steps 1 & 2: 95% UCL of the mean[4]	Step 3b: Risk Ratio[5]	Step 3b: COPC?
Surface Soils (0 - 6 in depth)	Aluminum	mg/kg	7,800	NC	7,700	22,700	19,100	27,800	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	14,828	1.9	Site ≤ BG	NO					
	Antimony		3.1	NC	3.1	NS	5.2	2	NO	NO	Max <SL										
	Arsenic		0.43	C	0.39	12.5	12.6	59.1	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	14.38	36.9	**Site >BG**	**YES**	9 of 31 data points excavated 95%UCL = 7.39 Risk Ratio = 18.9	NO Site ≤ BG			
	Barium		550	NC	1,500	NS	172	208	NO	NO	Max <SL										
	Beryllium		16	NC	16	NS	1.9	2.6	NO	NO	Max <SL										
	Cadmium		3.9	NC	7	NS	2.36	1.3	NO	NO	Max <SL										
	Calcium		NA		NA	NS	NA	16,800	NO	NO	Essential nutrient										
	Chromium		23 (for Cr+6)	NC	12,000 (for Cr+3)	42.5	51.3	311	YES	NO	Max <SL	HHRA results above acceptable levels for child trespasser, but based on Cr+6, overly conservative (HHRA Table 9.2, p 44 of pdf)									
	Cobalt		470	NC	2.3	NS	17.8	121	NO	**YES**	**Max >SL and >BG**	SL decreased	45.69	19.9	**Site >BG**	**YES**	9 of 31 data points excavated 95%UCL = 57.07 Risk Ratio = 24.8	**YES** Site > BG	57.81	25.1	**YES Site > BG**
	Copper		310	NC	310	NS	49.65	154	NO	NO	Max <SL										
	Iron		2,300	NC	5,500	30,700	32,400	64,500	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	32,565	5.9	Site ≤ BG	NO					
	Lead		400	--	400	99	194	737	NO	**YES**	**Max >SL and >BG**		166.1	0.4	--	NO					
	Magnesium		NA		NA	NS	6,950	14,100	NO	NO	Essential nutrient										
	Manganese		180	NC	180	NS	968	1,390	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	608	3.4	Site ≤ BG	NO					
	Mercury		2.3	NC	1	NS	0.25	3.7	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	1.0	1	--	NO					
	Nickel		160	NC	150	NS	33.5	170	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	65.94	0.4	--	NO					
	Potassium		NA		NA	NS	NA	4,540	NO	NO	Essential nutrient										
	Selenium		39	NC	39	NS	1.2	1.1	NO	NO	Max <SL										
	Silver		39	NC	39	NS	0.87	2.6	NO	NO	Max <SL										
	Sodium		NA		NA	NS	NA	191	NO	NO	Essential nutrient										
	Thallium		0.55	NC	0.078	NS	2.2	0.285	NO	NO	Max <BG										
	Vanadium		55	NC	39	NS	75.5	293	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	76.97	2.0	Site ≤ BG	NO					
	Zinc		2,300	NC	2,300	NS	158	209	NO	NO	Max <SL										
	Cyanide		160	NC	2.2	NS	0.26	0.51	NO	NO	Max <SL										

Table A.5

USEPA American University HHRA (2000) - Southern AU

Screening Levels Review

USEPA HHRA - Southern AU (2000)	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs [2]	Background Metals Concs Used [3]	2008 Background Concs	Maximum Detected Value (from Tables 2.1 and 2.2, USEPA, 2000)	Selected as COPC in previous HHRA	INITIAL SCREEN: Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	ADDITIONAL SCREEN: Step 1: 95% UCL of the mean[4]	Step 1: Risk Ratio[5]	Step 2: Statistical Comparison to Background[6]	Conclusion following Steps 1 and 2: COPC?	Step 3a - Remove Excavated Soil Data Points: Re-run Steps 1 & 2 [7]	Step 3a: COPC?	Step 3b - Insert Backfill Data and Re-run Steps 1 & 2: 95% UCL of the mean[4]	Step 3b: Risk Ratio[5]	Step 3b: COPC?
Subsurface Soils (> 6 inch depth)	Aluminum	mg/kg	7,800	NC	7,700	22,700	19,100	26,900	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	20,862	2.7	**Site >BG**	**YES**	1 of 7 data points excavated 95%UCL = 21,923 Risk Ratio = 2.8	**YES** Site > BG	20,912	2.7	**YES Site > BG**
	Antimony		3.1	NC	3.1	NS	5.2	5.2	YES	NO	Max < or = BG	HHRA results within acceptable levels (note DL>SL)									
	Arsenic		0.43	C	0.39	12.5	12.6	141	YES	**YES**	**Max >SL and >BG**	HHRA results above acceptable levels for construction worker (HHRA Table 9.5)	226.2	362	Site ≤ BG	NO					
	Barium		550	NC	1,500	NS	172	155	NO	NO	Max <SL										
	Beryllium		16	NC	16	NS	1.9	19	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels (note DL>SL)	68.16	1.2	Site ≤ BG	NO					
	Cadmium		3.9	NC	7	NS	2.36	0.79	NO	NO	Max <SL										
	Calcium		NA		NA	NS	NA	2,550	NO	NO	Essential nutrient										
	Chromium		23	NC	12,000	42.5	51.3	586	YES	NO	Max <SL	HHRA results above acceptable levels for child trespasser, but based on Cr+6, overly conservative (HHRA Table 9.5)									
	Cobalt		470	NC	2.3	NS	17.8	67.4	NO	**YES**	**Max >SL and >BG**	SL decreased	56.58	25	**Site >BG**	**YES**	1 of 7 data points excavated 95%UCL = 62.13 Risk Ratio = 27.0	**YES** Site > BG	56.6	24.6	**YES Site > BG**
	Copper		310	NC	310	NS	49.65	55.5	NO	NO	Max <SL										
	Iron		2,300	NC	5,500	30,700	32,400	45,600	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	41,460	8	**Site >BG**	**YES**	1 of 7 data points excavated 95%UCL = 42,836 Risk Ratio = 7.8	**YES** Site > BG	41,011	7.5	**YES Site > BG**
	Lead		400	--	400	99	194	197	NO	NO	Max <SL										
	Magnesium		NA		NA	NS	6,950	14,000	NO	NO	Essential nutrient										
	Manganese		180	NC	180	NS	968	1,020	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	725.7	4	Site ≤ BG	NO					
	Mercury		2.3	NC	1	NS	0.25	1.8	NO	**YES**	**Max >SL and >BG**	SL decreased		1.8	Site ≤ BG	NO					
	Nickel		160	NC	150	NS	33.5	95	NO	NO	Max <SL										
	Potassium		NA		NA	NS	NA	5,400	NO	NO	Essential nutrient										
	Selenium		39	NC	39	NS	1.2	0.51	NO	NO	Max <SL										
	Silver		39	NC	39	NS	0.87	1.7	NO	NO	Max <SL										
	Sodium		NA		NA	NS	NA	61.8	NO	NO	Essential nutrient										
	Vanadium		55	NC	39	NS	75.5	105	YES	**YES**	**Max >SL and >BG**	HHRA results within acceptable levels	93.31	2.4	**Site >BG**	**YES**	1 of 7 data points excavated 95%UCL = 96.63 Risk Ratio = 2.5	**YES** Site > BG	90.8	2.3	**YES Site > BG**
	Zinc		2,300	NC	2,300	NS	158	85.1	NO	NO	Max <SL										
	Cyanide		160	NC	2.2	NS	NA	0.81	NO	NO	Max <SL										

Notes:

1. RBSCs for residential soil from EPA Region III Risk Based Concentration (RBC) Table from October 27, 1999, corresponding to a 1 x 10^{-6} cancer risk and a target HQ of 0.1.
2. USEPA November 2012 RSLs NC adjusted downward by factor of 10.
3. Background values (cited as the UPL values from the Background Study, Appendix D of the HHRA) were only listed for aluminum, arsenic, chromium, iron, and lead.
4. Calculated using EPA's ProUCL software.
5. EPC divided by adjusted RSL. Drop out COPC if < or = 1. If insufficient sample number, then risk ratio is max value divided by adjusted RSL.
6. Statistical background comparisons using ProUCL two-sample hypothesis test to determine if site results greater than background (output provided in separate appendix).
7. Step 3 is completed ONLY for those compounds that are a YES after Step 2, AND which have had excavation activity; otherwise, Step 3 is left blank.

C = Carcinogenic-based; NC = non-carcinogenic-based, and adjusted down by 10. Lead SL was the screening level recommended by EPA Headquarters for residential land use (USEPA 1994b).
NA = not analyzed or not available. NS = not specified SL = screening level; BG = background
COPC = chemical of potential concern. DL >SL = analyte detection limit was higher than the screening level in the previous HHRA
Reference: USEPA, 2000. USEPA Region III American University Property, Spring Valley (OU3) HHRA (August 2000).

Table A.6
USACE HHRA for the 4801 Glenbrook Road Property (2000)
Screening Levels Review

													Step 1		Step 2	Conclusion following Steps 1 and 2	Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
4801 Glenbrook Rd	Detected Analytes	Units	Screening Levels Used in HHRA[1]		USEPA Nov 2012 RSLs[2]	Background Metals Concentrations Used in HHRA	2008 Background Concentrations	Maximum Detected Concentration	Selected as COPC in previous HHRA	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comp to Background[6]	COPC?	Re-run Steps 1 & 2[7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
Surface Soil																					
	Antimony	mg/kg	31	NC	3.1	NA	5.2	3.3	NO	NO	Max <BG										
	Arsenic		0.43	C	0.39	12.6	12.6	1,040	YES	**YES**	**Max >SL and >BG**	Additional screening steps not completed because of extensive arsenic excavation									
	Chromium[3]		120,000	NC	12,000	NA	51.3	1,140	NO	NO	Max <SL										
	Vanadium *		550	NC	39	NA	75.5	192	NO	**YES**	**Max >SL and >BG**		66.72	1.7	**Site >BG**	**YES**	10 of 244 data points excavated 95%UCL = 65.04 Risk Ratio = 1.7	**YES Site > BG ***	Note--although backfilled, there are no vanadium BF results		
Subsurface soil	Arsenic	mg/kg	0.43	C	0.39	12.6	12.6	16	YES	**YES**	**Max >SL and >BG**	Additional screening steps not completed because of extensive arsenic excavation									

Notes:
1. Screening levels used in the HHRA were the Risk-Based Screening Concentrations (RBSCs) for residential soil from USEPA Region III Risk-Based Concentration Table from October 27, 1999 without NC values adjusted. However, these values are adjusted for the 2012 RSLs.
2. USEPA November 2012 RSLs NC adjusted downward by factor of 10.
3. No hexavalent chromium detected; results are assumed to be trivalent chromium.
4. Calculated using EPA's ProUCL software.
5. EPC divided by adjusted RSL. Drop out COPC if < or = 1. If insufficient sample number, then risk ratio is max value divided by adjusted RSL.
6. Statistical background comparisons using ProUCL two-sample hypothesis test to determine if site results greater than background (output provided in separate appendix).
7. Step 3 is completed ONLY for those compounds that are a YES after Step 2, AND which have had excavation activity; otherwise, Step 3 is left blank.

NA=background not reported in 2000 HHRA.
C = Carcinogenic-based; NC = non-carcinogenic-based, and adjusted down by 10
SL = Screening level
COPC = Chemical of potential concern

Reference:
USACE, 2000. Revised Final Engineering Evaluation/Cost Analysis - 4801, 4825, and 4835 Glenbrook Road, Spring Valley Operable Unit 3, Washington, DC.

***** See Section 2.4 of report for additional evaluation of this COPC.

Table A.7

Comprehensive List Detections for Selected OU-4 Residences (From Table 1A, AUES List Sampling Results)

Part 1: INITIAL SELECTION OF PROVISIONAL COPCS
Four Residences Combined (4710 Quebec Street, 3819 48th Street, 4625 Rockwood, and 4633 Rockwood)

Units: ug/kg for organics; mg/kg for metals

INITIAL SCREEN

Analyte	Original Screening Level Used[1]		USEPA Nov 2012 RSLs[2]	2008 Background Conc.	Maximum Detected Value	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes	
Volatile Organic Compounds - SW8260B (ug/Kg)									
1,4-Dichlorobenzene	27,000	C	2,400	18	2	NO	Max <SL		
2-Butanone (MEK)	4,700,000	NC	2,800,000	18	30	NO	Max <SL		
2-Hexanone	310,000	NC	21,000	18	1	NO	Max <SL		
Acetone	780,000	NC	6,100,000	554.7	120	NO	Max <SL		
Acrolein	160,000	NC	15	NA	16	NO	Max approx = SL	Unadj RSL far > max	
Benzene	12,000	C	1,100	18	4	NO	Max <SL		
Benzyl Bromide	NA	NA	NA	NA	16	NO	No SL or BG available[3]		
Carbon Disulfide	780,000	NC	82,000	18	170	NO	Max <SL		
Chloroform	78,000	NC	290	18	1.5	NO	Max <SL		
Chloromethane	NA	NC	12,000	18	7	NO	Max <SL		
Dichlorodifluoromethane	1,600,000	NC	9,400	18	160	NO	Max <SL		
Methyl Acetate	7,800,000	NC	7,800,000	18	20	NO	Max <SL		
Methylene Chloride	85,000	C	56,000	18	24	NO	Max <SL		
Toluene	1,600,000	NC	500,000	18	8	NO	Max <SL		
Trichlorofluoromethane	2,300,000	NC	79,000	18	9	NO	Max <SL		
Semivolatile Organic Compounds - SW8270C (ug/Kg)									
2-Methylnaphthalene	160,000	NC	23,000	510	18	NO	Max < SL		
4-Methylphenol	39,000	NC	610,000	510	13	NO	Max < SL		
Acenaphthylene	470,000	NC	NA	510	230	NO	Max < BG		
Anthracene	2,300,000	NC	1,700,000	510	62	NO	Max <SL		
Benzo[a]Anthracene	870	C	150	357.5	1,100	**YES**	**Max >SL and >BG**	Max from OU4-4625RP-4	See Part 2 Analysis
Benzo[a]Pyrene	87	C	15	375	720	**YES**	**Max >SL and >BG**	Max from OU4-4625RP-4	See Part 2 Analysis
Benzo[b]Fluoranthene	870	C	150	365.7	1,800	**YES**	**Max >SL and >BG**	Max from OU4-4625RP-4	See Part 2 Analysis
Benzo[g,h,i]Perylene	NA	NA	NA	331.5	350	**YES**	**Max >BG**	Max from OU4-4625RP-4	See Part 2 Analysis
Benzo[k]Fluoranthene	8,700	C	1,500	356.6	800	NO	Max <SL		
Benzoic Acid	31,000,000	NC	24,000,000	510	61	NO	Max <SL		
Benzyl Alcohol	2,300,000	NC	610,000	NA	27	NO	Max <SL		
Bis(2-Ethylhexyl)Phthalate	46,000	C	35,000	1,479	230	NO	Max <SL		
Butylbenzylphthalate	1,600,000	NC	26,000	510	22	NO	Max <SL		
Carbazole	32,000	C	15,000	519	33	NO	Max <SL		
Chrysene	87,000	C	15,000	400.9	620	NO	Max <SL		
Dibenz[a,h]Anthracene	87	C	15	510	140	NO	Max <BG		
Dibenzofuran	16,000	NC	7,800	510	14	NO	Max < SL		
Diethylphthalate	6,300,000	NC	4,900,000	510	250	NO	Max <SL		
Di-N-Butylphthalate	780,000	NC	NA	510	29	NO	Max < BG		
Fluoranthene	310,000	NC	230,000	699.9	1,200	NO	Max <SL		
Fluorene	310,000	NC	230,000	510	24	NO	Max <SL		
Indeno[1,2,3-cd]Pyrene	870	C	150	334.7	660	**YES**	**Max >SL and >BG**	Max from OU4-4625RP-4	See Part 2 Analysis
Naphthalene	160,000	NC	3,600	510	90	NO	Max <SL		
Phenanthrene	NA	NA	NA	407.4	300	NO	No SL		
Pyrene	230,000	NC	170,000	626.4	1,800	NO	Max <SL		

Table A.7

Comprehensive List Detections for Selected OU-4 Residences (From Table 1A, AUES List Sampling Results)

Part 1: INITIAL SELECTION OF PROVISIONAL COPCS
Four Residences Combined (CONTINUED)

Units: ug/kg for organics; mg/kg for metals

INITIAL SCREEN

Analyte	Original Screening Level Used[1]		USEPA May 2012 RSLs[2]	2008 Background Concentration	Maximum Detected Value	Provisional COPC (max > higher of current RSL or 2008 background)?	Rationale	Notes
ICP Inorganic Analyses - SW6010B (mg/Kg)								
Aluminum	7,800	NC	7,700	19,100	36,300	**YES**	**Max >SL and >BG**	Max from OU4-3819(48th)-3
Arsenic	0.43	C	0.39	12.6	133	**YES**	**Max >SL and >BG**	Max from OU4-4625RP-3B
Barium	550	NC	1,500	172	168	NO	Max <SL	
Beryllium	16	NC	16	1.9	2.4	NO	Max <SL	
Calcium	NA	NC	NA	NA	9,240	NO	Essential nutrient	
Chromium	12,000	NC	12,000	51.3	192	NO	Max <SL	
Cobalt	160	NC	2.3	17.8	27.9	**YES**	**Max >SL and >BG**	Max from OU4-3819(48th)-3
Copper	310	NC	310	49.65	116	NO	Max <SL	
Iron	2,300	NC	5,500	32,400	43,900	NO	Essential nutrient	
Lead	400	NA	400	194	72	NO	Max <SL	
Magnesium	NA	NA	NA	6,950	22,300	NO	Essential nutrient	
Manganese	160	NC	180	968	840	NO	Max <BG	
Mercury	NA	NC	1	0.25	0.54	NO	Max <SL	
Nickel	160	NC	150	33.5	87.2	NO	Max <SL	
Phosphorus	NA	NA	NA		1,530	NO	Essential nutrient	
Potassium	NA	NA	NA	NA	13,900	NO	Essential nutrient	
Selenium	39	NC	39	1.2	1.2	NO	Max <SL	
Silicon	NA	NA	NA	NA	2560	NO	No SL or BG available[3]	
Silver	39	NC	39	0.87	2	NO	Max <SL	
Sodium	NA	NA	NA	NA	157	NO	Essential nutrient	
Strontium	4,700	NC	4,700	53	13	NO	Max <SL	
Sulfur	NA	NA	NA	NA	422	NO	No SL or BG available[3]	
Thallium	0.55	NC	0.078	2.2	1.6	NO	Max <BG	
Tin	4,700	NC	4,700	8.4	4.5	NO	Max <SL	
Titanium	31,000	NC	NA	2,690	2,320	NO	Max < BG	
Vanadium	55	NC	39	75.5	108	**YES**	**Max >SL and >BG**	Max from OU4-3819(48th)-3
Zinc	2,300	NC	2,300	158	140	NO	Max <SL	
IC Scan (mg/Kg)								
Chloride	NA	NA	NA	NA	70.1	NO	No SL or BG available[3]	
Fluoride	NA	NA	310	11	6.66	NO	Max <SL	
Nitrate-N	13000	NC	13,000	NA	11.6	NO	Max < SL	
Phosphate-P	NA	NA	NA	NA	37.5	NO	No SL or BG available	
Sulfate	NA	NA	NA	NA	83.6	NO	No SL or BG available[3]	
Mustard and Mustard Breakdown Products (ug/kg)								
Thiodyglycol	39000	NC	540,000	NA	813	NO	Max <SL	
Other Parameters (mg/kg)								
Cyanide	160	NC	2.2	0.26	1.19	NO	Max <SL	

See Part 2 Analysis

See Part 2 Analysis

See Part 2 Analysis

See Part 2 Analysis

Table A.7
Comprehensive List Detections for Selected OU-4 Residences (From Table 1A, AUES List Sampling Results)

Table A.7, Part 2

Part 2: PROVISIONAL COPCS Separated by Residences		Units: ug/kg for organics; mg/kg for metals					**INITIAL SCREEN FOR INDIVIDUAL PROPERTIES**			**ADDITIONAL SCREEN FOR INDIVIDUAL PROPERTIES**									
										Step 1		Step 2	Conclusion following Steps 1 and 2		Step 3a - Remove Excavated Soil Data Points		Step 3b - Insert Backfill Data and Re-run Steps 1 & 2		
	Provisional COPCs as selected in Table A.14, Part 1	Original Screening Level Used[1]		USEPA Nov 2012 RSLs[2]	2008 Background Conc.	Maximum Detected Conc.	**Provisional COPC (max > higher of current RSL or 2008 background)?**	**Rationale**	**Notes**	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Notes	Re-run Steps 1 & 2 [7]	COPC?	95% UCL of the mean[4]	Risk Ratio[5]	COPC?
4710 Quebec Street	aluminum	7,800	NC	7,700	19,100	29,700	**YES**	**Max >SL and >BG**			3.9	Test not possible with 3 samples	**YES, risk ratio >1**	Only 3 samples; used max detect value in risk ratio	2 of 3 data points excavated, max remains 29,700 [8]	**YES** Max > BG	**Although backfilled, there are insufficient samples to re-run Steps 1 & 2**		
(3 samples)	arsenic	0.43	C	0.39	12.6	36.1	**YES**	**Max >SL and >BG**			92.6	Test not possible with 3 samples	**YES, risk ratio >1**	Only 3 samples; used max detect value in risk ratio	2 of 3 data points excavated, new max is 12 ppm [8]	**NO** (Max < BG)			
	cobalt	160	NC	2.3	17.8	25.7	**YES**	**Max >SL and >BG**			11.2	Test not possible with 3 samples	**YES, risk ratio >1**	Only 3 samples; used max detect value in risk ratio	2 of 3 data points excavated, max remains 25.7 [8]	**YES** Max > BG			
	vanadium	55	NC	39	75.5	103	**YES**	**Max >SL and >BG**			2.6	Test not possible with 3 samples	**YES, risk ratio >1**	Only 3 samples; used max detect value in risk ratio	2 of 3 data points excavated, max remains 103 [8]	**YES** Max > BG			
3819 48th Street	aluminum *	7,800	NC	7,700	19,100	36,300	**YES**	**Max >SL and >BG**			4.7	Test not possible with 4 samples	**YES, risk ratio >1 ***	Only 4 samples; used max detect value in risk ratio					
(4 samples)	cobalt *	160	NC	2.3	17.8	27.9	**YES**	**Max >SL and >BG**			12.1	Test not possible with 4 samples	**YES, risk ratio >1 ***	Only 4 samples; used max detect value in risk ratio					
	vanadium *	55	NC	39	75.5	108	**YES**	**Max >SL and >BG**			2.8	Test not possible with 4 samples	**YES, risk ratio >1 ***	Only 4 samples; used max detect value in risk ratio					
4625 and 4633 Rockwood	benzo[a] anthracene	870	C	150	358	1,100	**YES**	**Max >SL and >BG**		711	4.7	Site ≤ BG	NO						
(6 samples)	benzo[a] pyrene	87	C	15	375	720	**YES**	**Max >SL and >BG**		473	31.5	Site ≤ BG	NO						
	benzo[b] fluoranthene	870	C	150	366	1,800	**YES**	**Max >SL and >BG**		1,125	7.5	Site ≤ BG	NO						
	Benzo[g,h,i] Perylene	NA	NA	NA	331.5	350	**YES**	**Max >BG**		246	No SL	Site ≤ BG	NO						
	indeno[1,2,3-cd]pyrene	870	C	150	335	660	**YES**	**Max >SL and >BG**		418	2.8	Site ≤ BG	NO						
	arsenic	0.43	C	0.39	12.6	133	**YES**	**Max >SL and >BG**		98	252	Site ≤ BG	NO						
	cobalt	160	NC	2.3	17.8	18.5	**YES**	**Max >SL and >BG**		17	7.2	Site ≤ BG	NO						
	vanadium	55	NC	39	75.5	85.8	**YES**	**Max >SL and >BG**		67	1.7	Site ≤ BG	NO						

In the original report (EE/CA, 2003), results were not screened against background and no HHRA was conducted.
1. April 2003 USEPA Residential RBC, NC adjusted downward by factor of 10.
2. USEPA November 2012 RSLs NC adjusted downward by factor of 10
3. No SL or BG available = these compounds (benzyl bromide, silicon, sulfur, chloride, phosphate, and sulfate) have limited toxicity at the levels detected, therefore are not further evaluated.
4. Calculated using EPA's ProUCL software.
5. EPC divided by adjusted RSL. Drop out COPC if < or = 1. If insufficient sample number, then risk ratio is max value divided by adjusted RSL.
6. Statistical background comparisons using ProUCL two-sample hypothesis test to determine if site results greater than background (output provided in separate appendix).
7. Step 3a and 3b are completed ONLY for those compounds that are a YES after Step 2, AND which have had excavation activity; otherwise, Step 3 is left blank.
8. Insufficient sample quantity to re-run Step 1 & 2 tests.
C=cancer risk-based, NC=non-cancer risk-based
NA=not applicable or not available SL=screening level; BG=background RSL=USEPA residential soil regional screening leve
***** See Section 2.4 of report for additional evaluation of this COPC.

Table A.8

Comprehensive List Detections for AU Lot 12 and CDC (From Table 1A, AUES List Sampling Results)

								ADDITIONAL SCREEN					
						INITIAL SCREEN		Step 1		Step 2	Conclusion following Steps 1 and 2	Step 3a - Remove Excavated Soil Data Points	
Analyte	**Original Screening Level Used[1]**		**Nov 2012 RSLs[2]**	**2008 Background Concentration**	**Maximum Detected Value**	**Provisional COPC (max > higher of current RSL or 2008 background)?**	**Rationale**	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Re-run Steps 1 & 2 [7]	COPC?
Volatile Organic Compounds - SW8260B (ug/Kg)													
1,4-Dichlorobenzene	27,000	C	2,400	18	2	NO	Max <SL						
2-Butanone (MEK)	4,700,000	NC	2,800,000	18	58	NO	Max <SL						
2-Hexanone	310,000	NC	21,000	18	4	NO	Max <SL						
4-Methyl-2-Pentanone	630,000	NC	530,000	18	2	NO	Max <SL						
Acetone	780,000	NC	6,100,000	555	360	NO	Max <SL						
Acetonitrile	NA	NC	870,000	NA	9	NO	Max <SL						
Acrolein	160,000	NC	15	NA	13	NO	Max <SL						
Benzene	12,000	C	1,100	18	3	NO	Max <SL						
Carbon Disulfide	780,000	NC	82,000	18	31	NO	Max <SL						
Chloroform	78,000	NC	290	18	3	NO	Max <SL						
Chloromethane	NA	NC	12,000	18	23	NO	Max <SL						
Isopropylbenzene (Cumene)	780,000	NC	2,100,000	18	2	NO	Max <SL						
Methyl Acetate	7,800,000	NC	7,800,000	18	30	NO	Max <SL						
Methylcyclohexane	470,000	NC	NA	18	3	NO	Max < BG						
Methylene Chloride	85,000	C	56,000	18	2	NO	Max <SL						
Tetrachloroethene	32,000	C	22	18	2	NO	Max <SL						
Toluene	1,600,000	NC	500,000	18	11	NO	Max <SL						
Semivolatile Organic Compounds - SW8270C (ug/Kg)													
2-Chloronaphthalene	630,000	NC	630,000	510	17	NO	Max <SL						
2-Methylnaphthalene	160,000	NC	23,000	510	46	NO	Max < SL						
4-Methylphenol	39,000	NC	610,000	510	190	NO	Max < SL						
4-Nitrophenol	63,000	NC	NA	1,300	15	NO	Max < BG						
Acenaphthene	470,000	NC	340,000	510	120	NO	Max <SL						
Acenaphthylene	470,000	NC	NA	510	100	NO	Max < BG						
Anthracene	2,300,000	NC	1,700,000	510	59	NO	Max <SL						
Benzo[a]Anthracene	870	C	150	358	2,000	**YES**	**Max >SL and >BG**	705.4	5	Site ≤ BG	NO		
Benzo[a]Pyrene	87	C	15	375	1,100	**YES**	**Max >SL and >BG**	350.9	23	Site ≤ BG	NO		
Benzo[b]Fluoranthene	870	C	150	366	2,300	**YES**	**Max >SL and >BG**	858.2	6	Site ≤ BG	NO		
Benzo[g,h,i]Perylene	NA	NA	NA	331.5	680	**YES**	**Max >BG**	324.1	No SL available	Site ≤ BG	NO		
Benzo[k]Fluoranthene	8,700	NC	1,500	357	1,300	NO	Max <SL						
Benzoic Acid	31,000,000	NC	24,000,000	510	210	NO	Max <SL						
Bis(2-Ethylhexyl) Phthalate	46,000	C	35,000	1,479	590	NO	Max <SL						
Butylbenzylphthalate	1,600,000	NC	26,000	510	190	NO	Max <SL						
Carbazole	32,000	C	15,000	519	67	NO	Max <SL						
Chrysene	87,000	C	15,000	401	1,100	NO	Max <SL						
Dibenz[a,h]Anthracene	87	C	15	510	330	NO	Max <BG						
Dibenzofuran	16,000	NC	7,800	510	68	NO	Max <SL						
Diethylphthalate	6,300,000	NC	4,900,000	510	24	NO	Max <SL						
Di-N-Butylphthalate	780,000	NC	610,000	510	57	NO	Max <SL						
Fluoranthene	310,000	NC	230,000	699.9	3,500	NO	Max <SL						
Fluorene	310,000	NC	230,000	510	110	NO	Max <SL						
Indeno[1,2,3-cd]Pyrene	870	C	150	334.7	1,100	**YES**	**Max >SL and >BG**	507.9	3	Site ≤ BG	NO		
Naphthalene	160,000	NC	3,600	510	82	NO	Max <SL						
Phenanthrene	NA	NC	NA	407	1,600	**YES**	**Max >BG**	453.1	No SL available	Site ≤ BG	NO		
Pyrene	230,000	NC	170,000	626	3,200	NO	Max <SL						
ICP Inorganic Analyses - SW6010B (mg/Kg)													
Aluminum	7,800	NC	7,700	19,100	13,000	NO	Max <BG						
Antimony	3.1	NC	3.1	5.2	2.1	NO	Max <BG						
Arsenic	0.43	NC	0.39	12.6	399	**YES**	**Max >SL and >BG**	165.2	424	**Site>BG**	**YES**	31 of 32 data points excavated, new max is 11.4 ppm [8]	**NO** (11.4 < BG)
Barium	550	NC	1,500	172	112	NO	Max <SL						
Beryllium	16	NC	16	1.9	0.78	NO	Max <SL						
Calcium	NA	NA	NA	NA	8,660	NO	Essential nutrient						

Table A.8

Comprehensive List Detections for AU Lot 12 and CDC (From Table 1A, AUES List Sampling Results)

								ADDITIONAL SCREEN					
						INITIAL SCREEN		Step 1		Step 2	Conclusion following Steps 1 and 2	Step 3a - Remove Excavated Soil Data Points	
Analyte	**Original Screening Level Used[1]**		**Nov 2012 RSLs[2]**	**2008 Background Concentration**	**Maximum Detected Value**	**Provisional COPC (max > higher of current RSL or 2008 background)?**	**Rationale**	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Re-run Steps 1 & 2 [7]	COPC?
Chromium	12,000	NC	12,000	51.3	91.4	NO	Max <SL						
Cobalt	160	NC	2.3	17.8	27.8	**YES**	**Max >SL and >BG**	8.791	4	Site ≤ BG	NO		
Copper	310	NC	310	49.65	56.9	NO	Max <SL						
Iron	2,300	NC	5,500	32,400	41,700	NO	Essential nutrient						
Lead	400	NA	400	194	64.3	NO	Max <SL						
Magnesium	NA	NA	NA	6,950	5,910	NO	Essential nutrient						
Manganese	160	NC	180	968	482	NO	Max <BG						
Mercury	NA	NC	1	0.25	0.75	NO	Max <SL						
Nickel	160	NC	150	33.5	345	**YES**	**Max >SL and >BG**	74.3	0.5	--	NO		
Phosphorus	NA	NA	NA	NA	514	NO	Essential nutrient						
Potassium	NA	NA	NA	NA	3,260	NO	Essential nutrient						
Selenium	39	NC	39	1.2	1.7	NO	Max <SL						
Silicon	NA	NA	NA	NA	2,970	NO	No SL or BG available[3]						
Sodium	NA	NA	NA	NA	190	NO	Essential nutrient						
Strontium	4,700	NC	4,700	53	35.6	NO	Max <SL						
Sulfur	NA	NA	NA	NA	420	NO	No SL or BG available[3]						
Thallium	0.55	NC	0.078	2.2	1.4	NO	Max <BG						
Tin	4,700	NC	4,700	8.4	5.7	NO	Max <SL						
Titanium	31,000	NC	NA	2,690	483	NO	Max <BG						
Vanadium	55	NC	39	75.5	78.6	**YES**	**Max >SL and >BG**	41.49	1	--	NO		
Zinc	2,300	NC	2,300	158	80.2	NO	Max <SL						
IC Scan (mg/Kg)													
Chloride	NA	NA	NA	NA	30.6	NO	No SL or BG available[3]						
Fluoride	NA	NC	310	NA	7.74	NO	Max <SL						
Nitrate-N	13,000	NC	13,000	NA	18.9	NO	Max < SL						
Phosphate-P	NA	NA	NA	NA	5.34	NO	No SL or BG available[3]						
Sulfate	NA	NA	NA	NA	73.4	NO	No SL or BG available[3]						
Mustard And Mustard Breakdown Products (ug/Kg)													
Thiodyglycol	39,100	NC	540,000	NA	732	NO	Max <SL						
Other Parameters (mg/Kg)													
Ammonia-N	NA	NA	NA	NA	1.54	NO	No SL or BG available[3]						
Cyanide	160	NC	2.2	NA	0.6	NO	Max <SL						

Notes:

Analyzed chemicals that had no positive detections are not shown in the table.

In the original report (EE/CA, 2003), results were not screened against background and no HHRA was conducted.

1. April 2003 USEPA Residential RBC, NC adjusted downward by factor of 10.

2. USEPA November 2012 RSLs NC adjusted downward by factor of 10.

3. No SL or BG available = these compounds (silicon, sulfur, chloride, phosphate, sulfate, and ammonia) have limited toxicity at the levels detected, therefore are not further evaluated.

4. Calculated using EPA's ProUCL software.

5. EPC divided by adjusted RSL. Drop out COPC if < or = 1. If insufficient sample number, then risk ratio is max value divided by adjusted RSL.

6. Statistical background comparisons using ProUCL two-sample hypothesis test to determine if site results greater than background (output provided in separate appendix).

7. Step 3a and 3b are completed ONLY for those compounds that are a YES after Step 2, AND which have had excavation activity; otherwise, Step 3 is left blank.

8. Insufficient sample quantity to re-run Step 1 & 2 tests.

"--" Step 2 (statistical comparison to background) not done because risk ratio <1.

C=cancer risk-based, NC=non-cancer risk-based

NA=not applicable or not available

ND = non-detect, DL = Detection Limit

SL=screening level

RSL=residential soil regional screening level

SL = screening level; BG = background

Table A.9

Comprehensive List Detections for Sedgwick Trench (From Table 1A, AUES List Sampling Results)

POI 1								**ADDITIONAL SCREEN**				
						INITIAL SCREEN		Step 1		Step 2	Conclusion following Steps 1 and 2	Step 3a & 3b
Analyte	**Original Screening Level Used[1]**		**Nov 2012 RSLs[2]**	**2008 Background Concentration**	**Maximum Detected Value**	**Provisional COPC (max > higher of current RSL or 2008 background)?**	**Rationale**	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Excavation & Backfill of Soil
Volatile Organic Compounds - SW8260B (UG/KG)												**No excavation relevant to the trench samples was conducted**
4-Methyl-2-Pentanone	630,000	NC	530,000	18	2	NO	Max <SL					
Acetone	780,000	NC	6,100,000	554.7	3	NO	Max <SL					
Dichlorodifluoromethane	1,600,000	NC	9,400	18	1	NO	Max <SL					
m&p-Xylene	1,600,000	NC	59,000	18	2	NO	Max <SL					
O-Xylene	1,600,000	NC	69,000	18	2	NO	Max <SL					
Toluene	1,600,000	NC	500,000	18	4	NO	Max <SL					
Semivolatile Organic Compounds - SW8270C (ug/Kg)												
Anthracene	2,300,000	NC	1,700,000	510	75	NO	Max <SL					
Benzo[a]Anthracene	870	C	150	357.5	340	NO	Max <BG					
Benzo[a]Pyrene	87	C	15	375	140	NO	Max <BG					
Benzo[b]Fluoranthene	870	C	150	365.7	300	NO	Max <BG					
Benzo[g,h,i]Perylene	NA	NA	NA	331.5	97	NO	Max <BG					
Benzo[k]Fluoranthene	8,700	C	1,500	356.6	130	NO	Max <SL					
Bis(2-Ethylhexyl)Phthalate	46,000	C	35,000	1479	51	NO	Max <SL					
Chrysene	87,000	C	15,000	400.9	160	NO	Max <SL					
Dibenz[a,h]Anthracene	87	C	15	510	34	NO	Max <BG					
Di-N-Butylphthalate	780,000	NC	610,000	510	10	NO	Max <SL					
Fluoranthene	310,000	NC	230,000	699.9	650	NO	Max <SL					
Indeno[1,2,3-cd]Pyrene	870	C	150	334.7	120	NO	Max <SL					
Phenanthrene	NA	NA	NA	407.4	270	NO	Max <BG					
Pyrene	230,000	NC	170,000	626.4	450	NO	Max <SL					
ICP Inorganic Analyses - SW6010B (mg/Kg)												
Aluminum	7,800	NC	7,700	19,100	18,800	NO	Max < BG					
Arsenic	0.43	C	0.39	12.6	2.2	NO	Max < BG					
Barium	550	NC	1500	172	85.4	NO	Max <SL					
Beryllium	16	NC	16	1.9	2.1	NO	Max <SL					
Calcium	NA	NA	NA	NA	448	NO	Essential nutrient					
Chromium	12,000	NC	12,000	51.3	26.5	NO	Max <SL					
Cobalt	160	NC	2.3	17.8	21.1	**YES**	**Max >SL and >BG**	19.64	8.5	**Site>BG**	**YES**	
Copper	310	NC	310	49.65	38.2	NO	Max <SL					
Iron	2,300	NC	5,500	32,400	26,800	NO	Essential nutrient					
Lead	400	NA	400	194	12.8	NO	Max <SL					
Magnesium	NA	NA	NA	6,950	7,490	NO	Essential nutrient					

Table A.9

Comprehensive List Detections for Sedgwick Trench (From Table 1A, AUES List Sampling Results)

POI 1								**ADDITIONAL SCREEN**				
						INITIAL SCREEN		Step 1		Step 2	Conclusion following Steps 1 and 2	Step 3a & 3b
Analyte	**Original Screening Level Used[1]**		**Nov 2012 RSLs[2]**	**2008 Background Concentration**	**Maximum Detected Value**	**Provisional COPC (max > higher of current RSL or 2008 background)?**	**Rationale**	95% UCL of the mean[4]	Risk Ratio[5]	Statistical Comparison to Background[6]	COPC?	Excavation & Backfill of Soil
Manganese	160	NC	180	968	602	NO	Max < BG					**No excavation relevant to the trench samples was conducted**
Mercury	NA	NC	1	0.25	0.05	NO	Max <SL					
Nickel	160	NC	150	33.5	32.4	NO	Max <SL					
Phosphorus	NA	NA	NA	NA	502	NO	Essential nutrient					
Potassium	NA	NA	NA	NA	6,020	NO	Essential nutrient					
Silicon	NA	NA	NA	NA	2,410	NO	No SL or BG available[3]					
Sodium	NA	NA	NA	NA	57.5	NO	Essential nutrient					
Strontium	4,700	NC	4,700	53	7.9	NO	Max <SL					
Sulfur	NA	NA	NA	NA	116	NO	No SL					
Titanium	31,000	NC	NA	2,690	930	NO	Max <BG					
Vanadium	55	NC	39	75.5	39.8	NO	Max <BG					
Zinc	2,300	NC	2,300	158	96.7	NO	Max <SL					
IC Scan (mg/Kg)												
Chloride		NA	NA	NA	20.2	NO	No SL or BG available[3]					
Nitrate-N		NC	13,000	NA	1.69	NO	Max <SL					
Sulfate		NC	NA	NA	69.1	NO	No SL					

Notes:

In the original report (EE/CA, 2003), results were not screened against background and no HHRA was conducted.

Analyzed chemicals that had no positive detections are not shown in the table.

1. April 2003 USEPA Residential RBC, NC adjusted downward by factor of 10.

2. USEPA November 2012 RSLs NC adjusted downward by factor of 10

3. No SL or BG available = these compounds (silicon, sulfur, chloride, phosphate, sulfate, and ammonia) have limited toxicity at the levels detected, therefore are not further evaluated.

4. Calculated using EPA's ProUCL software.

5. EPC divided by adjusted RSL. Drop out COPC if < or = 1. If insufficient sample number, then risk ratio is max value divided by adjusted RSL.

6. Statistical background comparisons using ProUCL two-sample hypothesis test to determine if site results greater than background (output provided in separate appendix).

C=cancer risk-based

NC=non-cancer risk-based

NA=not applicable or not available

SL=screening level; BG=background

RSL=USEPA residential soil regional screening level

COPC = Chemical of Potential Concern

ND = non-detect, DL = Detection Limit

Table A.10

Metals Background Data Used in Risk Assesments at Spring Valley

All units (mg/kg)	USACE, 1995 (1)	USACE 1996 (2)	USEPA 1999 (3)	USEPA 2000 (4)	USACE, 2000 (5)	SVFUDS Metals Background 2008 (6)
Aluminum	4,860/77,833		80,000	22,700		19,100
Antimony	4.67 U		0.2		ND	5.2
Arsenic	3.54	3.54	1.8	12.5	12.6	12.6
Barium	99.21					172
Beryllium	1.82/0.26		2.8			1.9
Boron	--					NA
Cadmium	1.43					2.36
Calcium	1,155					NA
Chromium	101		100	42.5	53.9	51.3
Cobalt	21.70/2.39					17.8
Copper	30.66/8.63					49.65
Iron	29,323			30,700		32,400
Lead	77.92		13	99		194
Magnesium	9,539/653					6,950
Manganese	851/138		950			968
Mercury, Elemental	0.07		0.08			0.25
Nickel	41.37		75			33.5
Potassium	2,855/7477					NA
Selenium	12.21 U					1.2
Silicon	--					NA
Silver	1.5					0.87
Sodium	65.32					NA
Strontium	--					53
Tellurium	--					5
Thallium	14.29 U		0.5			2.2
Tin	--					8.4
Titanium	--					2,690
Vanadium	47.93		135		67.6	75.5
Zinc	69.76/726.56					158
Zirconium						48.3

Notes: Blank spaces indicate no values were reported for that analyte.

(1) (USACE, 1995) Average of 12 soil samples (3 from each of the 4 soil associations present at the OSR FUDS) collected during the OSR FUDS RI (USACE, 1995); when two values are given, the first is the average concentration of pooled background soil sample data for Urban Land-Brandywine, Manor-Glenelg, and Urban Land-Manor Glenelg soil associations, and the second is the average concentration of background soil sample data for Urban Land-Sassafras Chillum soil association.

(2) Used only arsenic background concentration from USACE, 1995.

(3) EPA 12 split samples (split with USACE in background study) in the same background locations as those collected during the OSR FUDS RI. Using both the OSR FUDS RI background data and the EPA background data from split samples, a statistical analysis of the site and background data was conducted by National Environmental Research Laboratory (NERL) (as shown in an attachment to the USEPA 1999 HHRA).

(4) An additional background sampling program was conducted by USEPA, as summarized in the Background Trip Report, Spring Valley OU3 (Appendix C of the HHRA) in August and September, 1999. The background data sets comprised 25 to 30 surface soils, depending on the type of parent soil material and the appropriate statistical population. A statistical assessment of five metals from this sampling event was conducted, as described in Appendix D of 2000 HHRA.

(5) The background data from the USEPA 2000 HHRA was used for the 4801 Glenbrook Road HHRA because the data collected from 4801 Glenbrook Road was determined to be similar in soil type to these background soil samples. Table 2.1.2 in Appendix B of this HHRA.

(6) USACE, Background Soil Sampling Report, Spring Valley FUDS, Parsons, April 2008, data from Table 3, SVFUDS 2007 Background Sampling, New Background Values for Metals, page 10. USACE used the nonparametric 95% UTL with 90% coverage as calculated by ProUCL v. 4.0 as the background concentration.

Table A.11
Summary of Exposure Assessment Changes for HHRA Review
Review of Exposure Parameters

Exposure Pathways[1]	Receptors	Change in Assumptions Used for Pathway
Incidental Soil Ingestion		
Incidental Soil Ingestion Rate (mg/day)	Residents	No change
	Outdoor workers	Increase in incidental soil ingestion rate from RME of 100 to 330 mg/day.
	Construction workers	Decrease from RME of 480 to 330 mg/day.
Dermal Contact with Soil	All receptors	Qualitatively evaluated in several previous HHRAs, because USEPA had not identified toxicity reference values for dermal exposure, and the judgment was that information was limited for determining uptake of chemicals across intact skin. Pathway would currently be quantitatively evaluted. USEPA, 2004, provides dermal absorption values for ten compounds.[2]
Soil Adherence Factors	Residential adults	Adult factor has changed from 1 (RME) or 0.08 (CTE) (EPA, 1999) to 0.076 mg/cm^2
		Adult factor has changed from 0.035 (RME) (EPA, 2000) to 0.076 mg/cm^2
	Residential children	Child factor has changed from 1 (RME) or 0.3 (CTE) (EPA, 1999) to 0.054 mg/cm^2 (day care data)
		Child factor has changed from 0.3 (RME) (EPA, 2000) to 0.054 mg/cm^2 (day care data)
	Adult student athlete	Change from 0.13 to 0.094 mg/cm^2 (adult outdoor sports data)
	Recreational users	Increase from 0.035 to 0.076 mg/cm^2 (outdoor gardening data)
	Outdoor workers	Increase from 0.035 to 0.076 mg/cm^2 (outdoor gardening data)
	Construction workers	Construction worker factor has change from 1 (RME) or 0.08 (CTE) to 0.16 mg/cm^2 (for face, arms, hands, legs)
Skin Surface Area Available for Contact	Residential adults	For adult, for contact with face, arms, hands, legs RME has increased from 5,800 to 13,940 cm^2/day and CTE has increased from 3,300 to 11,385 cm^2/day.
	Residential children	RME has decreased from 6,600 to 4,070 cm^2/day, and CTE has increased from 2,900 to 3,465 cm^2/day (head, arms, hands, legs, and feet)
	Trespasser adults	Change from 6,763 (face, forearms, hands, lower legs, and feet) to 15,475 cm^2/day for RME (average for head, arms, hands, legs, and feet for adult males and females) (EPA, 2000)
	Trespasser children	Change from 6,600 (face, forearms, hands, lower legs, and feet) to 4,070 cm^2/day for RME (ages 0-6, average for head, arms, hands, legs, and feet) (EPA, 2000)
	Adult student athlete	Increase from 7,250 (head, forearms, hands and lower legs, 95th percentile) to 13,940 cm^2/day (adult face, arms, hand, legs)
	Recreational users	Increase from RME of 6,783 and CTE of 6,411 cm^2/day to 13,940 as the RME and 11,385 cm^2/day for CTE (head arms, hand, and legs)
	Outdoor workers	Increase from RME of 3,378 and CTE of 2.817 cm^2/day to 13,940 as the RME and 11,385 cm^2/day for CTE (head arms, hand, and legs)
	Construction workers	Increase from RME of 5,800 and CTE of 3,300 cm^2/day to RME of 6,840 and CTE of 5,570 cm^2/day (for face, arms, hands for adult males)

Table A.11
Summary of Exposure Assessment Changes for HHRA Review
Review of Exposure Parameters

Exposure Pathways[1]	Receptors	Change in Assumptions Used for Pathway
Ingestion of homegrown vegetables		Qualitatively evaluated in several previous HHRAs, because aluminum, beryllium, nickel, and vanadium are not readily bioavailable for plant uptake in neutral pH soils. Although some data indicate increased cadmium concentrations in animals at the top of the food chain, the data available on biomagnification are not conclusive. Therefore, previous HHRAs assumed negligible risk to residents from the ingestion of home-grown garden produce. Pathway would currently be quantitatively evaluated.[3]
Vegetable Ingestion Rate	Resident adults Resident children	Change in recommendations for total vegetable intake for adults from RME of 34.3 g/day to RME of 6 g/day and CTE of 2.5 g/day Change in recommendations for total vegetable intake for child from RME of 7.4 g/day to RME of 15.7 g/day and CTE of 6.4 g/day.
Particulate Inhalation Inhalation Rate	Construction Workers, Moderate activity (OSR FUDS, 1995 and 1996 RI) Construction workers (EPA 2000) Adult student athlete	RME inhalation rate decreased from 2.5 to 2.15 m^3/hour, while the CTE inhalation rate increased from 0.83 to 1.59 m^3/hour. Values increased from RME of 20 and CTE of 13.3 m^3/day to RME of 19.4 and CTE of of 14.7 m^3/day (EFH, adults >21 years old) Change from 19 m^3/day to RME of 24.6 and CTE of 16.3 m^3/day (ages 16 to 21)

Notes:
RME = reasonable maximum exposure
CTE = central tendency (or average) exposure
1) No change in recommendations for:
Exposure Frequency (days/year)
Exposure Duration (years)
Fraction Ingested (unitless)
Body Weight (kg)
Averaging Time (non-cancer) (days)
Averaging Time (cancer) (days)

2) Compounds include arsenic, cadmium, and semi-volatile organic compounds as a class. No values are provided for other inorganic compounds, due to the lack of sufficient data on which to base an appropriate default screening level for inorganics other than arsenic and cadmium

3) Recent USEPA guidance (USEPA, 2011) presents per capita (average over the whole population) and consumer-only ingestion rates for all fruits and vegetables, combining both homegrown and commercially purchased.

Table A.12					
Review of Toxicity Values					
HHRA Report	**Previously Selected COPCs**	**Oral Reference Dose Used in Previous HHRA (mg/kg-day)**	**Updated Oral Reference Dose (mg/kg-day) (1)**	**Oral Slope Factor Used in Previous HHRA $(mg/kg\text{-}day)^{-1}$**	**Updated Oral Slope Factor $(mg/kg\text{-}day)^{-1}$**
USACE OSR FUDS HHRA (1995 RI)	aluminum	2.90E+00	Not available on IRIS; could use PPRTV of 1.0E+00	—	NA
	antimony	4.00E-04	No change	—	NA
	beryllium	5.00E-03	2.00E-03	4.30E+00	IRIS provides only inhalation carcinogenicity value
	cadmium	1.00E-03	No change	—	NA
	manganese	1.40E-01	No change	—	NA
	mercury	2.00E-02	Not available on IRIS; could use 3.00E-0.4 for mercuric chloride	—	NA
	nickel	2.00E-02	No change	—	NA
	selenium	5.00E-03	No change	—	NA
	thallium	8.00E-05	Not available on IRIS; PPRTV of 1.0E-05 not approved for use by EPA Region 3	—	NA
	vanadium (4)	7.00E-03	Not available on IRIS; value listed in RSL table of 5.0E-03 not approved for use by EPA Region 3	—	NA
	zinc	3.00E-01	No change	—	NA
USACE HHRA for Spaulding and Captain Rankin Areas (RI Report, 1996)	arsenic	3.00E-04	No change	1.5	No change
USEPA Region III HHRA (1999)	benzo(a)anthracene	—	NA	7.30E-01	No change
	benzo(b)fluoranthene	—	NA	7.30E-01	No change
	benzo(a)pyrene	—	NA	7.30E+00	No change
	indeno(1.2.3-cd)pyrene	—	NA	7.30E-01	No change
	dibenz(a.h)anthracene	—	NA	7.30E+00	No change
	arochlor-1260	—	NA	2.00E+00	No change
	antimony	4.00E-04	No change	—	NA
	arsenic	3.00E-04	No change	1.5	No change
	mercury	3.00E-04	No change	—	NA
	nickel	2.00E-02	No change	—	NA
	selenium	5.00E-03	No change	—	NA
	thallium	7.00E-05	Not available on IRIS; PPRTV of 1.0E-05 not approved for use by EPA Region 3	—	NA

Table A.12

Review of Toxicity Values

HHRA Report	Previously Selected COPCs	Oral Reference Dose Used in Previous HHRA (mg/kg-day)	Updated Oral Reference Dose (mg/kg-day) (1)	Oral Slope Factor Used in Previous HHRA $(mg/kg\text{-}day)^{-1}$	Updated Oral Slope Factor $(mg/kg\text{-}day)^{-1}$
USEPA Region III American University HHRA (2000)	aluminum	1.00E+00	No change	—	NA
	antimony	4.00E-04	No change	—	NA
	arsenic	3.00E-04	No change	1.5	No change
	beryllium	2.00E-03	No change	—	NA
	chromium VI (5)	3.00E-03	No change	Not available on IRIS; could use value listed in RSL table of 5.0E-1	IRIS provides only inhalation carcinogenicity value
	chromium III	1.50E+00	No change	—	NA
	iron	3.00E-01	Not available on IRIS; could use PPRTV of 7.0E-01	—	NA
	manganese (2)	2.00E-02	1.40E-01	—	NA
	mercury (3)	3.00E-04	No change	—	NA
	nickel	2.00E-02	No change	—	NA
	vanadium (4)	7.00E-03	Not available on IRIS; value listed in RSL table of 5.0E-03 not approved for use by EPA Region 3	—	NA
USACE HHRA for the 4801 Glenbrook Road property (2000)	arsenic	3.00E-04	No change	1.5	No change

NA = not listed in IRIS on-line, 2013

Notes:

1. Alternative sources of toxicity values, as listed, would be used only if approved by EPA Region 3.
2. For USPA, 2000: Manganese nonfood toxicity value used.
3. For USPA, 2000: Mercuric Chloride toxicity value used.
4. The oral RfD toxicity value for Vanadium is derived from the IRIS oral RfD for Vanadium Pentoxide by factoring out the molecular weight (MW) of the oxide ion.
(http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm)
5. The oral cancer slope factor is from the New Jersey Department of Environmental Protection (NJDEP), that recently determined that Cr(VI) by ingestion is likely to be carcinogenic in humans. NJDEP derived a new oral cancer slope factor, based on cancer bioassays conducted by the National Toxicology Program.
(http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm)

APPENDIX B:
FIGURES

Figure 1: Site Location Map
Figure 2: Areas covered by HHRAs and AUES sampling
Figure 3: Areas with at least one COPC through Initial Screen
Figure 4: COPCs Remaining through Additional Screen (Step 3b)
Figure 5: Proposed Exposure Units

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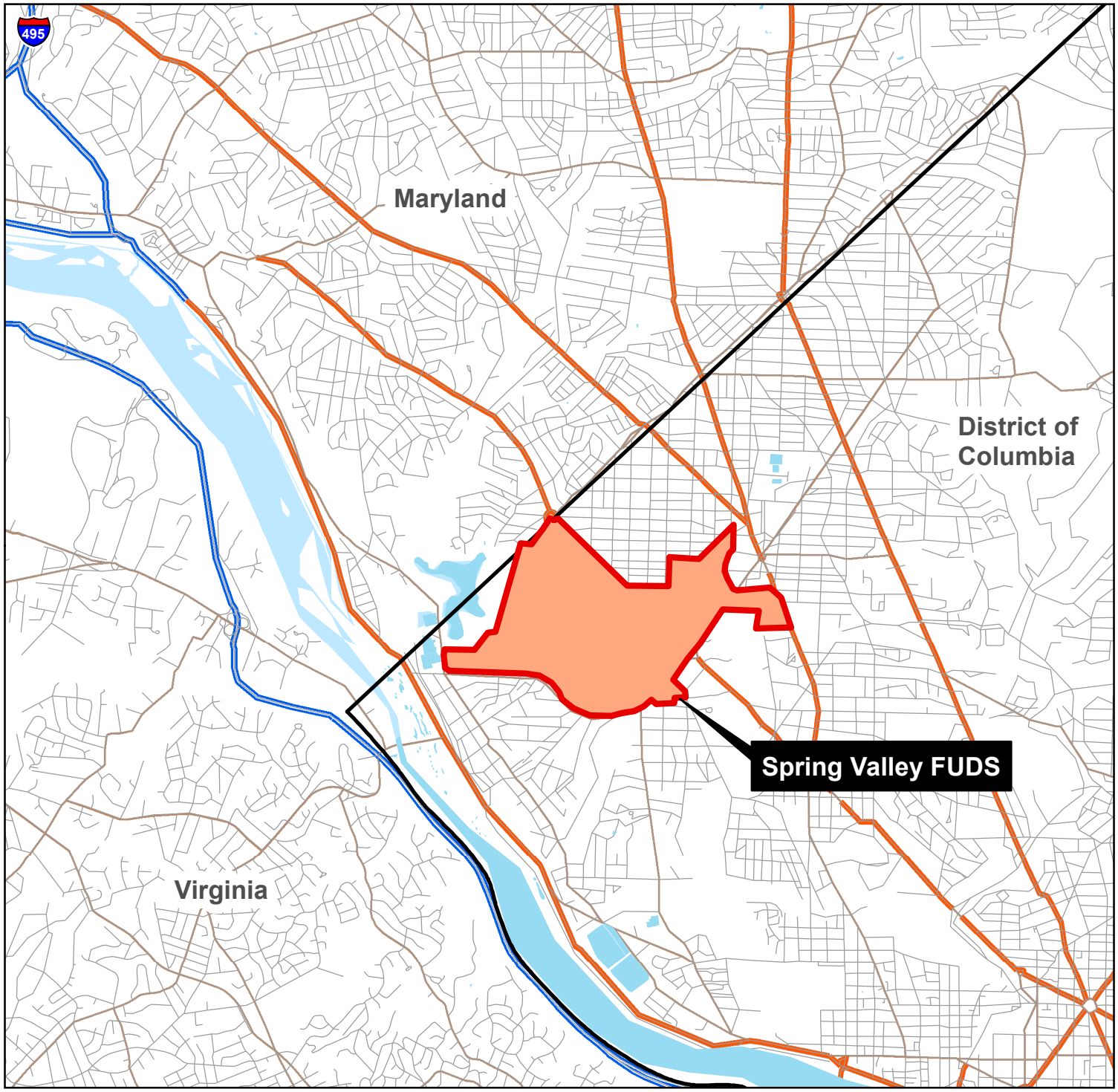


Figure 1
Site Location Map

Spring Valley FUDS
Washington, DC

Legend

- Spring Valley Site
- District of Columbia Boundary
- Urban Freeway
- Urban Interstate
- Local Streets
- Rivers and Lakes

FUDS - Formerly Used Defense Site

N
W E
S

0 0.25 0.5 1
Mile

ERT

March 2013

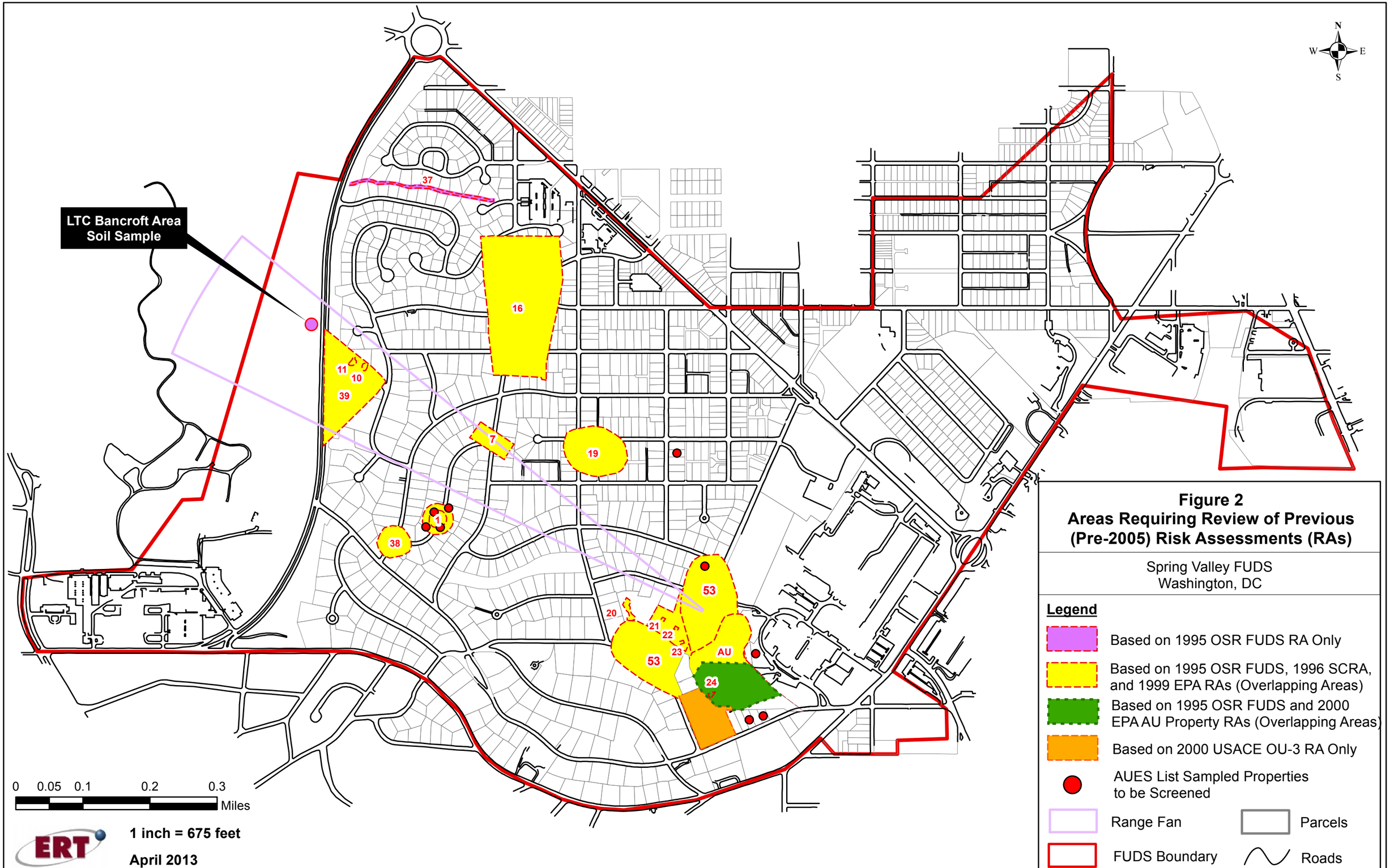


Figure 2
Areas Requiring Review of Previous (Pre-2005) Risk Assessments (RAs)

Spring Valley FUDS
Washington, DC

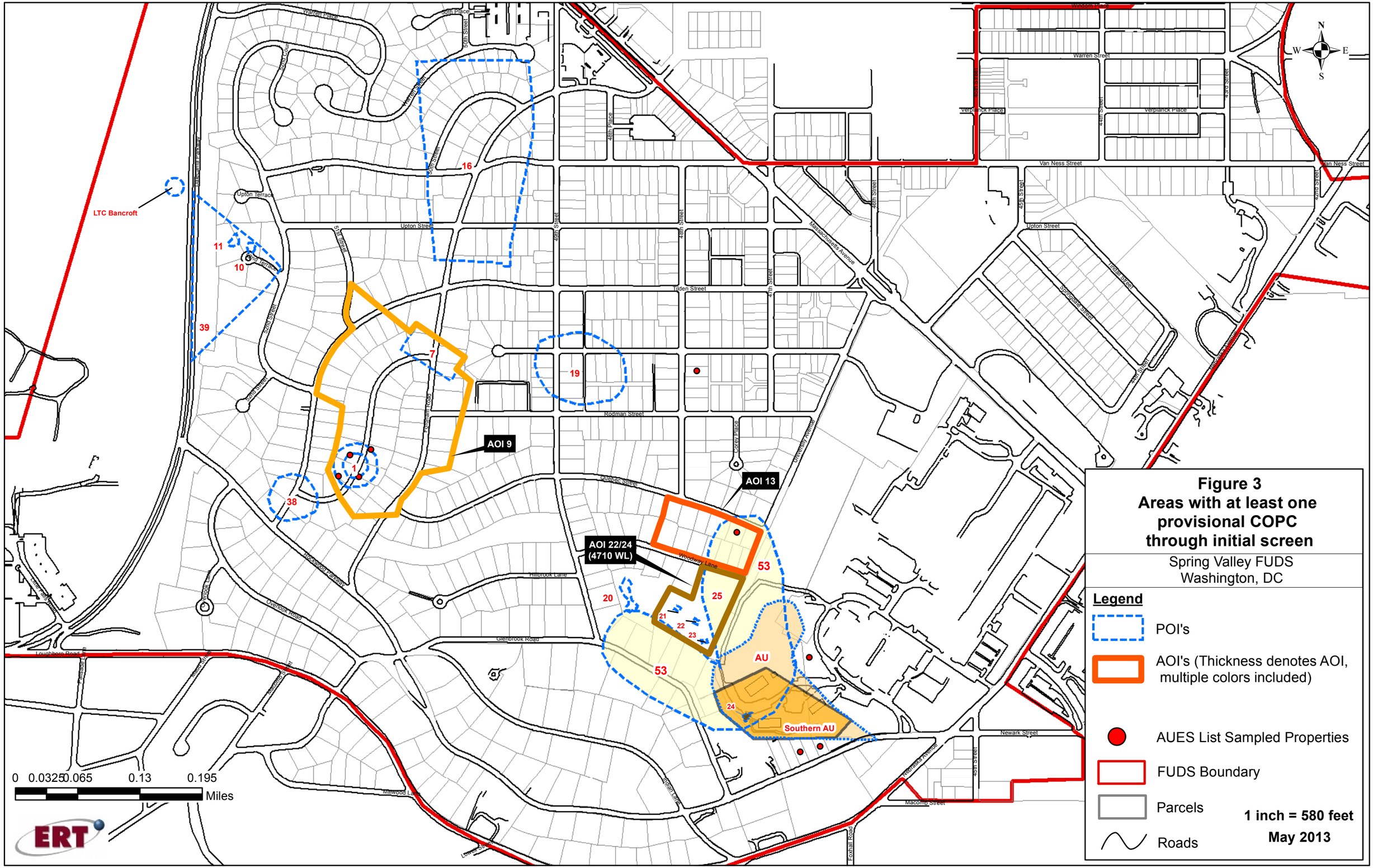


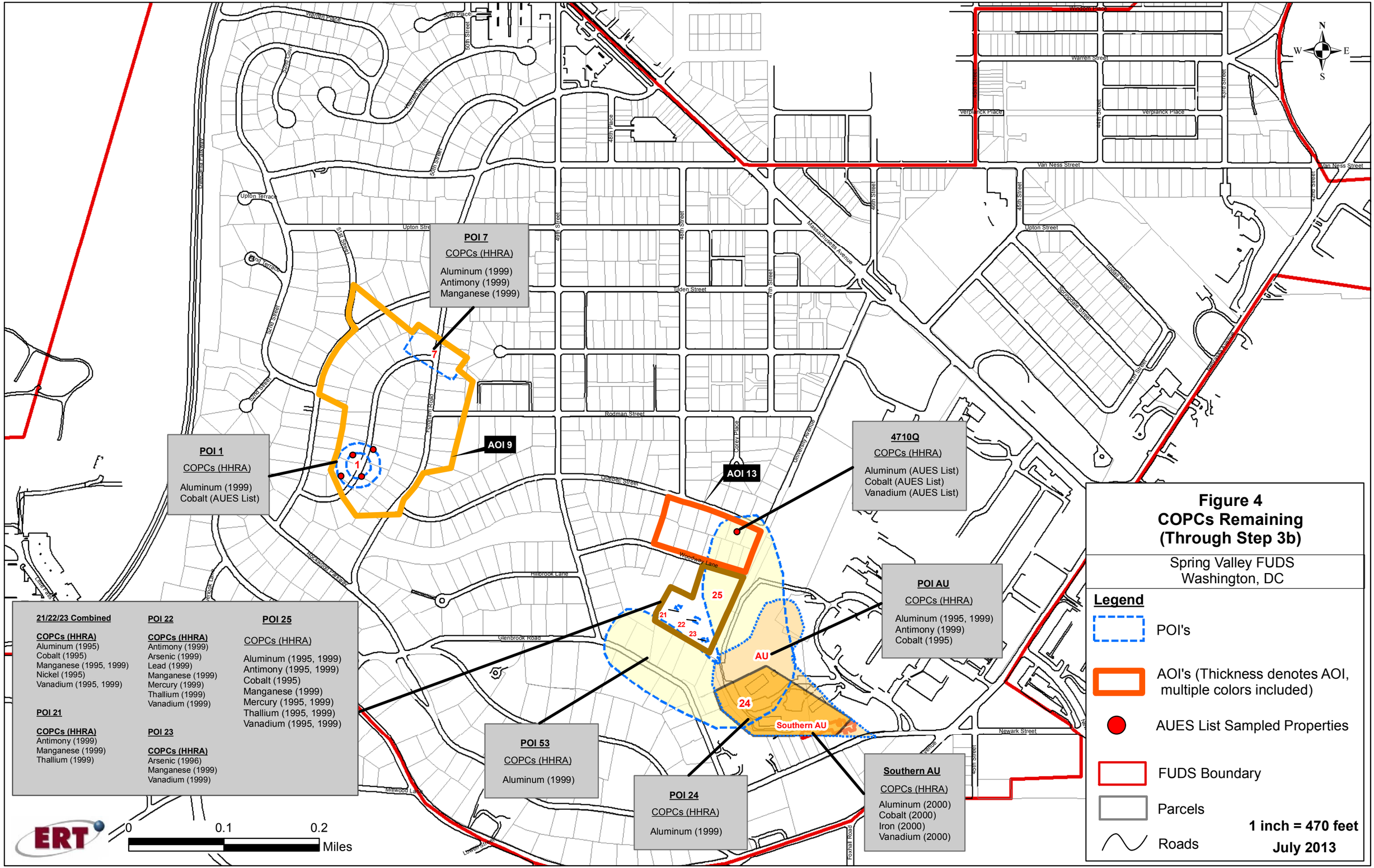
Figure 3
Areas with at least one provisional COPC through initial screen

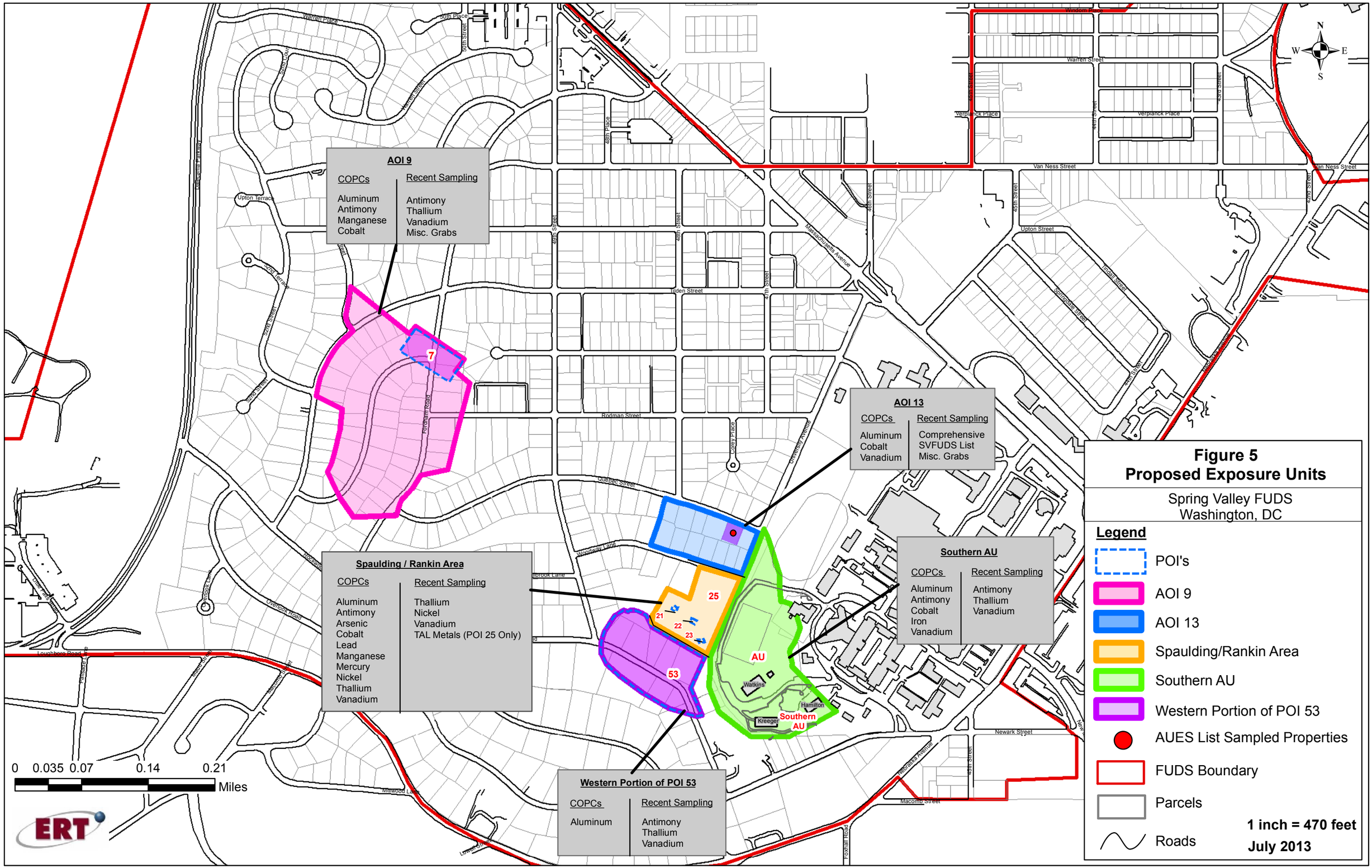
Spring Valley FUDS
Washington, DC

Legend

- POI's
- AOI's (Thickness denotes AOI, multiple colors included)
- AUES List Sampled Properties
- FUDS Boundary
- Parcels
- Roads

1 inch = 580 feet
May 2013


POI 7
COPCs (HHRA)
Aluminum (1999)
Antimony (1999)
Manganese (1999)
POI 1
COPCs (HHRA)
Aluminum (1999)
Cobalt (AUES List)
AOI 9
AOI 13
4710Q
COPCs (HHRA)
Aluminum (AUES List)
Cobalt (AUES List)
Vanadium (AUES List)
POI AU
COPCs (HHRA)
Aluminum (1995, 1999)
Antimony (1999)
Cobalt (1995)
21/22/23 Combined
COPCs (HHRA)
Aluminum (1995)
Cobalt (1995)
Manganese (1995, 1999)
Nickel (1995)
Vanadium (1995, 1999)
POI 21
COPCs (HHRA)
Antimony (1999)
Manganese (1999)
Thallium (1999)
POI 22
COPCs (HHRA)
Antimony (1999)
Arsenic (1999)
Lead (1999)
Manganese (1999)
Mercury (1999)
Thallium (1999)
Vanadium (1999)
POI 23
COPCs (HHRA)
Arsenic (1996)
Manganese (1999)
Vanadium (1999)
POI 25
COPCs (HHRA)
Aluminum (1995, 1999)
Antimony (1995, 1999)
Cobalt (1995)
Manganese (1999)
Mercury (1995, 1999)
Thallium (1995, 1999)
Vanadium (1995, 1999)
POI 53
COPCs (HHRA)
Aluminum (1999)
POI 24
COPCs (HHRA)
Aluminum (1999)
Southern AU
COPCs (HHRA)
Aluminum (2000)
Cobalt (2000)
Iron (2000)
Vanadium (2000)
AU
Southern AU
Figure 4
COPCs Remaining
(Through Step 3b)
Spring Valley FUDS
Washington, DC
Legend
POI's
AOI's (Thickness denotes AOI, multiple colors included)
AUES List Sampled Properties
FUDS Boundary
Parcels
Roads
1 inch = 470 feet
July 2013
0
0.1
0.2
Miles
ERT


AOI 9
COPCs
Aluminum
Antimony
Manganese
Cobalt
Recent Sampling
Antimony
Thallium
Vanadium
Misc. Grabs
AOI 13
COPCs
Aluminum
Cobalt
Vanadium
Recent Sampling
Comprehensive SVFUDS List
Misc. Grabs
Spaulding / Rankin Area
COPCs
Aluminum
Antimony
Arsenic
Cobalt
Lead
Manganese
Mercury
Nickel
Thallium
Vanadium
Recent Sampling
Thallium
Nickel
Vanadium
TAL Metals (POI 25 Only)
Southern AU
COPCs
Aluminum
Antimony
Cobalt
Iron
Vanadium
Recent Sampling
Antimony
Thallium
Vanadium
Western Portion of POI 53
COPCs
Aluminum
Recent Sampling
Antimony
Thallium
Vanadium
7
25
21
22
23
53
AU
Southern AU
Watkins
Hamilton
Kreeger
Warren Place
50th Place
50th Street
Warren Street
Upton Terrace
49th Street
48th Place
48th Street
47th Street
46th Street
45th Street
44th Street
43rd Street
42nd Street
Massachusetts Avenue
Van Ness Street
Upton Street
Tilden Street
Rodman Street
Quebec Street
Woodway Lane
Overlook Road
Loughboro Road
Millwood Lane
Newark Street
Macomb Street
Nebraska Avenue
Foxhall Road
Wisconsin Avenue
Windom Place
Verplanck Place
Idaho Place
Fordham Road
Carey Place
University Avenue
Spring Terrace
Lincoln Street
Springdale Street
Wallace Place
Wallace Place Parkway
N
S
E
W
0 0.035 0.07 0.14 0.21
Miles
ERT
Figure 5
Proposed Exposure Units
Spring Valley FUDS
Washington, DC
Legend
POI's
AOI 9
AOI 13
Spaulding/Rankin Area
Southern AU
Western Portion of POI 53
AUES List Sampled Properties
FUDS Boundary
Parcels
Roads
1 inch = 470 feet
July 2013

APPENDIX C:
SCREENING STEPS PROCEDURE - MEMORANDUM

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APPENDIX C
Screening Procedure Memorandum

Screening by Original Report and POI or Area of Investigation

A. Initial Screen for all Detected Chemicals

Initial Screen: Compare to higher of RSL and Background

1. Compare the maximum detected concentration to the risk-based screening level (RSL) (adjusted down by 10 if based on non-cancer effects) and
2. For inorganics, compare the maximum detected concentrations to the 2008 background concentration

Initial Screen (for Sample Sets with All NDs)

1. Check the Detection Limit (DL). If the DL is greater than the screening level (SL), the analyte is selected as a Provisional COPC (whether DL is greater than or less than background). [Based on the concept that these chemicals with high DLs could exist on a site with concentrations greater than SLs.]

Conclusions of Initial Screen:

If the maximum detected concentration is greater than the higher of the current RSL or the 2008 background, or for data sets with all NDs the DL<SL, it is selected as a Provisional COPC.

B. Additional Screen for Provisional COPCs

Additional Screen Step 1: Calculate Risk Ratio:

1. Assuming sufficient quantity of samples (5 or greater),[1] ProUCL is used to calculate the exposure point concentration (EPC), which is the 95% upper confidence limit (UCL) of the mean.

    - If a data set consists of all ND results, the EPC is assumed to be ½ of the *average* DL.
    - If there is only one detect, the EPC is the detected value.
    - If a data set consists of fewer than 5 samples, the EPC is the maximum detected concentration.
    - If the ProUCL-calculated EPC is greater than the maximum detected value, then the maximum detected value is used as the EPC in the risk ratio.

2. Calculate Risk Ratio: compare EPCs to the most current RSLs (adjusted down by 10 if based on non-cancer endpoint)[2]

[1] ProUCL will not compute any decision statistics such as UCLs and UPLs, UTLs for data sets of size less than 5 (without NDs). Moreover, for data sets with NDs of at least 5, no decision statistics will be computed when not more than one detected observation is present in the data set. For small data sets of size less than 5, ProUCL provides warning messages informing the user about the potential deficiencies present in the data set.

Conclusions of Additional Screen Step 1:
If the risk ratio is less than or equal to one, EPC does not exceed RSL, and that COPC drops out.

If the risk ratio is greater than one, EPC exceeds the RSL, go to next step (statistical comparison to background).

Additional Screen Step 2. Background Comparison: Assuming sufficient quantity of samples (5 or greater),[3] a two-sample hypothesis test comparing site concentrations to background concentrations is done using ProUCL- recommended procedures:[4]

1. For sample sets without NDs (all results are detected values), use the Student's t (pooled test) (assumes equal variances), or the Welch-Satterthwaite (W-S) test (assumes unequal variances), as described below (ProUCL provides both).
   - Use Student's t (pooled test), which assumes equal variances, as long as this assumption is consistent with the Test of Equality of Variances.
   - When variances are found by the Test of Equality of Variances to be unequal, two things could occur:
     - The conclusions of the Student's t test and the W-S test are the same, and this conclusion is listed in the results.
     - The conclusions of the Student's t test and the W-S test are different. Then, if the Test of Equality of Variances shows that the data set has unequal variances, the W-S results are used.
2. For sample sets with any nondetects (either some or all non-detects), use the Wilcoxon-Mann-Whitney (WMW) test (ProUCL enters in the minimum detection limit and the maximum detection limit to do the comparison).
   - For data sets with all NDs and DL>SL, if the result of the statistical comparison to background is site<BG, this means that, even with the elevated detection limits, if this COPC was found on the site at these DL concentrations, the concentrations would be less than background, so the COPC drops out.

---

[2] Risk ratio defined as EPC/RSL (RSL adjusted down by 10 for non-cancer-based RSLs).
[3] ProUCL recommends a minimum data set of 8 to 10 samples, however, does perform background calculations for sample sets of as low as 5; reduced statistical power is associated with calculations based on the bare minimum number of samples. For locations with <5 samples, the background comparison is not done.
[4] These tests are appropriate for site-versus-background comparisons of the means, and compare: site parameters (e.g., mean, shape, distribution, variability) to background parameters (e.g., mean, shape, distribution, variability). According to ProUCL User's Guide, two-sample hypothesis tests are preferably used for site-versus-background comparisons.

Notes:
In some cases, the listed site mean and maximum concentrations are higher than the background mean and maximums, but the ProUCL tests still conclude that site < BG. This is because the mean, shape, distribution, and variability of the data, as well as the number of non-detects, are taken into account in the ProUCL statistical tests.[5] ProUCL concludes that the differences are consistent with the random variation observed (and expected) in the samples. Therefore the sample results do not constitute "statistically significant evidence of a difference." That is, this 'small' difference is thoroughly consistent with chance variations predicted by statistical theory and therefore it would be invalid to conclude there is any difference in means. In effect, ProUCL concludes that there is insufficient evidence that site is greater than BG.

Conclusions of Additional Screen Step 2:

<u>If ProUCL determines that Site concentrations are less than background, the COPC drops out.</u>

<u>If ProUCL determines that Site concentrations are greater than background, go to Step 3.</u>

Additional Screen Step 3

Step 3a: Re-Analyze Data after Removing Samples that Represent Excavated Soil

Check whether any of the remaining Provisional COPCs are based on soil that has already been excavated (noting the depths of the samples removed):

If the COPC selection was based on soil that has been removed, remove excavated soil samples from the data set, then re-do Additional Steps 1 and 2 (i.e., re-calculate the risk ratio and re-run the statistical comparison to background using only those samples that remain). A statistical comparison to background using ProUCL is done only if there are 5 or more samples left in the data set. Otherwise, the maximum is compared to the 2008 background concentration.

Conclusions of Additional Screen Step 3a:

<u>If ProUCL determines for the in-place unexcavated soil data that ***either*** the risk ratio is less than or equal to one, ***or*** site concentrations are less than background, the COPC drops out.</u>

<u>If ProUCL determines for the in-place unexcavated soil data, that the risk ratio is greater than one ***and*** the site concentrations are greater than background, proceed to Step 3b.</u>

[5] For the WMW test, the ProUCL Technical Guide states: "The WMW test does not place enough weight on the larger site and background measurements. This means, a WMW may lead to the conclusion that two populations are comparable even when the observations in the right tail of one distribution (e.g., site) are significantly larger than the right tail observations of other population (e.g., background)." For the t test, this may occur because the test is not robust to outliers because sample means and standard deviations are sensitive to outliers.

Step 3b: Re-Analyze Data with Backfill Data Added

Using a combination of the remaining in-place samples and replacing the removed samples with the average backfill concentration for that COPC, re-do Additional Steps 1 and 2 (i.e., re-calculate the risk ratio and re-run the statistical comparison to background). Specifically:

Average the concentrations of the soil results from the backfill per chemical (if chemical was ND, use ½ DL). On a one-to-one basis, replace any excavation removed soil result with the average backfill result. Depending on which backfill soil pile was used, the average could be an average of multiple backfill samples, or in some cases where there were discrete plus composite backfill samples, take the average of the discrete samples and average that with the composite sample.

Conclusions of Additional Screen Step 3b:

If ProUCL determines for the in-place unexcavated soil plus the backfill soil, that ***either*** the risk ratio is less than or equal to one, ***or*** site concentrations are less than background, the COPC drops out.

If ProUCL determines for the in-place unexcavated soil plus the backfill soil, that the risk ratio is greater than one ***and*** the site concentrations are greater than background, COPC is retained.

General Notes:

- The 2 Rockwood properties that are part of the Table A.7 AUES List sampling were grouped together rather than reviewed individually. Similarly, multiple properties in the Sedgwick Trench area were grouped for analysis.
- The 2008 background concentrations listed in the tables are the 95% UTL concentrations for the background data set. For the statistical comparison to background, the background raw data (from Appendix B of the Background Soil Sampling Report, April 18, 2008, Parsons) was entered into ProUCL. These are all surface soil samples, but for the screen are used as background numbers for the entire site whether surface or subsurface data are being assessed.

APPENDIX D:
ProUCL STATISTICAL TESTING OUTPUT
(provided on CD only)

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STEPs 1 & 2:

95% UCL RESULTS
(BY POI OR AREA OF INVESTIGATION)

BACKGROUND TEST RESULTS
(BY TABLE--A.2, A.3, etc)

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

STEPS 1 & 2
POI AU
95% UCLs

Aluminum POI AU 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13
Raw Statistics		**Log-transformed Statistics**	
Minimum	9120	Minimum of Log Data	9.118
Maximum	57700	Maximum of Log Data	10.96
Mean	28541	Mean of log Data	10.14
Geometric Mean	25258	SD of log Data	0.535
Median	26400		
SD	14024		
Std. Error of Mean	3890		
Coefficient of Variation	0.491		
Skewness	0.608		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.958	Shapiro Wilk Test Statistic	0.97
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	35473	95% H-UCL	40653
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	47969
95% Adjusted-CLT UCL (Chen-1995)	35639	97.5% Chebyshev (MVUE) UCL	56266
95% Modified-t UCL (Johnson-1978)	35582	99% Chebyshev (MVUE) UCL	72566
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.321	Data appear Normal at 5% Significance Level	
Theta Star	8593		
MLE of Mean	28541		
MLE of Standard Deviation	15660		
nu star	86.36		
Approximate Chi Square Value (.05)	65.93	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	34939
Adjusted Chi Square Value	63.4	95% Jackknife UCL	35473
		95% Standard Bootstrap UCL	34842
Anderson-Darling Test Statistic	0.165	95% Bootstrap-t UCL	36743
Anderson-Darling 5% Critical Value	0.737	95% Hall's Bootstrap UCL	37223
Kolmogorov-Smirnov Test Statistic	0.101	95% Percentile Bootstrap UCL	34741
Kolmogorov-Smirnov 5% Critical Value	0.238	95% BCA Bootstrap UCL	35132
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	45495
		97.5% Chebyshev(Mean, Sd) UCL	52831
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	67242
95% Approximate Gamma UCL (Use when n >= 40)	37380		
95% Adjusted Gamma UCL (Use when n < 40)	38877		
Potential UCL to Use		**Use 95% Student's-t UCL**	**35473**

Aluminum POI AU 1995

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	14

Raw Statistics		Log-transformed Statistics	
Minimum	8679	Minimum of Log Data	9.069
Maximum	56138	Maximum of Log Data	10.94
Mean	27620	Mean of log Data	10.09
Geometric Mean	23990	SD of log Data	0.57
Median	23236		
SD	14575		
Std. Error of Mean	3895		
Coefficient of Variation	0.528		
Skewness	0.589		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.939	Shapiro Wilk Test Statistic	0.959
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	34518	95% H-UCL	39527
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	47024
95% Adjusted-CLT UCL (Chen-1995)	34682	97.5% Chebyshev (MVUE) UCL	55317
95% Modified-t UCL (Johnson-1978)	34620	99% Chebyshev (MVUE) UCL	71607
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.96	Data appear Normal at 5% Significance Level	
Theta Star	9331		
MLE of Mean	27620		
MLE of Standard Deviation	16053		
nu star	82.88		
Approximate Chi Square Value (.05)	62.9	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	34027
Adjusted Chi Square Value	60.6	95% Jackknife UCL	34518
		95% Standard Bootstrap UCL	33662
Anderson-Darling Test Statistic	0.228	95% Bootstrap-t UCL	35541
Anderson-Darling 5% Critical Value	0.741	95% Hall's Bootstrap UCL	34857
Kolmogorov-Smirnov Test Statistic	0.109	95% Percentile Bootstrap UCL	33954
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	34078
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	44599
		97.5% Chebyshev(Mean, Sd) UCL	51946
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	66377
95% Approximate Gamma UCL (Use when n >= 40)	36393		
95% Adjusted Gamma UCL (Use when n < 40)	37778		
Potential UCL to Use		**Use 95% Student's-t UCL**	**34518**

Antimony POI AU 1999

General Statistics			
Number of Valid Data	13	Number of Detected Data	12
Number of Distinct Detected Data	12	Number of Non-Detect Data	1
		Percent Non-Detects	7.69%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	6.9	Minimum Detected	1.932
Maximum Detected	40.4	Maximum Detected	3.699
Mean of Detected	20.96	Mean of Detected	2.9
SD of Detected	11.23	SD of Detected	0.573
Minimum Non-Detect	9.8	Minimum Non-Detect	2.282
Maximum Non-Detect	9.8	Maximum Non-Detect	2.282

UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.928	Shapiro Wilk Test Statistic	0.961
5% Shapiro Wilk Critical Value	0.859	5% Shapiro Wilk Critical Value	0.859
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	19.72	Mean	2.799
SD	11.64	SD	0.658
95% DL/2 (t) UCL	25.48	95% H-Stat (DL/2) UCL	31.66
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	18.65	Mean in Log Scale	2.834
SD	12.85	SD in Log Scale	0.599
95% MLE (t) UCL	25	Mean in Original Scale	19.94
95% MLE (Tiku) UCL	25.22	SD in Original Scale	11.37
		95% t UCL	25.56
		95% Percentile Bootstrap UCL	25.1
		95% BCA Bootstrap UCL	25.41
		95% H UCL	29.92
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	2.807	Data appear Normal at 5% Significance Level	
Theta Star	7.467		
nu star	67.37		
A-D Test Statistic	0.233	**Nonparametric Statistics**	
5% A-D Critical Value	0.737	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.737	Mean	19.95
5% K-S Critical Value	0.247	SD	10.91
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	3.163
		95% KM (t) UCL	25.58
Assuming Gamma Distribution		95% KM (z) UCL	25.15
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	25.57
Minimum	3.569	95% KM (bootstrap t) UCL	26.57
Maximum	40.4	95% KM (BCA) UCL	25.43
Mean	19.62	95% KM (Percentile Bootstrap) UCL	25.13
Median	16.3	95% KM (Chebyshev) UCL	33.73
SD	11.79	97.5% KM (Chebyshev) UCL	39.7
k star	2.077	99% KM (Chebyshev) UCL	51.42
Theta star	9.446		
Nu star	54	**Potential UCLs to Use**	
AppChi2	38.12	**95% KM (t) UCL**	**25.58**
95% Gamma Approximate UCL (Use when n >= 40)	27.8	95% KM (Percentile Bootstrap) UCL	25.13
95% Adjusted Gamma UCL (Use when n < 40)	29.25		

Note: DL/2 is not a recommended method.

Arsenic POI AU 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13

Raw Statistics		Log-transformed Statistics	
Minimum	1.7	Minimum of Log Data	0.531
Maximum	13.5	Maximum of Log Data	2.603
Mean	7.038	Mean of log Data	1.768
Geometric Mean	5.861	SD of log Data	0.683
Median	8.4		
SD	3.842		
Std. Error of Mean	1.066		
Coefficient of Variation	0.546		
Skewness	0.0481		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.94	Shapiro Wilk Test Statistic	0.903
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	8.938	95% H-UCL	11.75
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	13.49
95% Adjusted-CLT UCL (Chen-1995)	8.806	97.5% Chebyshev (MVUE) UCL	16.19
95% Modified-t UCL (Johnson-1978)	8.94	99% Chebyshev (MVUE) UCL	21.5
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.273	Data appear Normal at 5% Significance Level	
Theta Star	3.097		
MLE of Mean	7.038		
MLE of Standard Deviation	4.668		
nu star	59.1		
Approximate Chi Square Value (.05)	42.42	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	8.791
Adjusted Chi Square Value	40.42	95% Jackknife UCL	8.938
		95% Standard Bootstrap UCL	8.747
Anderson-Darling Test Statistic	0.477	95% Bootstrap-t UCL	8.975
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	8.762
Kolmogorov-Smirnov Test Statistic	0.231	95% Percentile Bootstrap UCL	8.715
Kolmogorov-Smirnov 5% Critical Value	0.238	95% BCA Bootstrap UCL	8.808
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	11.68
		97.5% Chebyshev(Mean, Sd) UCL	13.69
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	17.64
95% Approximate Gamma UCL (Use when n >= 40)	9.805		
95% Adjusted Gamma UCL (Use when n < 40)	10.29		
Potential UCL to Use		**Use 95% Student's-t UCL**	**8.938**

Cobalt POI AU 1995

General Statistics			
Number of Valid Data	14	Number of Detected Data	13
Number of Distinct Detected Data	13	Number of Non-Detect Data	1
		Percent Non-Detects	7.14%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	3.15	Minimum Detected	1.147
Maximum Detected	193.1	Maximum Detected	5.263
Mean of Detected	48.94	Mean of Detected	3.434
SD of Detected	51.08	SD of Detected	1.072
Minimum Non-Detect	1.59	Minimum Non-Detect	0.464
Maximum Non-Detect	1.59	Maximum Non-Detect	0.464

UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.749	Shapiro Wilk Test Statistic	0.957
5% Shapiro Wilk Critical Value	0.866	5% Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	45.5	Mean	3.172
SD	50.74	SD	1.421
95% DL/2 (t) UCL	69.51	95% H-Stat (DL/2) UCL	264.1
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	43.47	Mean in Log Scale	3.251
SD	51.65	SD in Log Scale	1.236
95% MLE (t) UCL	67.92	Mean in Original Scale	45.61
95% MLE (Tiku) UCL	66.79	SD in Original Scale	50.63
		95% t UCL	69.58
		95% Percentile Bootstrap UCL	68.59
		95% BCA Bootstrap UCL	77.12
		95% H UCL	165.9
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.001	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	48.9		
nu star	26.02		
A-D Test Statistic	0.32	Nonparametric Statistics	
5% A-D Critical Value	0.754	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.754	Mean	45.67
5% K-S Critical Value	0.242	SD	48.74
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	13.56
		95% KM (t) UCL	69.68
Assuming Gamma Distribution		95% KM (z) UCL	67.97
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	69.45
Minimum	0.000001	95% KM (bootstrap t) UCL	96.65
Maximum	193.1	95% KM (BCA) UCL	71.83
Mean	45.44	95% KM (Percentile Bootstrap) UCL	68.38
Median	36.38	95% KM (Chebyshev) UCL	104.8
SD	50.79	97.5% KM (Chebyshev) UCL	130.3
k star	0.367	99% KM (Chebyshev) UCL	180.6
Theta star	123.8		
Nu star	10.28	Potential UCLs to Use	
AppChi2	4.114	95% KM (Chebyshev) UCL	104.8
95% Gamma Approximate UCL (Use when n >= 40)	113.5		
95% Adjusted Gamma UCL (Use when n < 40)	129.3		

Note: DL/2 is not a recommended method.

Manganese POI AU 1995

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	14
Raw Statistics		**Log-transformed Statistics**	
Minimum	32.19	Minimum of Log Data	3.472
Maximum	3070	Maximum of Log Data	8.029
Mean	815.4	Mean of log Data	6.144
Geometric Mean	466	SD of log Data	1.217
Median	430.9		
SD	902.9		
Std. Error of Mean	241.3		
Coefficient of Variation	1.107		
Skewness	1.873		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.731	Shapiro Wilk Test Statistic	0.925
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1243	95% H-UCL	2847
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2316
95% Adjusted-CLT UCL (Chen-1995)	1341	97.5% Chebyshev (MVUE) UCL	2929
95% Modified-t UCL (Johnson-1978)	1263	99% Chebyshev (MVUE) UCL	4132
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.856	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	953		
MLE of Mean	815.4		
MLE of Standard Deviation	881.5		
nu star	23.96		
Approximate Chi Square Value (.05)	13.81	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	1212
Adjusted Chi Square Value	12.8	95% Jackknife UCL	1243
		95% Standard Bootstrap UCL	1190
Anderson-Darling Test Statistic	0.505	95% Bootstrap-t UCL	1878
Anderson-Darling 5% Critical Value	0.759	95% Hall's Bootstrap UCL	3482
Kolmogorov-Smirnov Test Statistic	0.168	95% Percentile Bootstrap UCL	1238
Kolmogorov-Smirnov 5% Critical Value	0.235	95% BCA Bootstrap UCL	1343
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1867
		97.5% Chebyshev(Mean, Sd) UCL	2322
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3216
95% Approximate Gamma UCL (Use when n >= 40)	1414		
95% Adjusted Gamma UCL (Use when n < 40)	1526		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**1414**

Manganese POI AU 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13

Raw Statistics		Log-transformed Statistics	
Minimum	23.9	Minimum of Log Data	3.174
Maximum	1760	Maximum of Log Data	7.473
Mean	632	Mean of log Data	6.009
Geometric Mean	406.9	SD of log Data	1.175
Median	475		
SD	530.9		
Std. Error of Mean	147.2		
Coefficient of Variation	0.84		
Skewness	1.254		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.86	Shapiro Wilk Test Statistic	0.884
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	894.4	95% H-UCL	2368
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1913
95% Adjusted-CLT UCL (Chen-1995)	928.9	97.5% Chebyshev (MVUE) UCL	2416
95% Modified-t UCL (Johnson-1978)	902.9	99% Chebyshev (MVUE) UCL	3405
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.033	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	611.5		
MLE of Mean	632		
MLE of Standard Deviation	621.6		
nu star	26.87		
Approximate Chi Square Value (.05)	16.05	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	874.2
Adjusted Chi Square Value	14.87	95% Jackknife UCL	894.4
		95% Standard Bootstrap UCL	858.4
Anderson-Darling Test Statistic	0.317	95% Bootstrap-t UCL	1072
Anderson-Darling 5% Critical Value	0.753	95% Hall's Bootstrap UCL	1374
Kolmogorov-Smirnov Test Statistic	0.163	95% Percentile Bootstrap UCL	875.6
Kolmogorov-Smirnov 5% Critical Value	0.242	95% BCA Bootstrap UCL	931.1
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1274
		97.5% Chebyshev(Mean, Sd) UCL	1552
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2097
95% Approximate Gamma UCL (Use when n >= 40)	1058		
95% Adjusted Gamma UCL (Use when n < 40)	1142		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**1058**

Mercury POI AU 1995

General Statistics			
Number of Valid Data	14	Number of Detected Data	9
Number of Distinct Detected Data	9	Number of Non-Detect Data	5
		Percent Non-Detects	35.71%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.1	Minimum Detected	-2.303
Maximum Detected	9.74	Maximum Detected	2.276
Mean of Detected	1.318	Mean of Detected	-1.126
SD of Detected	3.163	SD of Detected	1.439
Minimum Non-Detect	0.09	Minimum Non-Detect	-2.408
Maximum Non-Detect	0.11	Maximum Non-Detect	-2.207
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	8
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	42.86%

UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.438	Shapiro Wilk Test Statistic	0.781
5% Shapiro Wilk Critical Value	0.829	5% Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.865	Mean	-1.795
SD	2.56	SD	1.464
95% DL/2 (t) UCL	2.077	95% H-Stat (DL/2) UCL	2.113
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-2.29
		SD in Log Scale	2
		Mean in Original Scale	0.852
		SD in Original Scale	2.565
		95% t UCL	2.066
		95% Percentile Bootstrap UCL	2.205
		95% BCA Bootstrap UCL	2.894
		95% H-UCL	10.03
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.38	Data do not follow a Discernable Distribution (0.05)	
Theta Star	3.467		
nu star	6.842		
A-D Test Statistic	1.538	**Nonparametric Statistics**	
5% A-D Critical Value	0.778	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.778	Mean	0.883
5% K-S Critical Value	0.296	SD	2.461
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.698
		95% KM (t) UCL	2.119
Assuming Gamma Distribution		95% KM (z) UCL	2.031
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2.089
Minimum	0.000001	95% KM (bootstrap t) UCL	15.54
Maximum	9.74	95% KM (BCA) UCL	2.284
Mean	0.847	95% KM (Percentile Bootstrap) UCL	2.246
Median	0.115	95% KM (Chebyshev) UCL	3.924
SD	2.567	97.5% KM (Chebyshev) UCL	5.24
k star	0.159	99% KM (Chebyshev) UCL	7.825
Theta star	5.344		
Nu star	4.439	**Potential UCLs to Use**	
AppChi2	0.902	**97.5% KM (Chebyshev) UCL**	**5.24**
95% Gamma Approximate UCL (Use when n >= 40)	4.167		
95% Adjusted Gamma UCL (Use when n < 40)	5.263		
Note: DL/2 is not a recommended method.			

Mercury POI AU 1999

General Statistics			
Number of Valid Data	13	Number of Detected Data	7
Number of Distinct Detected Data	7	Number of Non-Detect Data	6
		Percent Non-Detects	46.15%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.11	Minimum Detected	-2.207
Maximum Detected	1.3	Maximum Detected	0.262
Mean of Detected	0.487	Mean of Detected	-1.049
SD of Detected	0.421	SD of Detected	0.9
Minimum Non-Detect	0.12	Minimum Non-Detect	-2.12
Maximum Non-Detect	0.15	Maximum Non-Detect	-1.897
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	8
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	5
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	61.54%

UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.867	Shapiro Wilk Test Statistic	0.961
5% Shapiro Wilk Critical Value	0.803	5% Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.292	Mean	-1.834
SD	0.37	SD	1.089
95% DL/2 (t) UCL	0.475	95% H-Stat (DL/2) UCL	0.744
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-1.751
		SD in Log Scale	1.047
		Mean in Original Scale	0.3
		SD in Original Scale	0.365
		95% t UCL	0.481
		95% Percentile Bootstrap UCL	0.474
		95% BCA Bootstrap UCL	0.526
		95% H-UCL	0.728
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	1.046	Data appear Normal at 5% Significance Level	
Theta Star	0.466		
nu star	14.64		
A-D Test Statistic	0.227	**Nonparametric Statistics**	
5% A-D Critical Value	0.719	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.719	Mean	0.313
5% K-S Critical Value	0.316	SD	0.342
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.103
		95% KM (t) UCL	0.496
Assuming Gamma Distribution		95% KM (z) UCL	0.482
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.484
Minimum	0.000001	95% KM (bootstrap t) UCL	0.659
Maximum	1.3	95% KM (BCA) UCL	0.542
Mean	0.266	95% KM (Percentile Bootstrap) UCL	0.519
Median	0.11	95% KM (Chebyshev) UCL	0.76
SD	0.388	97.5% KM (Chebyshev) UCL	0.954
k star	0.174	99% KM (Chebyshev) UCL	1.334
Theta star	1.531		
Nu star	4.516	**Potential UCLs to Use**	
AppChi2	0.935	**95% KM (t) UCL**	**0.496**
95% Gamma Approximate UCL (Use when n >= 40)	1.284	95% KM (Percentile Bootstrap) UCL	0.519
95% Adjusted Gamma UCL (Use when n < 40)	1.646		

Note: DL/2 is not a recommended method.

Nickel POI AU 1995

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	14

Raw Statistics		Log-transformed Statistics	
Minimum	5.8	Minimum of Log Data	1.758
Maximum	176.5	Maximum of Log Data	5.173
Mean	79.12	Mean of log Data	3.974
Geometric Mean	53.18	SD of log Data	1.075
Median	71.69		
SD	57.8		
Std. Error of Mean	15.45		
Coefficient of Variation	0.731		
Skewness	0.313		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.932	Shapiro Wilk Test Statistic	0.907
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	106.5	95% H-UCL	226.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	211.9
95% Adjusted-CLT UCL (Chen-1995)	105.9	97.5% Chebyshev (MVUE) UCL	264.9
95% Modified-t UCL (Johnson-1978)	106.7	99% Chebyshev (MVUE) UCL	369

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.149	Data appear Normal at 5% Significance Level	
Theta Star	68.84		
MLE of Mean	79.12		
MLE of Standard Deviation	73.8		
nu star	32.18		
Approximate Chi Square Value (.05)	20.21	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	104.5
Adjusted Chi Square Value	18.96	95% Jackknife UCL	106.5
		95% Standard Bootstrap UCL	104.1
Anderson-Darling Test Statistic	0.344	95% Bootstrap-t UCL	107.3
Anderson-Darling 5% Critical Value	0.752	95% Hall's Bootstrap UCL	103.7
Kolmogorov-Smirnov Test Statistic	0.159	95% Percentile Bootstrap UCL	104.6
Kolmogorov-Smirnov 5% Critical Value	0.233	95% BCA Bootstrap UCL	104.1
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	146.5
		97.5% Chebyshev(Mean, Sd) UCL	175.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	232.8
95% Approximate Gamma UCL (Use when n >= 40)	125.9		
95% Adjusted Gamma UCL (Use when n < 40)	134.3		

Potential UCL to Use	Use 95% Student's-t UCL 106.5

Vanadium POI AU 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13

Raw Statistics		Log-transformed Statistics	
Minimum	28	Minimum of Log Data	3.332
Maximum	627	Maximum of Log Data	6.441
Mean	141.3	Mean of log Data	4.591
Geometric Mean	98.62	SD of log Data	0.818
Median	78.8		
SD	158		
Std. Error of Mean	43.82		
Coefficient of Variation	1.118		
Skewness	2.774		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.647	Shapiro Wilk Test Statistic	0.957
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	219.4	95% H-UCL	251.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	273
95% Adjusted-CLT UCL (Chen-1995)	249.4	97.5% Chebyshev (MVUE) UCL	333.4
95% Modified-t UCL (Johnson-1978)	225	99% Chebyshev (MVUE) UCL	452.1

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.233	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	114.5		
MLE of Mean	141.3		
MLE of Standard Deviation	127.2		
nu star	32.07		
Approximate Chi Square Value (.05)	20.13	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	213.3
Adjusted Chi Square Value	18.79	95% Jackknife UCL	219.4
		95% Standard Bootstrap UCL	210.1
Anderson-Darling Test Statistic	0.605	95% Bootstrap-t UCL	343.6
Anderson-Darling 5% Critical Value	0.75	95% Hall's Bootstrap UCL	505.3
Kolmogorov-Smirnov Test Statistic	0.186	95% Percentile Bootstrap UCL	218.7
Kolmogorov-Smirnov 5% Critical Value	0.241	95% BCA Bootstrap UCL	257.2
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	332.3
		97.5% Chebyshev(Mean, Sd) UCL	414.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	577.2
95% Approximate Gamma UCL (Use when n >= 40)	225.1		
95% Adjusted Gamma UCL (Use when n < 40)	241.1		

Potential UCL to Use	Use 95% Approximate Gamma UCL 225.1

Vanadium POI AU 1995

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	14

Raw Statistics		Log-transformed Statistics	
Minimum	17.07	Minimum of Log Data	2.837
Maximum	488	Maximum of Log Data	6.19
Mean	124.2	Mean of log Data	4.422
Geometric Mean	83.26	SD of log Data	0.937
Median	96.54		
SD	124.7		
Std. Error of Mean	33.32		
Coefficient of Variation	1.004		
Skewness	2.12		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.771	Shapiro Wilk Test Statistic	0.98
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	183.2	95% H-UCL	259.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	269.6
95% Adjusted-CLT UCL (Chen-1995)	199.2	97.5% Chebyshev (MVUE) UCL	332.7
95% Modified-t UCL (Johnson-1978)	186.4	99% Chebyshev (MVUE) UCL	456.6

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.142	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	108.8		
MLE of Mean	124.2		
MLE of Standard Deviation	116.2		
nu star	31.98		
Approximate Chi Square Value (.05)	20.06	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	179
Adjusted Chi Square Value	18.81	95% Jackknife UCL	183.2
		95% Standard Bootstrap UCL	177.8
Anderson-Darling Test Statistic	0.287	95% Bootstrap-t UCL	230.9
Anderson-Darling 5% Critical Value	0.753	95% Hall's Bootstrap UCL	406.7
Kolmogorov-Smirnov Test Statistic	0.138	95% Percentile Bootstrap UCL	180.2
Kolmogorov-Smirnov 5% Critical Value	0.233	95% BCA Bootstrap UCL	198.3
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	269.4
		97.5% Chebyshev(Mean, Sd) UCL	332.3
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	455.7
95% Approximate Gamma UCL (Use when n >= 40)	198.1		
95% Adjusted Gamma UCL (Use when n < 40)	211.2		

Potential UCL to Use	Use 95% Approximate Gamma UCL 198.1

Benzo[a]anthracene POI AU 1999

General Statistics			
Number of Valid Data	13	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	10
		Percent Non-Detects	76.92%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.029	Minimum Detected	-3.54
Maximum Detected	3.8	Maximum Detected	1.335
Mean of Detected	1.323	Mean of Detected	-1.391
SD of Detected	2.146	SD of Detected	2.488
Minimum Non-Detect	0.371	Minimum Non-Detect	-0.992
Maximum Non-Detect	0.478	Maximum Non-Detect	-0.738
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	12
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	92.31%

UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.772	Shapiro Wilk Test Statistic	0.96
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.463	Mean	-1.541
SD	1.004	SD	1.022
95% DL/2 (t) UCL	0.959	95% H-Stat (DL/2) UCL	0.845
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.422
		SD in Log Scale	1.321
		Mean in Original Scale	0.367
		SD in Original Scale	1.033
		95% t UCL	0.878
		95% Percentile Bootstrap UCL	0.938
		95% BCA Bootstrap UCL	1.221
		95% H-UCL	0.788
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	N/A	Data appear Normal at 5% Significance Level	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.37
5% K-S Critical Value	N/A	SD	0.992
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.339
		95% KM (t) UCL	0.975
Assuming Gamma Distribution		95% KM (z) UCL	0.928
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.894
Minimum	N/A	95% KM (bootstrap t) UCL	4.203
Maximum	N/A	95% KM (BCA) UCL	3.8
Mean	N/A	95% KM (Percentile Bootstrap) UCL	3.8
Median	N/A	95% KM (Chebyshev) UCL	1.849
SD	N/A	97.5% KM (Chebyshev) UCL	2.489
k star	N/A	99% KM (Chebyshev) UCL	3.746
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	**95% KM (t) UCL**	**0.975**
95% Gamma Approximate UCL (Use when n >= 40)	N/A	95% KM (Percentile Bootstrap) UCL	3.8
95% Adjusted Gamma UCL (Use when n < 40)	N/A		
Note: DL/2 is not a recommended method.			

Benzo[a]pyrene POI AU 1999

General Statistics			
Number of Valid Data	13	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	10
		Percent Non-Detects	76.92%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.026	Minimum Detected	-3.65
Maximum Detected	2.8	Maximum Detected	1.03
Mean of Detected	0.999	Mean of Detected	-1.464
SD of Detected	1.562	SD of Detected	2.355
Minimum Non-Detect	0.371	Minimum Non-Detect	-0.992
Maximum Non-Detect	0.478	Maximum Non-Detect	-0.738
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	12
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	92.31%

UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.789	Shapiro Wilk Test Statistic	0.987
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.388	Mean	-1.558
SD	0.726	SD	0.965
95% DL/2 (t) UCL	0.747	95% H-Stat (DL/2) UCL	0.73
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.439
		SD in Log Scale	1.25
		Mean in Original Scale	0.291
		SD in Original Scale	0.756
		95% t UCL	0.664
		95% Percentile Bootstrap UCL	0.71
		95% BCA Bootstrap UCL	0.92
		95% H-UCL	0.627
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	Data appear Normal at 5% Significance Level	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	Nonparametric Statistics	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.306
5% K-S Critical Value	N/A	SD	0.723
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.251
		95% KM (t) UCL	0.754
Assuming Gamma Distribution		95% KM (z) UCL	0.719
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.709
Minimum	N/A	95% KM (bootstrap t) UCL	2.008
Maximum	N/A	95% KM (BCA) UCL	2.8
Mean	N/A	95% KM (Percentile Bootstrap) UCL	2.8
Median	N/A	95% KM (Chebyshev) UCL	1.401
SD	N/A	97.5% KM (Chebyshev) UCL	1.875
k star	N/A	99% KM (Chebyshev) UCL	2.806
Theta star	N/A		
Nu star	N/A	Potential UCLs to Use	
AppChi2	N/A	95% KM (t) UCL	0.754
95% Gamma Approximate UCL (Use when n >= 40)	N/A	95% KM (Percentile Bootstrap) UCL	2.8
95% Adjusted Gamma UCL (Use when n < 40)	N/A		
Note: DL/2 is not a recommended method.			

Benzo[b]fluoranthene POI AU 1999			
General Statistics			
Number of Valid Data	13	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	10
		Percent Non-Detects	76.92%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.03	Minimum Detected	-3.507
Maximum Detected	3.4	Maximum Detected	1.224
Mean of Detected	1.2	Mean of Detected	-1.352
SD of Detected	1.907	SD of Detected	2.393
Minimum Non-Detect	0.371	Minimum Non-Detect	-0.992
Maximum Non-Detect	0.478	Maximum Non-Detect	-0.738
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	12
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	92.31%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.781	Shapiro Wilk Test Statistic	0.977
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.435	Mean	-1.532
SD	0.892	SD	0.985
95% DL/2 (t) UCL	0.876	95% H-Stat (DL/2) UCL	0.783
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.344
		SD in Log Scale	1.271
		Mean in Original Scale	0.344
		SD in Original Scale	0.92
		95% t UCL	0.798
		95% Percentile Bootstrap UCL	0.852
		95% BCA Bootstrap UCL	1.12
		95% H-UCL	0.733
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	N/A	Data appear Normal at 5% Significance Level	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.354
5% K-S Critical Value	N/A	SD	0.882
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.304
		95% KM (t) UCL	0.895
Assuming Gamma Distribution		95% KM (z) UCL	0.854
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.832
Minimum	N/A	95% KM (bootstrap t) UCL	2.862
Maximum	N/A	95% KM (BCA) UCL	3.4
Mean	N/A	95% KM (Percentile Bootstrap) UCL	N/A
Median	N/A	95% KM (Chebyshev) UCL	1.678
SD	N/A	97.5% KM (Chebyshev) UCL	2.252
k star	N/A	99% KM (Chebyshev) UCL	3.378
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	**95% KM (t) UCL**	**0.895**
95% Gamma Approximate UCL (Use when n >= 40)	N/A	95% KM (Percentile Bootstrap) UCL	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A		
Note: DL/2 is not a recommended method.			

Indeno[1,2,3-cd]pyrene POI AU 1999

General Statistics			
Number of Valid Data	13	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	11
		Percent Non-Detects	84.62%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.14	Minimum Detected	-1.966
Maximum Detected	2	Maximum Detected	0.693
Mean of Detected	1.07	Mean of Detected	-0.636
SD of Detected	1.315	SD of Detected	1.88
Minimum Non-Detect	0.371	Minimum Non-Detect	-0.992
Maximum Non-Detect	0.478	Maximum Non-Detect	-0.738
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	12
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	92.31%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.338	Mean	-1.441
SD	0.5	SD	0.653
95% DL/2 (t) UCL	0.585	95% H-Stat (DL/2) UCL	0.453
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A
		95% H-UCL	N/A
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	N/A	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.283
5% K-S Critical Value	N/A	SD	0.496
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.194
		95% KM (t) UCL	0.63
Assuming Gamma Distribution		95% KM (z) UCL	0.603
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.547
Minimum	N/A	95% KM (bootstrap t) UCL	N/A
Maximum	N/A	95% KM (BCA) UCL	2
Mean	N/A	95% KM (Percentile Bootstrap) UCL	2
Median	N/A	95% KM (Chebyshev) UCL	1.13
SD	N/A	97.5% KM (Chebyshev) UCL	1.497
k star	N/A	99% KM (Chebyshev) UCL	2.217
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	**97.5% KM (Chebyshev) UCL**	**1.497**
95% Gamma Approximate UCL (Use when n >= 40)	N/A		
95% Adjusted Gamma UCL (Use when n < 40)	N/A		
Note: DL/2 is not a recommended method.			

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI 1 Sedgwick Trench.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 1
95% UCLs

Aluminum POI 1 Sedgwick Trench 1999

General Statistics

Number of Valid Observations	13	Number of Distinct Observations	13

Raw Statistics		**Log-transformed Statistics**	
Minimum	15300	Minimum of Log Data	9.636
Maximum	26900	Maximum of Log Data	10.2
Mean	20062	Mean of log Data	9.897
Geometric Mean	19861	SD of log Data	0.147
Median	19800		
SD	3009		
Std. Error of Mean	834.6		
Coefficient of Variation	0.15		
Skewness	0.743		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.968	Shapiro Wilk Test Statistic	0.99
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	21549	95% H-UCL	21659
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23624
95% Adjusted-CLT UCL (Chen-1995)	21618	97.5% Chebyshev (MVUE) UCL	25166
95% Modified-t UCL (Johnson-1978)	21578	99% Chebyshev (MVUE) UCL	28196

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	38.46	Data appear Normal at 5% Significance Level	
Theta Star	521.6		
MLE of Mean	20062		
MLE of Standard Deviation	3235		
nu star	1000		
Approximate Chi Square Value (.05)	927.6	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	21434
Adjusted Chi Square Value	917.7	95% Jackknife UCL	21549
		95% Standard Bootstrap UCL	21372
Anderson-Darling Test Statistic	0.146	95% Bootstrap-t UCL	21799
Anderson-Darling 5% Critical Value	0.733	95% Hall's Bootstrap UCL	22048
Kolmogorov-Smirnov Test Statistic	0.105	95% Percentile Bootstrap UCL	21438
Kolmogorov-Smirnov 5% Critical Value	0.236	95% BCA Bootstrap UCL	21546
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	23700
		97.5% Chebyshev(Mean, Sd) UCL	25274
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	28366
95% Approximate Gamma UCL (Use when n >= 40)	21627		
95% Adjusted Gamma UCL (Use when n < 40)	21862		

Potential UCL to Use	Use 95% Student's-t UCL 21549

Manganese POI 1 Sedgwick Trench 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13

Raw Statistics		Log-transformed Statistics	
Minimum	289	Minimum of Log Data	5.666
Maximum	1100	Maximum of Log Data	7.003
Mean	510.8	Mean of log Data	6.172
Geometric Mean	479.3	SD of log Data	0.35
Median	447		
SD	216.3		
Std. Error of Mean	59.99		
Coefficient of Variation	0.423		
Skewness	2.023		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.774	Shapiro Wilk Test Statistic	0.906
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	617.7	95% H-UCL	621
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	724.7
95% Adjusted-CLT UCL (Chen-1995)	645.4	97.5% Chebyshev (MVUE) UCL	818.9
95% Modified-t UCL (Johnson-1978)	623.3	99% Chebyshev (MVUE) UCL	1004

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	6.227	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	82.03		
MLE of Mean	510.8		
MLE of Standard Deviation	204.7		
nu star	161.9		
Approximate Chi Square Value (.05)	133.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	609.4
Adjusted Chi Square Value	129.8	95% Jackknife UCL	617.7
		95% Standard Bootstrap UCL	606.1
Anderson-Darling Test Statistic	0.75	95% Bootstrap-t UCL	758
Anderson-Darling 5% Critical Value	0.735	95% Hall's Bootstrap UCL	1183
Kolmogorov-Smirnov Test Statistic	0.219	95% Percentile Bootstrap UCL	614
Kolmogorov-Smirnov 5% Critical Value	0.237	95% BCA Bootstrap UCL	639.6
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	772.3
		97.5% Chebyshev(Mean, Sd) UCL	885.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1108
95% Approximate Gamma UCL (Use when n >= 40)	619.5		
95% Adjusted Gamma UCL (Use when n < 40)	637.1		

Potential UCL to Use	Use 95% Approximate Gamma UCL 619.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI 7.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 7
95% UCLs

Aluminum POI 7 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13
Raw Statistics		**Log-transformed Statistics**	
Minimum	15900	Minimum of Log Data	9.674
Maximum	51900	Maximum of Log Data	10.86
Mean	29038	Mean of log Data	10.23
Geometric Mean	27672	SD of log Data	0.318
Median	24400		
SD	9810		
Std. Error of Mean	2721		
Coefficient of Variation	0.338		
Skewness	1.111		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.9	Shapiro Wilk Test Statistic	0.953
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	33888	95% H-UCL	34736
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	40264
95% Adjusted-CLT UCL (Chen-1995)	34409	97.5% Chebyshev (MVUE) UCL	45142
95% Modified-t UCL (Johnson-1978)	34028	99% Chebyshev (MVUE) UCL	54724
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	8.158	Data appear Normal at 5% Significance Level	
Theta Star	3560		
MLE of Mean	29038		
MLE of Standard Deviation	10167		
nu star	212.1		
Approximate Chi Square Value (.05)	179.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	33514
Adjusted Chi Square Value	175.1	95% Jackknife UCL	33888
		95% Standard Bootstrap UCL	33503
Anderson-Darling Test Statistic	0.454	95% Bootstrap-t UCL	35566
Anderson-Darling 5% Critical Value	0.734	95% Hall's Bootstrap UCL	35869
Kolmogorov-Smirnov Test Statistic	0.21	95% Percentile Bootstrap UCL	33415
Kolmogorov-Smirnov 5% Critical Value	0.237	95% BCA Bootstrap UCL	34369
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	40899
		97.5% Chebyshev(Mean, Sd) UCL	46031
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	56111
95% Approximate Gamma UCL (Use when n >= 40)	34332		
95% Adjusted Gamma UCL (Use when n < 40)	35172		
Potential UCL to Use		Use 95% Student's-t UCL	33888

Antimony POI 7 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13

Raw Statistics		Log-transformed Statistics	
Minimum	7.9	Minimum of Log Data	2.067
Maximum	44.2	Maximum of Log Data	3.789
Mean	18.82	Mean of log Data	2.783
Geometric Mean	16.17	SD of log Data	0.564
Median	14.1		
SD	11.29		
Std. Error of Mean	3.132		
Coefficient of Variation	0.6		
Skewness	1.097		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.861	Shapiro Wilk Test Statistic	0.926
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	24.4	95% H-UCL	27.05
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	31.84
95% Adjusted-CLT UCL (Chen-1995)	24.99	97.5% Chebyshev (MVUE) UCL	37.52
95% Modified-t UCL (Johnson-1978)	24.56	99% Chebyshev (MVUE) UCL	48.7
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.7	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	6.971		
MLE of Mean	18.82		
MLE of Standard Deviation	11.45		
nu star	70.21		
Approximate Chi Square Value (.05)	51.92	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	23.97
Adjusted Chi Square Value	49.68	95% Jackknife UCL	24.4
		95% Standard Bootstrap UCL	23.7
Anderson-Darling Test Statistic	0.529	95% Bootstrap-t UCL	26.18
Anderson-Darling 5% Critical Value	0.738	95% Hall's Bootstrap UCL	24.71
Kolmogorov-Smirnov Test Statistic	0.211	95% Percentile Bootstrap UCL	24.05
Kolmogorov-Smirnov 5% Critical Value	0.238	95% BCA Bootstrap UCL	24.58
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	32.47
		97.5% Chebyshev(Mean, Sd) UCL	38.38
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	49.98
95% Approximate Gamma UCL (Use when n >= 40)	25.45		
95% Adjusted Gamma UCL (Use when n < 40)	26.6		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**25.45**

Manganese POI 7 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13
Raw Statistics		**Log-transformed Statistics**	
Minimum	318	Minimum of Log Data	5.762
Maximum	2040	Maximum of Log Data	7.621
Mean	797.5	Mean of log Data	6.54
Geometric Mean	692.4	SD of log Data	0.535
Median	717		
SD	486.7		
Std. Error of Mean	135		
Coefficient of Variation	0.61		
Skewness	1.663		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.829	Shapiro Wilk Test Statistic	0.963
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1038	95% H-UCL	1114
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1314
95% Adjusted-CLT UCL (Chen-1995)	1086	97.5% Chebyshev (MVUE) UCL	1541
95% Modified-t UCL (Johnson-1978)	1048	99% Chebyshev (MVUE) UCL	1987
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.896	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	275.4		
MLE of Mean	797.5		
MLE of Standard Deviation	468.6		
nu star	75.29		
Approximate Chi Square Value (.05)	56.31	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	1019
Adjusted Chi Square Value	53.97	95% Jackknife UCL	1038
		95% Standard Bootstrap UCL	1011
Anderson-Darling Test Statistic	0.383	95% Bootstrap-t UCL	1195
Anderson-Darling 5% Critical Value	0.738	95% Hall's Bootstrap UCL	2264
Kolmogorov-Smirnov Test Statistic	0.17	95% Percentile Bootstrap UCL	1023
Kolmogorov-Smirnov 5% Critical Value	0.238	95% BCA Bootstrap UCL	1076
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1386
		97.5% Chebyshev(Mean, Sd) UCL	1640
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2141
95% Approximate Gamma UCL (Use when n >= 40)	1066		
95% Adjusted Gamma UCL (Use when n < 40)	1112		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**1066**

Vanadium POI 7 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13

Raw Statistics		Log-transformed Statistics	
Minimum	15.7	Minimum of Log Data	2.754
Maximum	307	Maximum of Log Data	5.727
Mean	88.04	Mean of log Data	4.086
Geometric Mean	59.5	SD of log Data	0.91
Median	58.7		
SD	86.11		
Std. Error of Mean	23.88		
Coefficient of Variation	0.978		
Skewness	1.642		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.793	Shapiro Wilk Test Statistic	0.956
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	130.6	95% H-UCL	182.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	187.9
95% Adjusted-CLT UCL (Chen-1995)	138.9	97.5% Chebyshev (MVUE) UCL	231.8
95% Modified-t UCL (Johnson-1978)	132.4	99% Chebyshev (MVUE) UCL	318.1
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.143	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	76.99		
MLE of Mean	88.04		
MLE of Standard Deviation	82.33		
nu star	29.73		
Approximate Chi Square Value (.05)	18.28	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	127.3
Adjusted Chi Square Value	17.01	95% Jackknife UCL	130.6
		95% Standard Bootstrap UCL	126.3
Anderson-Darling Test Statistic	0.476	95% Bootstrap-t UCL	159.1
Anderson-Darling 5% Critical Value	0.751	95% Hall's Bootstrap UCL	141.1
Kolmogorov-Smirnov Test Statistic	0.169	95% Percentile Bootstrap UCL	129.3
Kolmogorov-Smirnov 5% Critical Value	0.241	95% BCA Bootstrap UCL	139.8
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	192.1
		97.5% Chebyshev(Mean, Sd) UCL	237.2
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	325.7
95% Approximate Gamma UCL (Use when n >= 40)	143.2		
95% Adjusted Gamma UCL (Use when n < 40)	153.9		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**143.2**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI 10-11.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 39 (10/11)
95% UCLs

Aluminum POI 10/11 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13

Raw Statistics		Log-transformed Statistics	
Minimum	14400	Minimum of Log Data	9.575
Maximum	28400	Maximum of Log Data	10.25
Mean	22900	Mean of log Data	10.02
Geometric Mean	22540	SD of log Data	0.19
Median	23100		
SD	4038		
Std. Error of Mean	1120		
Coefficient of Variation	0.176		
Skewness	-0.573		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.95	Shapiro Wilk Test Statistic	0.917
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	24896	95% H-UCL	25369
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	28213
95% Adjusted-CLT UCL (Chen-1995)	24552	97.5% Chebyshev (MVUE) UCL	30504
95% Modified-t UCL (Johnson-1978)	24867	99% Chebyshev (MVUE) UCL	35003
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	24.48	Data appear Normal at 5% Significance Level	
Theta Star	935.4		
MLE of Mean	22900		
MLE of Standard Deviation	4628		
nu star	636.5		
Approximate Chi Square Value (.05)	579	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	24742
Adjusted Chi Square Value	571.2	95% Jackknife UCL	24896
		95% Standard Bootstrap UCL	24707
Anderson-Darling Test Statistic	0.358	95% Bootstrap-t UCL	24718
Anderson-Darling 5% Critical Value	0.733	95% Hall's Bootstrap UCL	24595
Kolmogorov-Smirnov Test Statistic	0.174	95% Percentile Bootstrap UCL	24662
Kolmogorov-Smirnov 5% Critical Value	0.236	95% BCA Bootstrap UCL	24600
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	27782
		97.5% Chebyshev(Mean, Sd) UCL	29895
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	34044
95% Approximate Gamma UCL (Use when n >= 40)	25175		
95% Adjusted Gamma UCL (Use when n < 40)	25520		
Potential UCL to Use		**Use 95% Student's-t UCL 24896**	

Antimony POI 10/11 1999

General Statistics			
Number of Valid Data	13	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	10
		Percent Non-Detects	76.92%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	11.2	Minimum Detected	2.416
Maximum Detected	13.5	Maximum Detected	2.603
Mean of Detected	12.17	Mean of Detected	2.496
SD of Detected	1.193	SD of Detected	0.0964
Minimum Non-Detect	9.6	Minimum Non-Detect	2.262
Maximum Non-Detect	11.5	Maximum Non-Detect	2.442
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	11
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	2
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	84.62%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.929	Shapiro Wilk Test Statistic	0.939
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	6.919	Mean	1.864
SD	3.041	SD	0.365
95% DL/2 (t) UCL	8.422	95% H-Stat (DL/2) UCL	8.486
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	2.212
		SD in Log Scale	0.173
		Mean in Original Scale	9.266
		SD in Original Scale	1.769
		95% t UCL	10.14
		95% Percentile Bootstrap UCL	10.1
		95% BCA Bootstrap UCL	10.3
		95% H-UCL	10.15
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	N/A	Data appear Normal at 5% Significance Level	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	11.42
5% K-S Critical Value	N/A	SD	0.62
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.211
		95% KM (t) UCL	11.8
Assuming Gamma Distribution		95% KM (z) UCL	11.77
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	11.87
Minimum	N/A	95% KM (bootstrap t) UCL	11.82
Maximum	N/A	95% KM (BCA) UCL	13.5
Mean	N/A	95% KM (Percentile Bootstrap) UCL	N/A
Median	N/A	95% KM (Chebyshev) UCL	12.34
SD	N/A	97.5% KM (Chebyshev) UCL	12.74
k star	N/A	99% KM (Chebyshev) UCL	13.52
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	**95% KM (t) UCL**	**11.8**
95% Gamma Approximate UCL (Use when n >= 40)	N/A	95% KM (Percentile Bootstrap) UCL	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A		
Note: DL/2 is not a recommended method.			

Manganese POI 10/11 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	12

Raw Statistics		Log-transformed Statistics	
Minimum	233	Minimum of Log Data	5.451
Maximum	2580	Maximum of Log Data	7.856
Mean	845.5	Mean of log Data	6.539
Geometric Mean	691.8	SD of log Data	0.625
Median	551		
SD	649.7		
Std. Error of Mean	180.2		
Coefficient of Variation	0.768		
Skewness	2.025		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.741	Shapiro Wilk Test Statistic	0.932
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1167	95% H-UCL	1266
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1475
95% Adjusted-CLT UCL (Chen-1995)	1250	97.5% Chebyshev (MVUE) UCL	1755
95% Modified-t UCL (Johnson-1978)	1183	99% Chebyshev (MVUE) UCL	2306
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.087	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	405.1		
MLE of Mean	845.5		
MLE of Standard Deviation	585.2		
nu star	54.27		
Approximate Chi Square Value (.05)	38.34	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	1142
Adjusted Chi Square Value	36.44	95% Jackknife UCL	1167
		95% Standard Bootstrap UCL	1133
Anderson-Darling Test Statistic	0.759	95% Bootstrap-t UCL	1668
Anderson-Darling 5% Critical Value	0.741	95% Hall's Bootstrap UCL	2763
Kolmogorov-Smirnov Test Statistic	0.208	95% Percentile Bootstrap UCL	1141
Kolmogorov-Smirnov 5% Critical Value	0.239	95% BCA Bootstrap UCL	1261
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1631
		97.5% Chebyshev(Mean, Sd) UCL	1971
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2638
95% Approximate Gamma UCL (Use when n >= 40)	1197		
95% Adjusted Gamma UCL (Use when n < 40)	1259		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**1197**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI 16.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 16
95% UCLs

Aluminum POI 16 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13
Raw Statistics		**Log-transformed Statistics**	
Minimum	14100	Minimum of Log Data	9.554
Maximum	23800	Maximum of Log Data	10.08
Mean	19185	Mean of log Data	9.852
Geometric Mean	18995	SD of log Data	0.148
Median	19600		
SD	2765		
Std. Error of Mean	766.9		
Coefficient of Variation	0.144		
Skewness	-0.124		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.983	Shapiro Wilk Test Statistic	0.973
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	20552	95% H-UCL	20736
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	22634
95% Adjusted-CLT UCL (Chen-1995)	20418	97.5% Chebyshev (MVUE) UCL	24124
95% Modified-t UCL (Johnson-1978)	20547	99% Chebyshev (MVUE) UCL	27053
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	38.93	Data appear Normal at 5% Significance Level	
Theta Star	492.8		
MLE of Mean	19185		
MLE of Standard Deviation	3075		
nu star	1012		
Approximate Chi Square Value (.05)	939.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	20446
Adjusted Chi Square Value	929.4	95% Jackknife UCL	20552
		95% Standard Bootstrap UCL	20381
Anderson-Darling Test Statistic	0.174	95% Bootstrap-t UCL	20464
Anderson-Darling 5% Critical Value	0.733	95% Hall's Bootstrap UCL	20522
Kolmogorov-Smirnov Test Statistic	0.118	95% Percentile Bootstrap UCL	20331
Kolmogorov-Smirnov 5% Critical Value	0.236	95% BCA Bootstrap UCL	20385
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	22528
		97.5% Chebyshev(Mean, Sd) UCL	23974
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	26815
95% Approximate Gamma UCL (Use when n >= 40)	20672		
95% Adjusted Gamma UCL (Use when n < 40)	20895		
Potential UCL to Use		Use 95% Student's-t UCL	20552

Benzo[a]anthracene POI 16 1999			
General Statistics			
Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	6	Number of Non-Detect Data	7
		Percent Non-Detects	53.85%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.021	Minimum Detected	-3.863
Maximum Detected	0.56	Maximum Detected	-0.58
Mean of Detected	0.135	Mean of Detected	-2.814
SD of Detected	0.212	SD of Detected	1.304
Minimum Non-Detect	0.37	Minimum Non-Detect	-0.994
Maximum Non-Detect	0.414	Maximum Non-Detect	-0.882
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	12
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	92.31%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.637	Shapiro Wilk Test Statistic	0.844
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.169	Mean	-2.173
SD	0.141	SD	1.045
95% DL/2 (t) UCL	0.238	95% H-Stat (DL/2) UCL	0.475
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-3.015
		SD in Log Scale	0.864
		Mean in Original Scale	0.0846
		SD in Original Scale	0.145
		95% t UCL	0.156
		95% Percentile Bootstrap UCL	0.161
		95% BCA Bootstrap UCL	0.208
		95% H-UCL	0.137
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.48	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.282		
nu star	5.761		
A-D Test Statistic	0.668	Nonparametric Statistics	
5% A-D Critical Value	0.722	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.722	Mean	0.0894
5% K-S Critical Value	0.344	SD	0.141
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0448
		95% KM (t) UCL	0.169
Assuming Gamma Distribution		95% KM (z) UCL	0.163
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.167
Minimum	0.021	95% KM (bootstrap t) UCL	0.395
Maximum	0.56	95% KM (BCA) UCL	0.183
Mean	0.0866	95% KM (Percentile Bootstrap) UCL	0.161
Median	0.0449	95% KM (Chebyshev) UCL	0.285
SD	0.144	97.5% KM (Chebyshev) UCL	0.369
k star	0.892	99% KM (Chebyshev) UCL	0.535
Theta star	0.0971		
Nu star	23.19	Potential UCLs to Use	
AppChi2	13.23	95% KM (t) UCL	0.169
95% Gamma Approximate UCL (Use when n >= 40)	0.152		
95% Adjusted Gamma UCL (Use when n < 40)	0.165		
Note: DL/2 is not a recommended method.			

Benzo[a]pyrene POI 16 1999			
General Statistics			
Number of Valid Data	13	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	8
		Percent Non-Detects	61.54%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.032	Minimum Detected	-3.442
Maximum Detected	0.6	Maximum Detected	-0.511
Mean of Detected	0.171	Mean of Detected	-2.429
SD of Detected	0.243	SD of Detected	1.202
Minimum Non-Detect	0.37	Minimum Non-Detect	-0.994
Maximum Non-Detect	0.414	Maximum Non-Detect	-0.882
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	12
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	92.31%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.674	Shapiro Wilk Test Statistic	0.878
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.187	Mean	-1.933
SD	0.141	SD	0.805
95% DL/2 (t) UCL	0.257	95% H-Stat (DL/2) UCL	0.36
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.684
		SD in Log Scale	0.725
		Mean in Original Scale	0.102
		SD in Original Scale	0.151
		95% t UCL	0.176
		95% Percentile Bootstrap UCL	0.184
		95% BCA Bootstrap UCL	0.228
		95% H-UCL	0.147
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.488	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.35		
nu star	4.877		
A-D Test Statistic	0.554	**Nonparametric Statistics**	
5% A-D Critical Value	0.694	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.694	Mean	0.105
5% K-S Critical Value	0.365	SD	0.147
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.048
		95% KM (t) UCL	0.19
Assuming Gamma Distribution		95% KM (z) UCL	0.184
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.187
Minimum	0.032	95% KM (bootstrap t) UCL	0.434
Maximum	0.6	95% KM (BCA) UCL	0.195
Mean	0.103	95% KM (Percentile Bootstrap) UCL	0.186
Median	0.0599	95% KM (Chebyshev) UCL	0.314
SD	0.151	97.5% KM (Chebyshev) UCL	0.404
k star	1.151	99% KM (Chebyshev) UCL	0.582
Theta star	0.0891		
Nu star	29.92	**Potential UCLs to Use**	
AppChi2	18.43	**95% KM (t) UCL**	**0.19**
95% Gamma Approximate UCL (Use when n >= 40)	0.167		
95% Adjusted Gamma UCL (Use when n < 40)	0.179		
Note: DL/2 is not a recommended method.			

Benzo[b]fluoranthene POI 16 1999			
General Statistics			
Number of Valid Data	13	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	9
		Percent Non-Detects	69.23%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.029	Minimum Detected	-3.54
Maximum Detected	0.39	Maximum Detected	-0.942
Mean of Detected	0.15	Mean of Detected	-2.354
SD of Detected	0.165	SD of Detected	1.106
Minimum Non-Detect	0.37	Minimum Non-Detect	-0.994
Maximum Non-Detect	0.418	Maximum Non-Detect	-0.872
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	13
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.82	Shapiro Wilk Test Statistic	0.986
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.184	Mean	-1.844
SD	0.0858	SD	0.657
95% DL/2 (t) UCL	0.226	95% H-Stat (DL/2) UCL	0.305
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.573
		SD in Log Scale	0.58
		Mean in Original Scale	0.0942
		SD in Original Scale	0.091
		95% t UCL	0.139
		95% Percentile Bootstrap UCL	0.14
		95% BCA Bootstrap UCL	0.168
		95% H-UCL	0.131
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.476	Data appear Normal at 5% Significance Level	
Theta Star	0.314		
nu star	3.811		
A-D Test Statistic	0.284	Nonparametric Statistics	
5% A-D Critical Value	0.665	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.665	Mean	0.115
5% K-S Critical Value	0.401	SD	0.117
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0535
		95% KM (t) UCL	0.211
Assuming Gamma Distribution		95% KM (z) UCL	0.203
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.212
Minimum	0.029	95% KM (bootstrap t) UCL	0.335
Maximum	0.39	95% KM (BCA) UCL	0.21
Mean	0.102	95% KM (Percentile Bootstrap) UCL	0.232
Median	0.0905	95% KM (Chebyshev) UCL	0.349
SD	0.0895	97.5% KM (Chebyshev) UCL	0.449
k star	2.15	99% KM (Chebyshev) UCL	0.647
Theta star	0.0474		
Nu star	55.9	Potential UCLs to Use	
AppChi2	39.71	95% KM (t) UCL	0.211
95% Gamma Approximate UCL (Use when n >= 40)	0.144	95% KM (Percentile Bootstrap) UCL	0.232
95% Adjusted Gamma UCL (Use when n < 40)	N/A		
Note: DL/2 is not a recommended method.			

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI 19.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 19
95% UCLs

Aluminum POI 19 1999

General Statistics

Number of Valid Observations	13	Number of Distinct Observations	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	11200	Minimum of Log Data	9.324
Maximum	33900	Maximum of Log Data	10.43
Mean	20231	Mean of log Data	9.85
Geometric Mean	18968	SD of log Data	0.375
Median	20800		
SD	7555		
Std. Error of Mean	2095		
Coefficient of Variation	0.373		
Skewness	0.558		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.914	Shapiro Wilk Test Statistic	0.931
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	23965	95% H-UCL	25212
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	29552
95% Adjusted-CLT UCL (Chen-1995)	24024	97.5% Chebyshev (MVUE) UCL	33584
95% Modified-t UCL (Johnson-1978)	24019	99% Chebyshev (MVUE) UCL	41503
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.143	Data appear Normal at 5% Significance Level	
Theta Star	3294		
MLE of Mean	20231		
MLE of Standard Deviation	8163		
nu star	159.7		
Approximate Chi Square Value (.05)	131.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	23677
Adjusted Chi Square Value	127.8	95% Jackknife UCL	23965
		95% Standard Bootstrap UCL	23530
Anderson-Darling Test Statistic	0.386	95% Bootstrap-t UCL	24380
Anderson-Darling 5% Critical Value	0.735	95% Hall's Bootstrap UCL	24262
Kolmogorov-Smirnov Test Statistic	0.178	95% Percentile Bootstrap UCL	23669
Kolmogorov-Smirnov 5% Critical Value	0.237	95% BCA Bootstrap UCL	23823
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	29364
		97.5% Chebyshev(Mean, Sd) UCL	33316
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	41078
95% Approximate Gamma UCL (Use when n >= 40)	24572		
95% Adjusted Gamma UCL (Use when n < 40)	25273		
Potential UCL to Use		Use 95% Student's-t UCL	23965

Arsenic POI 19 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	10
Raw Statistics		**Log-transformed Statistics**	
Minimum	1.9	Minimum of Log Data	0.642
Maximum	16	Maximum of Log Data	2.773
Mean	4.108	Mean of log Data	1.21
Geometric Mean	3.354	SD of log Data	0.573
Median	2.8		
SD	3.747		
Std. Error of Mean	1.039		
Coefficient of Variation	0.912		
Skewness	3.081		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.568	Shapiro Wilk Test Statistic	0.824
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	5.96	95% H-UCL	5.684
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	6.681
95% Adjusted-CLT UCL (Chen-1995)	6.766	97.5% Chebyshev (MVUE) UCL	7.887
95% Modified-t UCL (Johnson-1978)	6.108	99% Chebyshev (MVUE) UCL	10.25
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.067	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1.987		
MLE of Mean	4.108		
MLE of Standard Deviation	2.857		
nu star	53.75		
Approximate Chi Square Value (.05)	37.9	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	5.817
Adjusted Chi Square Value	36.01	95% Jackknife UCL	5.96
		95% Standard Bootstrap UCL	5.744
Anderson-Darling Test Statistic	1.24	95% Bootstrap-t UCL	10.46
Anderson-Darling 5% Critical Value	0.741	95% Hall's Bootstrap UCL	12.81
Kolmogorov-Smirnov Test Statistic	0.25	95% Percentile Bootstrap UCL	6.077
Kolmogorov-Smirnov 5% Critical Value	0.239	95% BCA Bootstrap UCL	6.838
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	8.638
		97.5% Chebyshev(Mean, Sd) UCL	10.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	14.45
95% Approximate Gamma UCL (Use when n >= 40)	5.825		
95% Adjusted Gamma UCL (Use when n < 40)	6.13		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UCL**	**8.638**

Manganese POI 19 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13
Raw Statistics		**Log-transformed Statistics**	
Minimum	309	Minimum of Log Data	5.733
Maximum	1450	Maximum of Log Data	7.279
Mean	540.3	Mean of log Data	6.192
Geometric Mean	488.9	SD of log Data	0.428
Median	452		
SD	305		
Std. Error of Mean	84.58		
Coefficient of Variation	0.564		
Skewness	2.503		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.7	Shapiro Wilk Test Statistic	0.874
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	691.1	95% H-UCL	688.8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	812.4
95% Adjusted-CLT UCL (Chen-1995)	742.2	97.5% Chebyshev (MVUE) UCL	933.8
95% Modified-t UCL (Johnson-1978)	700.8	99% Chebyshev (MVUE) UCL	1172
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.019	Data appear Lognormal at 5% Significance Level	
Theta Star	134.4		
MLE of Mean	540.3		
MLE of Standard Deviation	269.5		
nu star	104.5		
Approximate Chi Square Value (.05)	81.9	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	679.4
Adjusted Chi Square Value	79.05	95% Jackknife UCL	691.1
		95% Standard Bootstrap UCL	672.9
Anderson-Darling Test Statistic	0.801	95% Bootstrap-t UCL	850.6
Anderson-Darling 5% Critical Value	0.736	95% Hall's Bootstrap UCL	1218
Kolmogorov-Smirnov Test Statistic	0.249	95% Percentile Bootstrap UCL	685
Kolmogorov-Smirnov 5% Critical Value	0.237	95% BCA Bootstrap UCL	756.2
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	909
		97.5% Chebyshev(Mean, Sd) UCL	1069
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1382
95% Approximate Gamma UCL (Use when n >= 40)	689.3		
95% Adjusted Gamma UCL (Use when n < 40)	714.1		
Potential UCL to Use		Use 95% Student's-t UCL	691.1
		or 95% Modified-t UCL	700.8
		or 95% H-UCL	688.8

Vanadium POI 19 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13
Raw Statistics		**Log-transformed Statistics**	
Minimum	10.8	Minimum of Log Data	2.38
Maximum	140	Maximum of Log Data	4.942
Mean	57.03	Mean of log Data	3.815
Geometric Mean	45.36	SD of log Data	0.733
Median	50.9		
SD	39.47		
Std. Error of Mean	10.95		
Coefficient of Variation	0.692		
Skewness	1.138		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.883	Shapiro Wilk Test Statistic	0.976
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	76.54	95% H-UCL	99.02
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	111.8
95% Adjusted-CLT UCL (Chen-1995)	78.73	97.5% Chebyshev (MVUE) UCL	135.1
95% Modified-t UCL (Johnson-1978)	77.12	99% Chebyshev (MVUE) UCL	180.9
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.849	Data appear Normal at 5% Significance Level	
Theta Star	30.84		
MLE of Mean	57.03		
MLE of Standard Deviation	41.94		
nu star	48.08		
Approximate Chi Square Value (.05)	33.16	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	75.04
Adjusted Chi Square Value	31.41	95% Jackknife UCL	76.54
		95% Standard Bootstrap UCL	74.09
Anderson-Darling Test Statistic	0.183	95% Bootstrap-t UCL	86.61
Anderson-Darling 5% Critical Value	0.742	95% Hall's Bootstrap UCL	97.36
Kolmogorov-Smirnov Test Statistic	0.114	95% Percentile Bootstrap UCL	74.92
Kolmogorov-Smirnov 5% Critical Value	0.239	95% BCA Bootstrap UCL	76.6
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	104.8
		97.5% Chebyshev(Mean, Sd) UCL	125.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	166
95% Approximate Gamma UCL (Use when n >= 40)	82.68		
95% Adjusted Gamma UCL (Use when n < 40)	87.31		
Potential UCL to Use		**Use 95% Student's-t UCL**	**76.54**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI 20.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 20
95% UCLs

Aluminum POI 20 1999

General Statistics

Number of Valid Observations	13	Number of Distinct Observations	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	7570	Minimum of Log Data	8.932
Maximum	36400	Maximum of Log Data	10.5
Mean	15697	Mean of log Data	9.567
Geometric Mean	14281	SD of log Data	0.441
Median	15100		
SD	7730		
Std. Error of Mean	2144		
Coefficient of Variation	0.492		
Skewness	1.694		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.848	Shapiro Wilk Test Statistic	0.961
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	19518	95% H-UCL	20430
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	24119
95% Adjusted-CLT UCL (Chen-1995)	20300	97.5% Chebyshev (MVUE) UCL	27799
95% Modified-t UCL (Johnson-1978)	19686	99% Chebyshev (MVUE) UCL	35026

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	4.245	Data appear Gamma Distributed at 5% Significance Level
Theta Star	3698	
MLE of Mean	15697	
MLE of Standard Deviation	7619	
nu star	110.4	
Approximate Chi Square Value (.05)	87.11	**Nonparametric Statistics**
Adjusted Level of Significance	0.0301	95% CLT UCL 19223
Adjusted Chi Square Value	84.17	95% Jackknife UCL 19518
		95% Standard Bootstrap UCL 19067
Anderson-Darling Test Statistic	0.311	95% Bootstrap-t UCL 21636
Anderson-Darling 5% Critical Value	0.736	95% Hall's Bootstrap UCL 38219
Kolmogorov-Smirnov Test Statistic	0.167	95% Percentile Bootstrap UCL 19362
Kolmogorov-Smirnov 5% Critical Value	0.237	95% BCA Bootstrap UCL 19882
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 25042
		97.5% Chebyshev(Mean, Sd) UCL 29085
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 37028
95% Approximate Gamma UCL (Use when n >= 40)	19886	
95% Adjusted Gamma UCL (Use when n < 40)	20581	

Potential UCL to Use	Use 95% Approximate Gamma UCL 19886

Manganese POI 20 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13

Raw Statistics		Log-transformed Statistics	
Minimum	71	Minimum of Log Data	4.263
Maximum	1550	Maximum of Log Data	7.346
Mean	477.2	Mean of log Data	5.912
Geometric Mean	369.6	SD of log Data	0.767
Median	362		
SD	378		
Std. Error of Mean	104.8		
Coefficient of Variation	0.792		
Skewness	2.037		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.798	Shapiro Wilk Test Statistic	0.964
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	664.1	95% H-UCL	856.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	953.4
95% Adjusted-CLT UCL (Chen-1995)	713	97.5% Chebyshev (MVUE) UCL	1157
95% Modified-t UCL (Johnson-1978)	674	99% Chebyshev (MVUE) UCL	1558
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.673	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	285.3		
MLE of Mean	477.2		
MLE of Standard Deviation	369		
nu star	43.5		
Approximate Chi Square Value (.05)	29.37	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	649.7
Adjusted Chi Square Value	27.73	95% Jackknife UCL	664.1
		95% Standard Bootstrap UCL	644.8
Anderson-Darling Test Statistic	0.298	95% Bootstrap-t UCL	773.3
Anderson-Darling 5% Critical Value	0.743	95% Hall's Bootstrap UCL	1426
Kolmogorov-Smirnov Test Statistic	0.136	95% Percentile Bootstrap UCL	656.8
Kolmogorov-Smirnov 5% Critical Value	0.239	95% BCA Bootstrap UCL	720.5
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	934.3
		97.5% Chebyshev(Mean, Sd) UCL	1132
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1520
95% Approximate Gamma UCL (Use when n >= 40)	706.7		
95% Adjusted Gamma UCL (Use when n < 40)	748.7		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**706.7**

Nickel POI 20 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	12

Raw Statistics		Log-transformed Statistics	
Minimum	34.6	Minimum of Log Data	3.544
Maximum	360	Maximum of Log Data	5.886
Mean	112	Mean of log Data	4.548
Geometric Mean	94.41	SD of log Data	0.574
Median	83.5		
SD	82.3		
Std. Error of Mean	22.83		
Coefficient of Variation	0.735		
Skewness	2.55		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.71	Shapiro Wilk Test Statistic	0.945
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	152.7	95% H-UCL	160.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	188.4
95% Adjusted-CLT UCL (Chen-1995)	166.8	97.5% Chebyshev (MVUE) UCL	222.4
95% Modified-t UCL (Johnson-1978)	155.4	99% Chebyshev (MVUE) UCL	289.2
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.42	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	46.29		
MLE of Mean	112		
MLE of Standard Deviation	72.01		
nu star	62.92		
Approximate Chi Square Value (.05)	45.67	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	149.6
Adjusted Chi Square Value	43.58	95% Jackknife UCL	152.7
		95% Standard Bootstrap UCL	148.4
Anderson-Darling Test Statistic	0.603	95% Bootstrap-t UCL	194.6
Anderson-Darling 5% Critical Value	0.739	95% Hall's Bootstrap UCL	306.4
Kolmogorov-Smirnov Test Statistic	0.232	95% Percentile Bootstrap UCL	153.7
Kolmogorov-Smirnov 5% Critical Value	0.238	95% BCA Bootstrap UCL	174.2
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	211.5
		97.5% Chebyshev(Mean, Sd) UCL	254.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	339.1
95% Approximate Gamma UCL (Use when n >= 40)	154.3		
95% Adjusted Gamma UCL (Use when n < 40)	161.7		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**154.3**

Vanadium POI 20 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13

Raw Statistics		Log-transformed Statistics	
Minimum	50.5	Minimum of Log Data	3.922
Maximum	112	Maximum of Log Data	4.718
Mean	73.76	Mean of log Data	4.277
Geometric Mean	72.01	SD of log Data	0.224
Median	68.5		
SD	17.46		
Std. Error of Mean	4.841		
Coefficient of Variation	0.237		
Skewness	0.993		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.919	Shapiro Wilk Test Statistic	0.962
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	82.39	95% H-UCL	83.24
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	93.81
95% Adjusted-CLT UCL (Chen-1995)	83.15	97.5% Chebyshev (MVUE) UCL	102.5
95% Modified-t UCL (Johnson-1978)	82.61	99% Chebyshev (MVUE) UCL	119.6
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	16.21	Data appear Normal at 5% Significance Level	
Theta Star	4.552		
MLE of Mean	73.76		
MLE of Standard Deviation	18.32		
nu star	421.3		
Approximate Chi Square Value (.05)	374.8	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	81.73
Adjusted Chi Square Value	368.5	95% Jackknife UCL	82.39
		95% Standard Bootstrap UCL	81.6
Anderson-Darling Test Statistic	0.364	95% Bootstrap-t UCL	84.62
Anderson-Darling 5% Critical Value	0.733	95% Hall's Bootstrap UCL	85.78
Kolmogorov-Smirnov Test Statistic	0.187	95% Percentile Bootstrap UCL	81.48
Kolmogorov-Smirnov 5% Critical Value	0.236	95% BCA Bootstrap UCL	82.62
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	94.87
		97.5% Chebyshev(Mean, Sd) UCL	104
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	121.9
95% Approximate Gamma UCL (Use when n >= 40)	82.93		
95% Adjusted Gamma UCL (Use when n < 40)	84.34		
Potential UCL to Use		**Use 95% Student's-t UCL**	**82.39**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI 21-22-23.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 21/22/23
95% UCLs

Aluminum POI 21/22/23 subsurface 1999

General Statistics

Number of Valid Observations	15	Number of Distinct Observations	15

Raw Statistics		**Log-transformed Statistics**	
Minimum	4830	Minimum of Log Data	8.483
Maximum	22684	Maximum of Log Data	10.03
Mean	15202	Mean of log Data	9.557
Geometric Mean	14138	SD of log Data	0.427
Median	15597		
SD	5210		
Std. Error of Mean	1345		
Coefficient of Variation	0.343		
Skewness	-0.555		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.947	Shapiro Wilk Test Statistic	0.873
Shapiro Wilk Critical Value	0.881	Shapiro Wilk Critical Value	0.881
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	17571	95% H-UCL	19450
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	22954
95% Adjusted-CLT UCL (Chen-1995)	17208	97.5% Chebyshev (MVUE) UCL	26228
95% Modified-t UCL (Johnson-1978)	17539	99% Chebyshev (MVUE) UCL	32659
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	5.689	Data appear Normal at 5% Significance Level	
Theta Star	2672		
MLE of Mean	15202		
MLE of Standard Deviation	6373		
nu star	170.7		
Approximate Chi Square Value (.05)	141.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0324	95% CLT UCL	17414
Adjusted Chi Square Value	138.2	95% Jackknife UCL	17571
		95% Standard Bootstrap UCL	17274
Anderson-Darling Test Statistic	0.596	95% Bootstrap-t UCL	17404
Anderson-Darling 5% Critical Value	0.738	95% Hall's Bootstrap UCL	17126
Kolmogorov-Smirnov Test Statistic	0.182	95% Percentile Bootstrap UCL	17319
Kolmogorov-Smirnov 5% Critical Value	0.222	95% BCA Bootstrap UCL	17237
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	21065
		97.5% Chebyshev(Mean, Sd) UCL	23602
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	28586
95% Approximate Gamma UCL (Use when n >= 40)	18341		
95% Adjusted Gamma UCL (Use when n < 40)	18775		
Potential UCL to Use		Use 95% Student's-t UCL	17571

Aluminum POI 21/22/23 subsurface 1995

General Statistics			
Number of Valid Observations	16	Number of Distinct Observations	16
Raw Statistics		**Log-transformed Statistics**	
Minimum	13467	Minimum of Log Data	9.508
Maximum	24662	Maximum of Log Data	10.11
Mean	19136	Mean of log Data	9.844
Geometric Mean	18850	SD of log Data	0.182
Median	19728		
SD	3333		
Std. Error of Mean	833.2		
Coefficient of Variation	0.174		
Skewness	-0.296		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.953	Shapiro Wilk Test Statistic	0.934
Shapiro Wilk Critical Value	0.887	Shapiro Wilk Critical Value	0.887
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	20597	95% H-UCL	20849
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	22966
95% Adjusted-CLT UCL (Chen-1995)	20441	97.5% Chebyshev (MVUE) UCL	24618
95% Modified-t UCL (Johnson-1978)	20587	99% Chebyshev (MVUE) UCL	27865
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	27.1	Data appear Normal at 5% Significance Level	
Theta Star	706.2		
MLE of Mean	19136		
MLE of Standard Deviation	3676		
nu star	867.1		
Approximate Chi Square Value (.05)	799.8	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0335	95% CLT UCL	20507
Adjusted Chi Square Value	792.4	95% Jackknife UCL	20597
		95% Standard Bootstrap UCL	20463
Anderson-Darling Test Statistic	0.435	95% Bootstrap-t UCL	20469
Anderson-Darling 5% Critical Value	0.736	95% Hall's Bootstrap UCL	20451
Kolmogorov-Smirnov Test Statistic	0.164	95% Percentile Bootstrap UCL	20430
Kolmogorov-Smirnov 5% Critical Value	0.215	95% BCA Bootstrap UCL	20352
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	22768
		97.5% Chebyshev(Mean, Sd) UCL	24340
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	27427
95% Approximate Gamma UCL (Use when n >= 40)	20748		
95% Adjusted Gamma UCL (Use when n < 40)	20940		
Potential UCL to Use		Use 95% Student's-t UCL	20597

Cobalt POI 21/22/23 subsurface 1995

General Statistics			
Number of Valid Observations	16	Number of Distinct Observations	16

Raw Statistics		Log-transformed Statistics	
Minimum	19.69	Minimum of Log Data	2.98
Maximum	426.5	Maximum of Log Data	6.056
Mean	115.9	Mean of log Data	4.348
Geometric Mean	77.29	SD of log Data	0.906
Median	67.54		
SD	116.4		
Std. Error of Mean	29.11		
Coefficient of Variation	1.004		
Skewness	1.63		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.772	Shapiro Wilk Test Statistic	0.936
Shapiro Wilk Critical Value	0.887	Shapiro Wilk Critical Value	0.887
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	167	95% H-UCL	212.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	233.3
95% Adjusted-CLT UCL (Chen-1995)	176.5	97.5% Chebyshev (MVUE) UCL	285.5
95% Modified-t UCL (Johnson-1978)	168.9	99% Chebyshev (MVUE) UCL	388.1
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.159	Data appear Lognormal at 5% Significance Level	
Theta Star	100		
MLE of Mean	115.9		
MLE of Standard Deviation	107.7		
nu star	37.1		
Approximate Chi Square Value (.05)	24.15	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0335	95% CLT UCL	163.8
Adjusted Chi Square Value	22.97	95% Jackknife UCL	167
		95% Standard Bootstrap UCL	163.1
Anderson-Darling Test Statistic	0.765	95% Bootstrap-t UCL	187.5
Anderson-Darling 5% Critical Value	0.757	95% Hall's Bootstrap UCL	175.2
Kolmogorov-Smirnov Test Statistic	0.232	95% Percentile Bootstrap UCL	164.4
Kolmogorov-Smirnov 5% Critical Value	0.219	95% BCA Bootstrap UCL	176
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	242.8
		97.5% Chebyshev(Mean, Sd) UCL	297.7
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	405.5
95% Approximate Gamma UCL (Use when n >= 40)	178.1		
95% Adjusted Gamma UCL (Use when n < 40)	187.3		
Potential UCL to Use		Use 95% H-UCL 212.1	

Manganese POI 21/22/23 subsurface 1999

General Statistics			
Number of Valid Observations	15	Number of Distinct Observations	15
Raw Statistics		**Log-transformed Statistics**	
Minimum	222	Minimum of Log Data	5.403
Maximum	3248	Maximum of Log Data	8.086
Mean	1084	Mean of log Data	6.639
Geometric Mean	764.6	SD of log Data	0.847
Median	705		
SD	1003		
Std. Error of Mean	258.9		
Coefficient of Variation	0.925		
Skewness	1.438		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.769	Shapiro Wilk Test Statistic	0.933
Shapiro Wilk Critical Value	0.881	Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1540	95% H-UCL	1930
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2146
95% Adjusted-CLT UCL (Chen-1995)	1613	97.5% Chebyshev (MVUE) UCL	2615
95% Modified-t UCL (Johnson-1978)	1556	99% Chebyshev (MVUE) UCL	3537
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.306	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	830.4		
MLE of Mean	1084		
MLE of Standard Deviation	949		
nu star	39.17		
Approximate Chi Square Value (.05)	25.84	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0324	95% CLT UCL	1510
Adjusted Chi Square Value	24.51	95% Jackknife UCL	1540
		95% Standard Bootstrap UCL	1490
Anderson-Darling Test Statistic	0.67	95% Bootstrap-t UCL	1788
Anderson-Darling 5% Critical Value	0.753	95% Hall's Bootstrap UCL	1594
Kolmogorov-Smirnov Test Statistic	0.179	95% Percentile Bootstrap UCL	1498
Kolmogorov-Smirnov 5% Critical Value	0.225	95% BCA Bootstrap UCL	1578
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2213
		97.5% Chebyshev(Mean, Sd) UCL	2701
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3660
95% Approximate Gamma UCL (Use when n >= 40)	1644		
95% Adjusted Gamma UCL (Use when n < 40)	1733		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**1644**

Manganese POI 21/22/23 subsurface 1995

General Statistics			
Number of Valid Observations	16	Number of Distinct Observations	16
Raw Statistics		**Log-transformed Statistics**	
Minimum	222	Minimum of Log Data	5.403
Maximum	3248	Maximum of Log Data	8.086
Mean	1175	Mean of log Data	6.72
Geometric Mean	828.7	SD of log Data	0.859
Median	788.2		
SD	1033		
Std. Error of Mean	258.3		
Coefficient of Variation	0.88		
Skewness	1.129		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.796	Shapiro Wilk Test Statistic	0.922
Shapiro Wilk Critical Value	0.887	Shapiro Wilk Critical Value	0.887
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1628	95% H-UCL	2083
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2337
95% Adjusted-CLT UCL (Chen-1995)	1678	97.5% Chebyshev (MVUE) UCL	2846
95% Modified-t UCL (Johnson-1978)	1640	99% Chebyshev (MVUE) UCL	3844
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.324	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	887		
MLE of Mean	1175		
MLE of Standard Deviation	1021		
nu star	42.38		
Approximate Chi Square Value (.05)	28.46	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0335	95% CLT UCL	1600
Adjusted Chi Square Value	27.16	95% Jackknife UCL	1628
		95% Standard Bootstrap UCL	1586
Anderson-Darling Test Statistic	0.754	95% Bootstrap-t UCL	1807
Anderson-Darling 5% Critical Value	0.754	95% Hall's Bootstrap UCL	1590
Kolmogorov-Smirnov Test Statistic	0.195	95% Percentile Bootstrap UCL	1602
Kolmogorov-Smirnov 5% Critical Value	0.219	95% BCA Bootstrap UCL	1668
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2301
		97.5% Chebyshev(Mean, Sd) UCL	2788
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3745
95% Approximate Gamma UCL (Use when n >= 40)	1750		
95% Adjusted Gamma UCL (Use when n < 40)	1833		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**1750**

Nickel POI 21/22/23 subsurface 1999

General Statistics			
Number of Valid Observations	15	Number of Distinct Observations	15
Raw Statistics		**Log-transformed Statistics**	
Minimum	35.9	Minimum of Log Data	3.581
Maximum	335	Maximum of Log Data	5.814
Mean	130.4	Mean of log Data	4.668
Geometric Mean	106.5	SD of log Data	0.682
Median	120		
SD	82.97		
Std. Error of Mean	21.42		
Coefficient of Variation	0.636		
Skewness	0.976		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.909	Shapiro Wilk Test Statistic	0.95
Shapiro Wilk Critical Value	0.881	Shapiro Wilk Critical Value	0.881
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	168.1	95% H-UCL	203.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	238.7
95% Adjusted-CLT UCL (Chen-1995)	171.4	97.5% Chebyshev (MVUE) UCL	284.8
95% Modified-t UCL (Johnson-1978)	169	99% Chebyshev (MVUE) UCL	375.4
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.147	Data appear Normal at 5% Significance Level	
Theta Star	60.74		
MLE of Mean	130.4		
MLE of Standard Deviation	89		
nu star	64.4		
Approximate Chi Square Value (.05)	46.94	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0324	95% CLT UCL	165.6
Adjusted Chi Square Value	45.11	95% Jackknife UCL	168.1
		95% Standard Bootstrap UCL	164.9
Anderson-Darling Test Statistic	0.302	95% Bootstrap-t UCL	176.4
Anderson-Darling 5% Critical Value	0.745	95% Hall's Bootstrap UCL	179.8
Kolmogorov-Smirnov Test Statistic	0.133	95% Percentile Bootstrap UCL	166.8
Kolmogorov-Smirnov 5% Critical Value	0.224	95% BCA Bootstrap UCL	169.9
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	223.8
		97.5% Chebyshev(Mean, Sd) UCL	264.2
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	343.5
95% Approximate Gamma UCL (Use when n >= 40)	178.9		
95% Adjusted Gamma UCL (Use when n < 40)	186.2		
Potential UCL to Use		Use 95% Student's-t UCL	168.1

Nickel POI 21/22/23 subsurface 1995

General Statistics			
Number of Valid Observations	16	Number of Distinct Observations	16
Raw Statistics		**Log-transformed Statistics**	
Minimum	36.38	Minimum of Log Data	3.594
Maximum	334.5	Maximum of Log Data	5.813
Mean	152.2	Mean of log Data	4.877
Geometric Mean	131.3	SD of log Data	0.582
Median	141.3		
SD	83.76		
Std. Error of Mean	20.94		
Coefficient of Variation	0.55		
Skewness	0.936		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.918	Shapiro Wilk Test Statistic	0.972
Shapiro Wilk Critical Value	0.887	Shapiro Wilk Critical Value	0.887
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	188.9	95% H-UCL	214.5
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	255.2
95% Adjusted-CLT UCL (Chen-1995)	191.9	97.5% Chebyshev (MVUE) UCL	299.1
95% Modified-t UCL (Johnson-1978)	189.7	99% Chebyshev (MVUE) UCL	385.4
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.917	Data appear Normal at 5% Significance Level	
Theta Star	52.17		
MLE of Mean	152.2		
MLE of Standard Deviation	89.1		
nu star	93.35		
Approximate Chi Square Value (.05)	72.07	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0335	95% CLT UCL	186.6
Adjusted Chi Square Value	69.94	95% Jackknife UCL	188.9
		95% Standard Bootstrap UCL	185.6
Anderson-Darling Test Statistic	0.205	95% Bootstrap-t UCL	198.3
Anderson-Darling 5% Critical Value	0.743	95% Hall's Bootstrap UCL	203
Kolmogorov-Smirnov Test Statistic	0.0955	95% Percentile Bootstrap UCL	186
Kolmogorov-Smirnov 5% Critical Value	0.216	95% BCA Bootstrap UCL	189.8
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	243.5
		97.5% Chebyshev(Mean, Sd) UCL	282.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	360.5
95% Approximate Gamma UCL (Use when n >= 40)	197.1		
95% Adjusted Gamma UCL (Use when n < 40)	203.1		
Potential UCL to Use		Use 95% Student's-t UCL	188.9

Thallium POI 21/22/23 subsurface 1999			
General Statistics			
Number of Valid Data	15	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	12
		Percent Non-Detects	80.00%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.25	Minimum Detected	-1.386
Maximum Detected	7.4	Maximum Detected	2.001
Mean of Detected	2.667	Mean of Detected	-0.145
SD of Detected	4.099	SD of Detected	1.866
Minimum Non-Detect	0.24	Minimum Non-Detect	-1.427
Maximum Non-Detect	12.7	Maximum Non-Detect	2.542
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	15
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.76	Shapiro Wilk Test Statistic	0.824
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3.051	Mean	0.367
SD	2.554	SD	1.602
95% DL/2 (t) UCL	4.213	95% H-Stat (DL/2) UCL	26.53
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.806
		SD in Log Scale	1.753
		Mean in Original Scale	0.567
		SD in Original Scale	1.893
		95% t UCL	1.428
		95% Percentile Bootstrap UCL	1.526
		95% BCA Bootstrap UCL	2.038
		95% H-UCL	1.905
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	Data appear Lognormal at 5% Significance Level	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	Nonparametric Statistics	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.918
5% K-S Critical Value	N/A	SD	2.05
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.757
		95% KM (t) UCL	2.252
Assuming Gamma Distribution		95% KM (z) UCL	2.164
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2.029
Minimum	N/A	95% KM (bootstrap t) UCL	28.47
Maximum	N/A	95% KM (BCA) UCL	7.4
Mean	N/A	95% KM (Percentile Bootstrap) UCL	N/A
Median	N/A	95% KM (Chebyshev) UCL	4.219
SD	N/A	97.5% KM (Chebyshev) UCL	5.647
k star	N/A	99% KM (Chebyshev) UCL	8.452
Theta star	N/A		
Nu star	N/A	Potential UCLs to Use	
AppChi2	N/A	97.5% KM (Chebyshev) UCL	5.647
95% Gamma Approximate UCL (Use when n >= 40)	N/A		
95% Adjusted Gamma UCL (Use when n < 40)	N/A		
Note: DL/2 is not a recommended method.			

Vanadium POI 21/22/23 subsurface 1999

General Statistics			
Number of Valid Observations	15	Number of Distinct Observations	15

Raw Statistics		Log-transformed Statistics	
Minimum	36.1	Minimum of Log Data	3.586
Maximum	195	Maximum of Log Data	5.273
Mean	99.15	Mean of log Data	4.515
Geometric Mean	91.38	SD of log Data	0.434
Median	98.7		
SD	39.98		
Std. Error of Mean	10.32		
Coefficient of Variation	0.403		
Skewness	0.672		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.963	Shapiro Wilk Test Statistic	0.966
Shapiro Wilk Critical Value	0.881	Shapiro Wilk Critical Value	0.881
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	117.3	95% H-UCL	126.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	149.6
95% Adjusted-CLT UCL (Chen-1995)	118	97.5% Chebyshev (MVUE) UCL	171.1
95% Modified-t UCL (Johnson-1978)	117.6	99% Chebyshev (MVUE) UCL	213.5
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	5.075	Data appear Normal at 5% Significance Level	
Theta Star	19.54		
MLE of Mean	99.15		
MLE of Standard Deviation	44.01		
nu star	152.3		
Approximate Chi Square Value (.05)	124.7	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0324	95% CLT UCL	116.1
Adjusted Chi Square Value	121.7	95% Jackknife UCL	117.3
		95% Standard Bootstrap UCL	115.7
Anderson-Darling Test Statistic	0.205	95% Bootstrap-t UCL	118.9
Anderson-Darling 5% Critical Value	0.738	95% Hall's Bootstrap UCL	122.6
Kolmogorov-Smirnov Test Statistic	0.128	95% Percentile Bootstrap UCL	115.9
Kolmogorov-Smirnov 5% Critical Value	0.222	95% BCA Bootstrap UCL	116.7
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	144.1
		97.5% Chebyshev(Mean, Sd) UCL	163.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	201.9
95% Approximate Gamma UCL (Use when n >= 40)	121		
95% Adjusted Gamma UCL (Use when n < 40)	124.1		
Potential UCL to Use		**Use 95% Student's-t UCL 117.3**	

Vanadium POI 21/22/23 subsurface 1995

General Statistics			
Number of Valid Observations	16	Number of Distinct Observations	16

Raw Statistics		Log-transformed Statistics	
Minimum	47.23	Minimum of Log Data	3.855
Maximum	194.9	Maximum of Log Data	5.272
Mean	125.1	Mean of log Data	4.766
Geometric Mean	117.5	SD of log Data	0.386
Median	122.1		
SD	42.2		
Std. Error of Mean	10.55		
Coefficient of Variation	0.337		
Skewness	0.0004509		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.97	Shapiro Wilk Test Statistic	0.926
Shapiro Wilk Critical Value	0.887	Shapiro Wilk Critical Value	0.887
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	143.6	95% H-UCL	153.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	179.9
95% Adjusted-CLT UCL (Chen-1995)	142.4	97.5% Chebyshev (MVUE) UCL	203.3
95% Modified-t UCL (Johnson-1978)	143.6	99% Chebyshev (MVUE) UCL	249.2
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.653	Data appear Normal at 5% Significance Level	
Theta Star	18.8		
MLE of Mean	125.1		
MLE of Standard Deviation	48.5		
nu star	212.9		
Approximate Chi Square Value (.05)	180.1	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0335	95% CLT UCL	142.4
Adjusted Chi Square Value	176.7	95% Jackknife UCL	143.6
		95% Standard Bootstrap UCL	141.8
Anderson-Darling Test Statistic	0.285	95% Bootstrap-t UCL	143.3
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	143.2
Kolmogorov-Smirnov Test Statistic	0.111	95% Percentile Bootstrap UCL	142.1
Kolmogorov-Smirnov 5% Critical Value	0.215	95% BCA Bootstrap UCL	142
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	171.1
		97.5% Chebyshev(Mean, Sd) UCL	191
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	230.1
95% Approximate Gamma UCL (Use when n >= 40)	147.8		
95% Adjusted Gamma UCL (Use when n < 40)	150.7		
Potential UCL to Use		**Use 95% Student's-t UCL**	**143.6**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Data Sets with Non-Detects	
User Selected Options		
From File	POI 22.wst	
Full Precision	OFF	
Confidence Coefficient	95%	
Number of Bootstrap Operations	2000	

POI 22 - 1996
95% UCLs

Arsenic POI 22 1996

General Statistics			
Number of Valid Observations	5	Number of Distinct Observations	5

Raw Statistics		Log-transformed Statistics	
Minimum	1.9	Minimum of Log Data	0.642
Maximum	26.9	Maximum of Log Data	3.292
Mean	7.4	Mean of log Data	1.376
Geometric Mean	3.958	SD of log Data	1.097
Median	2.4		
SD	10.92		
Std. Error of Mean	4.884		
Coefficient of Variation	1.476		
Skewness	2.217		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.603	Shapiro Wilk Test Statistic	0.734
Shapiro Wilk Critical Value	0.762	Shapiro Wilk Critical Value	0.762
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	17.81	95% H-UCL	134.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	18.77
95% Adjusted-CLT UCL (Chen-1995)	20.61	97.5% Chebyshev (MVUE) UCL	24.22
95% Modified-t UCL (Johnson-1978)	18.62	99% Chebyshev (MVUE) UCL	34.91
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.506	Data do not follow a Discernable Distribution (0.05)	
Theta Star	14.64		
MLE of Mean	7.4		
MLE of Standard Deviation	10.41		
nu star	5.055		
Approximate Chi Square Value (.05)	1.178	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0086	95% CLT UCL	15.43
Adjusted Chi Square Value	0.55	95% Jackknife UCL	17.81
		95% Standard Bootstrap UCL	14.56
Anderson-Darling Test Statistic	0.935	95% Bootstrap-t UCL	273.4
Anderson-Darling 5% Critical Value	0.693	95% Hall's Bootstrap UCL	132.1
Kolmogorov-Smirnov Test Statistic	0.401	95% Percentile Bootstrap UCL	16.96
Kolmogorov-Smirnov 5% Critical Value	0.365	95% BCA Bootstrap UCL	17.34
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	28.69
		97.5% Chebyshev(Mean, Sd) UCL	37.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	55.99
95% Approximate Gamma UCL (Use when n >= 40)	31.76		
95% Adjusted Gamma UCL (Use when n < 40)	68.03		

Potential UCL to Use	Use 95% Hall's Bootstrap UCL 132.1	1996

Recommended UCL exceeds the maximum observation

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI 23.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 23
95% UCLs

Manganese POI 23 1999

General Statistics			
Number of Valid Observations	5	Number of Distinct Observations	5
Raw Statistics		**Log-transformed Statistics**	
Minimum	450	Minimum of Log Data	6.109
Maximum	1120	Maximum of Log Data	7.021
Mean	683.6	Mean of log Data	6.464
Geometric Mean	641.4	SD of log Data	0.39
Median	549		
SD	284.7		
Std. Error of Mean	127.3		
Coefficient of Variation	0.417		
Skewness	1.116		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.86	Shapiro Wilk Test Statistic	0.892
Shapiro Wilk Critical Value	0.762	Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	955.1	95% H-UCL	1154
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1196
95% Adjusted-CLT UCL (Chen-1995)	961	97.5% Chebyshev (MVUE) UCL	1419
95% Modified-t UCL (Johnson-1978)	965.6	99% Chebyshev (MVUE) UCL	1857
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.34	Data appear Normal at 5% Significance Level	
Theta Star	204.7		
MLE of Mean	683.6		
MLE of Standard Deviation	374		
nu star	33.4		
Approximate Chi Square Value (.05)	21.19	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0086	95% CLT UCL	893
Adjusted Chi Square Value	17.07	95% Jackknife UCL	955.1
		95% Standard Bootstrap UCL	868.9
Anderson-Darling Test Statistic	0.41	95% Bootstrap-t UCL	1829
Anderson-Darling 5% Critical Value	0.68	95% Hall's Bootstrap UCL	2539
Kolmogorov-Smirnov Test Statistic	0.284	95% Percentile Bootstrap UCL	872
Kolmogorov-Smirnov 5% Critical Value	0.358	95% BCA Bootstrap UCL	886.2
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1239
		97.5% Chebyshev(Mean, Sd) UCL	1479
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1951
95% Approximate Gamma UCL (Use when n >= 40)	1078		
95% Adjusted Gamma UCL (Use when n < 40)	1338		
Potential UCL to Use		Use 95% Student's-t UCL	955.1

Vanadium POI 23 1999

General Statistics			
Number of Valid Observations	5	Number of Distinct Observations	5

Raw Statistics		Log-transformed Statistics	
Minimum	59.2	Minimum of Log Data	4.081
Maximum	86.5	Maximum of Log Data	4.46
Mean	72.98	Mean of log Data	4.278
Geometric Mean	72.12	SD of log Data	0.172
Median	67.5		
SD	12.63		
Std. Error of Mean	5.646		
Coefficient of Variation	0.173		
Skewness	0.335		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.843	Shapiro Wilk Test Statistic	0.861
Shapiro Wilk Critical Value	0.762	Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	85.02	95% H-UCL	88.03
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	97.4
95% Adjusted-CLT UCL (Chen-1995)	83.17	97.5% Chebyshev (MVUE) UCL	108
95% Modified-t UCL (Johnson-1978)	85.16	99% Chebyshev (MVUE) UCL	128.7
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	17.04	Data appear Normal at 5% Significance Level	
Theta Star	4.283		
MLE of Mean	72.98		
MLE of Standard Deviation	17.68		
nu star	170.4		
Approximate Chi Square Value (.05)	141.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0086	95% CLT UCL	82.27
Adjusted Chi Square Value	129.6	95% Jackknife UCL	85.02
		95% Standard Bootstrap UCL	81.35
Anderson-Darling Test Statistic	0.497	95% Bootstrap-t UCL	102.5
Anderson-Darling 5% Critical Value	0.678	95% Hall's Bootstrap UCL	243
Kolmogorov-Smirnov Test Statistic	0.279	95% Percentile Bootstrap UCL	82.2
Kolmogorov-Smirnov 5% Critical Value	0.357	95% BCA Bootstrap UCL	82.2
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	97.59
		97.5% Chebyshev(Mean, Sd) UCL	108.2
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	129.2
95% Approximate Gamma UCL (Use when n >= 40)	88.06		
95% Adjusted Gamma UCL (Use when n < 40)	95.99		
Potential UCL to Use		**Use 95% Student's-t UCL**	**85.02**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI 24.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 24
95% UCLs

Aluminum POI 24 1999

General Statistics

Number of Valid Observations	11	Number of Distinct Observations	11

Raw Statistics		**Log-transformed Statistics**	
Minimum	14100	Minimum of Log Data	9.554
Maximum	28510	Maximum of Log Data	10.26
Mean	18737	Mean of log Data	9.818
Geometric Mean	18358	SD of log Data	0.207
Median	17600		
SD	4186		
Std. Error of Mean	1262		
Coefficient of Variation	0.223		
Skewness	1.322		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.893	Shapiro Wilk Test Statistic	0.944
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	21025	95% H-UCL	21196
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23838
95% Adjusted-CLT UCL (Chen-1995)	21351	97.5% Chebyshev (MVUE) UCL	26054
95% Modified-t UCL (Johnson-1978)	21109	99% Chebyshev (MVUE) UCL	30405

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	17.96	Data appear Normal at 5% Significance Level	
Theta Star	1044		
MLE of Mean	18737		
MLE of Standard Deviation	4422		
nu star	395		
Approximate Chi Square Value (.05)	350	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	20813
Adjusted Chi Square Value	343	95% Jackknife UCL	21025
		95% Standard Bootstrap UCL	20697
Anderson-Darling Test Statistic	0.325	95% Bootstrap-t UCL	21835
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	22467
Kolmogorov-Smirnov Test Statistic	0.152	95% Percentile Bootstrap UCL	20810
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	21302
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	24239
		97.5% Chebyshev(Mean, Sd) UCL	26620
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	31296
95% Approximate Gamma UCL (Use when n >= 40)	21150		
95% Adjusted Gamma UCL (Use when n < 40)	21577		

Potential UCL to Use	Use 95% Student's-t UCL 21025

Antimony POI 24 1999

General Statistics			
Number of Valid Data	11	Number of Detected Data	10
Number of Distinct Detected Data	10	Number of Non-Detect Data	1
		Percent Non-Detects	9.09%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	6.3	Minimum Detected	1.841
Maximum Detected	28.6	Maximum Detected	3.353
Mean of Detected	16.9	Mean of Detected	2.744
SD of Detected	6.934	SD of Detected	0.445
Minimum Non-Detect	9.8	Minimum Non-Detect	2.282
Maximum Non-Detect	9.8	Maximum Non-Detect	2.282
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.951	Shapiro Wilk Test Statistic	0.951
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	15.81	Mean	2.639
SD	7.507	SD	0.548
95% DL/2 (t) UCL	19.91	95% H-Stat (DL/2) UCL	23.98
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	15.83	Mean in Log Scale	2.672
SD	7.266	SD in Log Scale	0.485
95% MLE (t) UCL	19.8	Mean in Original Scale	16
95% MLE (Tiku) UCL	19.87	SD in Original Scale	7.218
		95% t UCL	19.95
		95% Percentile Bootstrap UCL	19.49
		95% BCA Bootstrap UCL	19.7
		95% H UCL	22.67
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	4.401	Data appear Normal at 5% Significance Level	
Theta Star	3.84		
nu star	88.01		
A-D Test Statistic	0.246	**Nonparametric Statistics**	
5% A-D Critical Value	0.728	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.728	Mean	15.94
5% K-S Critical Value	0.267	SD	6.973
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	2.216
		95% KM (t) UCL	19.95
Assuming Gamma Distribution		95% KM (z) UCL	19.58
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	19.9
Minimum	3.46	95% KM (bootstrap t) UCL	20.17
Maximum	28.6	95% KM (BCA) UCL	20.15
Mean	15.68	95% KM (Percentile Bootstrap) UCL	19.62
Median	14.6	95% KM (Chebyshev) UCL	25.6
SD	7.726	97.5% KM (Chebyshev) UCL	29.78
k star	2.692	99% KM (Chebyshev) UCL	37.99
Theta star	5.824		
Nu star	59.22	**Potential UCLs to Use**	
AppChi2	42.53	**95% KM (t) UCL**	**19.95**
95% Gamma Approximate UCL (Use when n >= 40)	21.83	95% KM (Percentile Bootstrap) UCL	19.62
95% Adjusted Gamma UCL (Use when n < 40)	23.08		

Note: DL/2 is not a recommended method.

Arsenic POI 24 1999

General Statistics			
Number of Valid Observations	11	Number of Distinct Observations	11
Raw Statistics		**Log-transformed Statistics**	
Minimum	7.5	Minimum of Log Data	2.015
Maximum	103	Maximum of Log Data	4.635
Mean	26.69	Mean of log Data	2.765
Geometric Mean	15.87	SD of log Data	0.938
Median	11.5		
SD	34.76		
Std. Error of Mean	10.48		
Coefficient of Variation	1.302		
Skewness	1.903		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.588	Shapiro Wilk Test Statistic	0.742
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	45.69	95% H-UCL	57.93
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	53.82
95% Adjusted-CLT UCL (Chen-1995)	50.36	97.5% Chebyshev (MVUE) UCL	66.99
95% Modified-t UCL (Johnson-1978)	46.69	99% Chebyshev (MVUE) UCL	92.86
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.86	Data do not follow a Discernable Distribution (0.05)	
Theta Star	31.04		
MLE of Mean	26.69		
MLE of Standard Deviation	28.78		
nu star	18.92		
Approximate Chi Square Value (.05)	10.06	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	43.93
Adjusted Chi Square Value	9.021	95% Jackknife UCL	45.69
		95% Standard Bootstrap UCL	43.36
Anderson-Darling Test Statistic	1.692	95% Bootstrap-t UCL	164.8
Anderson-Darling 5% Critical Value	0.75	95% Hall's Bootstrap UCL	166.9
Kolmogorov-Smirnov Test Statistic	0.348	95% Percentile Bootstrap UCL	44.12
Kolmogorov-Smirnov 5% Critical Value	0.262	95% BCA Bootstrap UCL	51.29
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	72.38
		97.5% Chebyshev(Mean, Sd) UCL	92.15
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	131
95% Approximate Gamma UCL (Use when n >= 40)	50.21		
95% Adjusted Gamma UCL (Use when n < 40)	55.97		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UCL**	**72.38**

Vanadium POI 24 1999

General Statistics			
Number of Valid Observations	11	Number of Distinct Observations	11
Raw Statistics		**Log-transformed Statistics**	
Minimum	33.9	Minimum of Log Data	3.523
Maximum	135	Maximum of Log Data	4.905
Mean	79.68	Mean of log Data	4.313
Geometric Mean	74.67	SD of log Data	0.387
Median	70.1		
SD	29.31		
Std. Error of Mean	8.839		
Coefficient of Variation	0.368		
Skewness	0.486		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.968	Shapiro Wilk Test Statistic	0.971
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	95.7	95% H-UCL	103.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	121.1
95% Adjusted-CLT UCL (Chen-1995)	95.6	97.5% Chebyshev (MVUE) UCL	139
95% Modified-t UCL (Johnson-1978)	95.92	99% Chebyshev (MVUE) UCL	174
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	5.782	Data appear Normal at 5% Significance Level	
Theta Star	13.78		
MLE of Mean	79.68		
MLE of Standard Deviation	33.14		
nu star	127.2		
Approximate Chi Square Value (.05)	102.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	94.22
Adjusted Chi Square Value	98.5	95% Jackknife UCL	95.7
		95% Standard Bootstrap UCL	93.46
Anderson-Darling Test Statistic	0.183	95% Bootstrap-t UCL	97.98
Anderson-Darling 5% Critical Value	0.73	95% Hall's Bootstrap UCL	97.26
Kolmogorov-Smirnov Test Statistic	0.137	95% Percentile Bootstrap UCL	94.09
Kolmogorov-Smirnov 5% Critical Value	0.256	95% BCA Bootstrap UCL	95.08
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	118.2
		97.5% Chebyshev(Mean, Sd) UCL	134.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	167.6
95% Approximate Gamma UCL (Use when n >= 40)	99.22		
95% Adjusted Gamma UCL (Use when n < 40)	102.9		
Potential UCL to Use		Use 95% Student's-t UCL	95.7

Aroclor 1260 POI 24 1999			
General Statistics			
Number of Valid Data	10	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	5
		Percent Non-Detects	50.00%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.14	Minimum Detected	-1.966
Maximum Detected	1.3	Maximum Detected	0.262
Mean of Detected	0.42	Mean of Detected	-1.252
SD of Detected	0.494	SD of Detected	0.872
Minimum Non-Detect	0.039	Minimum Non-Detect	-3.244
Maximum Non-Detect	0.042	Maximum Non-Detect	-3.17
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	5
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	5
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	50.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.629	Shapiro Wilk Test Statistic	0.774
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.22	Mean	-2.582
SD	0.391	SD	1.518
95% DL/2 (t) UCL	0.447	95% H-Stat (DL/2) UCL	2.056
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-2.482
		SD in Log Scale	1.461
		Mean in Original Scale	0.223
		SD in Original Scale	0.389
		95% t UCL	0.449
		95% Percentile Bootstrap UCL	0.452
		95% BCA Bootstrap UCL	0.572
		95% H-UCL	1.801
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.711	Data appear Lognormal at 5% Significance Level	
Theta Star	0.591		
nu star	7.111		
A-D Test Statistic	0.86	**Nonparametric Statistics**	
5% A-D Critical Value	0.687	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.687	Mean	0.28
5% K-S Critical Value	0.362	SD	0.342
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.121
		95% KM (t) UCL	0.502
Assuming Gamma Distribution		95% KM (z) UCL	0.479
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.473
Minimum	0.000001	95% KM (bootstrap t) UCL	1.918
Maximum	1.3	95% KM (BCA) UCL	0.617
Mean	0.21	95% KM (Percentile Bootstrap) UCL	0.512
Median	0.07	95% KM (Chebyshev) UCL	0.807
SD	0.397	97.5% KM (Chebyshev) UCL	1.035
k star	0.158	99% KM (Chebyshev) UCL	1.483
Theta star	1.325		
Nu star	3.17	**Potential UCLs to Use**	
AppChi2	0.424	**95% KM (t) UCL**	**0.502**
95% Gamma Approximate UCL (Use when n >= 40)	1.568	95% KM (% Bootstrap) UCL	0.512
95% Adjusted Gamma UCL (Use when n < 40)	2.275		
Note: DL/2 is not a recommended method.			

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 25
95% UCLs

Aluminum POI 25 subsurface 1999

General Statistics

Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	19341	Minimum of Log Data	9.87
Maximum	37428	Maximum of Log Data	10.53
Mean	24509	Mean of log Data	10.09
Geometric Mean	24003	SD of log Data	0.211
Median	23504		
SD	5937		
Std. Error of Mean	2244		
Coefficient of Variation	0.242		
Skewness	2.19		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.709	Shapiro Wilk Test Statistic	0.777
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	28869	95% H-UCL	29174
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	32963
95% Adjusted-CLT UCL (Chen-1995)	30184	97.5% Chebyshev (MVUE) UCL	36641
95% Modified-t UCL (Johnson-1978)	29179	99% Chebyshev (MVUE) UCL	43866

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	13.89	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1764		
MLE of Mean	24509		
MLE of Standard Deviation	6575		
nu star	194.5		
Approximate Chi Square Value (.05)	163.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	28200
Adjusted Chi Square Value	154.6	95% Jackknife UCL	28869
		95% Standard Bootstrap UCL	27816
Anderson-Darling Test Statistic	0.902	95% Bootstrap-t UCL	34419
Anderson-Darling 5% Critical Value	0.707	95% Hall's Bootstrap UCL	46650
Kolmogorov-Smirnov Test Statistic	0.391	95% Percentile Bootstrap UCL	28542
Kolmogorov-Smirnov 5% Critical Value	0.311	95% BCA Bootstrap UCL	29425
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	34290
		97.5% Chebyshev(Mean, Sd) UCL	38523
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	46837
95% Approximate Gamma UCL (Use when n >= 40)	29203		
95% Adjusted Gamma UCL (Use when n < 40)	30841		

Potential UCL to Use		Use 95% Student's-t UCL	28869
		or 95% Modified-t UCL	29179

Aluminum POI 25 subsurface 1995

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7
Raw Statistics		**Log-transformed Statistics**	
Minimum	19341	Minimum of Log Data	9.87
Maximum	37428	Maximum of Log Data	10.53
Mean	24509	Mean of log Data	10.09
Geometric Mean	24003	SD of log Data	0.211
Median	23504		
SD	5937		
Std. Error of Mean	2244		
Coefficient of Variation	0.242		
Skewness	2.19		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.709	Shapiro Wilk Test Statistic	0.777
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	28869	95% H-UCL	29174
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	32963
95% Adjusted-CLT UCL (Chen-1995)	30184	97.5% Chebyshev (MVUE) UCL	36641
95% Modified-t UCL (Johnson-1978)	29179	99% Chebyshev (MVUE) UCL	43866
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	13.89	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1764		
MLE of Mean	24509		
MLE of Standard Deviation	6575		
nu star	194.5		
Approximate Chi Square Value (.05)	163.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	28200
Adjusted Chi Square Value	154.6	95% Jackknife UCL	28869
		95% Standard Bootstrap UCL	27895
Anderson-Darling Test Statistic	0.902	95% Bootstrap-t UCL	34717
Anderson-Darling 5% Critical Value	0.707	95% Hall's Bootstrap UCL	46946
Kolmogorov-Smirnov Test Statistic	0.391	95% Percentile Bootstrap UCL	28451
Kolmogorov-Smirnov 5% Critical Value	0.311	95% BCA Bootstrap UCL	29447
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	34290
		97.5% Chebyshev(Mean, Sd) UCL	38522
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	46836
95% Approximate Gamma UCL (Use when n >= 40)	29203		
95% Adjusted Gamma UCL (Use when n < 40)	30841		
Potential UCL to Use		**Use 95% Student's-t UCL**	**28869**
		or 95% Modified-t UCL	29179

Antimony POI 25 subsurface 1995

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7
Raw Statistics		**Log-transformed Statistics**	
Minimum	7.17	Minimum of Log Data	1.97
Maximum	16.45	Maximum of Log Data	2.8
Mean	10.14	Mean of log Data	2.276
Geometric Mean	9.742	SD of log Data	0.297
Median	8.88		
SD	3.286		
Std. Error of Mean	1.242		
Coefficient of Variation	0.324		
Skewness	1.33		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.858	Shapiro Wilk Test Statistic	0.906
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	12.55	95% H-UCL	13.31
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	15.08
95% Adjusted-CLT UCL (Chen-1995)	12.85	97.5% Chebyshev (MVUE) UCL	17.22
95% Modified-t UCL (Johnson-1978)	12.66	99% Chebyshev (MVUE) UCL	21.44
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	7.333	Data appear Normal at 5% Significance Level	
Theta Star	1.383		
MLE of Mean	10.14		
MLE of Standard Deviation	3.745		
nu star	102.7		
Approximate Chi Square Value (.05)	80.28	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	12.18
Adjusted Chi Square Value	74.32	95% Jackknife UCL	12.55
		95% Standard Bootstrap UCL	12.05
Anderson-Darling Test Statistic	0.416	95% Bootstrap-t UCL	14.2
Anderson-Darling 5% Critical Value	0.708	95% Hall's Bootstrap UCL	13.04
Kolmogorov-Smirnov Test Statistic	0.215	95% Percentile Bootstrap UCL	12.21
Kolmogorov-Smirnov 5% Critical Value	0.312	95% BCA Bootstrap UCL	12.7
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	15.55
		97.5% Chebyshev(Mean, Sd) UCL	17.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	22.5
95% Approximate Gamma UCL (Use when n >= 40)	12.97		
95% Adjusted Gamma UCL (Use when n < 40)	14.01		
Potential UCL to Use		Use 95% Student's-t UCL	12.55

Antimony POI 25 subsurface 1999

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	6
Raw Statistics		**Log-transformed Statistics**	
Minimum	7.2	Minimum of Log Data	1.974
Maximum	16.5	Maximum of Log Data	2.803
Mean	10.16	Mean of log Data	2.278
Geometric Mean	9.759	SD of log Data	0.297
Median	8.9		
SD	3.295		
Std. Error of Mean	1.245		
Coefficient of Variation	0.324		
Skewness	1.343		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.853	Shapiro Wilk Test Statistic	0.901
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	12.58	95% H-UCL	13.33
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	15.1
95% Adjusted-CLT UCL (Chen-1995)	12.88	97.5% Chebyshev (MVUE) UCL	17.25
95% Modified-t UCL (Johnson-1978)	12.68	99% Chebyshev (MVUE) UCL	21.47
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	7.332	Data appear Normal at 5% Significance Level	
Theta Star	1.385		
MLE of Mean	10.16		
MLE of Standard Deviation	3.751		
nu star	102.6		
Approximate Chi Square Value (.05)	80.27	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	12.21
Adjusted Chi Square Value	74.31	95% Jackknife UCL	12.58
		95% Standard Bootstrap UCL	12.08
Anderson-Darling Test Statistic	0.433	95% Bootstrap-t UCL	14.2
Anderson-Darling 5% Critical Value	0.708	95% Hall's Bootstrap UCL	13.14
Kolmogorov-Smirnov Test Statistic	0.218	95% Percentile Bootstrap UCL	12.17
Kolmogorov-Smirnov 5% Critical Value	0.312	95% BCA Bootstrap UCL	12.56
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	15.59
		97.5% Chebyshev(Mean, Sd) UCL	17.93
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	22.55
95% Approximate Gamma UCL (Use when n >= 40)	12.99		
95% Adjusted Gamma UCL (Use when n < 40)	14.03		
Potential UCL to Use		Use 95% Student's-t UCL	12.58

Cobalt POI 25 subsurface 1995

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	11.96	Minimum of Log Data	2.482
Maximum	80.57	Maximum of Log Data	4.389
Mean	41.85	Mean of log Data	3.593
Geometric Mean	36.34	SD of log Data	0.612
Median	38.64		
SD	22.13		
Std. Error of Mean	8.363		
Coefficient of Variation	0.529		
Skewness	0.614		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.975	Shapiro Wilk Test Statistic	0.959
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	58.1	95% H-UCL	86.04
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	85.7
95% Adjusted-CLT UCL (Chen-1995)	57.68	97.5% Chebyshev (MVUE) UCL	104.4
95% Modified-t UCL (Johnson-1978)	58.42	99% Chebyshev (MVUE) UCL	141.1
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.212	Data appear Normal at 5% Significance Level	
Theta Star	18.92		
MLE of Mean	41.85		
MLE of Standard Deviation	28.14		
nu star	30.96		
Approximate Chi Square Value (.05)	19.25	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	55.6
Adjusted Chi Square Value	16.52	95% Jackknife UCL	58.1
		95% Standard Bootstrap UCL	54.82
Anderson-Darling Test Statistic	0.168	95% Bootstrap-t UCL	61.34
Anderson-Darling 5% Critical Value	0.71	95% Hall's Bootstrap UCL	62.19
Kolmogorov-Smirnov Test Statistic	0.123	95% Percentile Bootstrap UCL	54.73
Kolmogorov-Smirnov 5% Critical Value	0.313	95% BCA Bootstrap UCL	55.94
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	78.3
		97.5% Chebyshev(Mean, Sd) UCL	94.07
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	125.1
95% Approximate Gamma UCL (Use when n >= 40)	67.3		
95% Adjusted Gamma UCL (Use when n < 40)	78.41		
Potential UCL to Use		Use 95% Student's-t UCL	58.1

Manganese POI 25 subsurface 1999

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	517	Minimum of Log Data	6.248
Maximum	1564	Maximum of Log Data	7.355
Mean	904.9	Mean of log Data	6.76
Geometric Mean	862.9	SD of log Data	0.326
Median	873		
SD	320		
Std. Error of Mean	121		
Coefficient of Variation	0.354		
Skewness	1.597		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.814	Shapiro Wilk Test Statistic	0.893
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1140	95% H-UCL	1228
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1390
95% Adjusted-CLT UCL (Chen-1995)	1182	97.5% Chebyshev (MVUE) UCL	1600
95% Modified-t UCL (Johnson-1978)	1152	99% Chebyshev (MVUE) UCL	2014
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.208	Data appear Normal at 5% Significance Level	
Theta Star	145.8		
MLE of Mean	904.9		
MLE of Standard Deviation	363.2		
nu star	86.91		
Approximate Chi Square Value (.05)	66.42	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	1104
Adjusted Chi Square Value	61.04	95% Jackknife UCL	1140
		95% Standard Bootstrap UCL	1097
Anderson-Darling Test Statistic	0.58	95% Bootstrap-t UCL	1275
Anderson-Darling 5% Critical Value	0.708	95% Hall's Bootstrap UCL	2180
Kolmogorov-Smirnov Test Statistic	0.321	95% Percentile Bootstrap UCL	1118
Kolmogorov-Smirnov 5% Critical Value	0.312	95% BCA Bootstrap UCL	1153
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1432
		97.5% Chebyshev(Mean, Sd) UCL	1660
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2108
95% Approximate Gamma UCL (Use when n >= 40)	1184		
95% Adjusted Gamma UCL (Use when n < 40)	1288		
Potential UCL to Use		Use 95% Student's-t UCL	1140

Mercury POI 25 subsurface 1995

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	16.53	Minimum of Log Data	2.805
Maximum	28.22	Maximum of Log Data	3.34
Mean	20.93	Mean of log Data	3.03
Geometric Mean	20.69	SD of log Data	0.16
Median	20.26		
SD	3.577		
Std. Error of Mean	1.352		
Coefficient of Variation	0.171		
Skewness	1.516		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.836	Shapiro Wilk Test Statistic	0.881
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	23.56	95% H-UCL	23.79
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	26.45
95% Adjusted-CLT UCL (Chen-1995)	23.98	97.5% Chebyshev (MVUE) UCL	28.85
95% Modified-t UCL (Johnson-1978)	23.68	99% Chebyshev (MVUE) UCL	33.55
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	25.09	Data appear Normal at 5% Significance Level	
Theta Star	0.834		
MLE of Mean	20.93		
MLE of Standard Deviation	4.178		
nu star	351.3		
Approximate Chi Square Value (.05)	308.9	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	23.15
Adjusted Chi Square Value	296.8	95% Jackknife UCL	23.56
		95% Standard Bootstrap UCL	22.94
Anderson-Darling Test Statistic	0.582	95% Bootstrap-t UCL	24.98
Anderson-Darling 5% Critical Value	0.707	95% Hall's Bootstrap UCL	36.29
Kolmogorov-Smirnov Test Statistic	0.265	95% Percentile Bootstrap UCL	23.17
Kolmogorov-Smirnov 5% Critical Value	0.311	95% BCA Bootstrap UCL	23.7
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	26.82
		97.5% Chebyshev(Mean, Sd) UCL	29.37
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	34.38
95% Approximate Gamma UCL (Use when n >= 40)	23.8		
95% Adjusted Gamma UCL (Use when n < 40)	24.77		
Potential UCL to Use		Use 95% Student's-t UCL	23.56

Mercury POI 25 subsurface 1999

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	16.5	Minimum of Log Data	2.803
Maximum	28.2	Maximum of Log Data	3.339
Mean	20.93	Mean of log Data	3.03
Geometric Mean	20.69	SD of log Data	0.16
Median	20.3		
SD	3.572		
Std. Error of Mean	1.35		
Coefficient of Variation	0.171		
Skewness	1.498		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.836	Shapiro Wilk Test Statistic	0.881
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	23.55	95% H-UCL	23.79
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	26.45
95% Adjusted-CLT UCL (Chen-1995)	23.97	97.5% Chebyshev (MVUE) UCL	28.85
95% Modified-t UCL (Johnson-1978)	23.68	99% Chebyshev (MVUE) UCL	33.55
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	25.12	Data appear Normal at 5% Significance Level	
Theta Star	0.833		
MLE of Mean	20.93		
MLE of Standard Deviation	4.176		
nu star	351.6		
Approximate Chi Square Value (.05)	309.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	23.15
Adjusted Chi Square Value	297.1	95% Jackknife UCL	23.55
		95% Standard Bootstrap UCL	22.95
Anderson-Darling Test Statistic	0.586	95% Bootstrap-t UCL	24.85
Anderson-Darling 5% Critical Value	0.707	95% Hall's Bootstrap UCL	36.18
Kolmogorov-Smirnov Test Statistic	0.266	95% Percentile Bootstrap UCL	23.09
Kolmogorov-Smirnov 5% Critical Value	0.311	95% BCA Bootstrap UCL	23.57
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	26.81
		97.5% Chebyshev(Mean, Sd) UCL	29.36
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	34.36
95% Approximate Gamma UCL (Use when n >= 40)	23.8		
95% Adjusted Gamma UCL (Use when n < 40)	24.77		
Potential UCL to Use		**Use 95% Student's-t UCL 23.55**	

Selenium POI 25 subsurface 1995

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	30.51	Minimum of Log Data	3.418
Maximum	47.07	Maximum of Log Data	3.852
Mean	36.64	Mean of log Data	3.593
Geometric Mean	36.35	SD of log Data	0.135
Median	35.21		
SD	5.214		
Std. Error of Mean	1.971		
Coefficient of Variation	0.142		
Skewness	1.436		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.88	Shapiro Wilk Test Statistic	0.919
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	40.47	95% H-UCL	40.74
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	44.77
95% Adjusted-CLT UCL (Chen-1995)	41.02	97.5% Chebyshev (MVUE) UCL	48.29
95% Modified-t UCL (Johnson-1978)	40.65	99% Chebyshev (MVUE) UCL	55.21
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	35.63	Data appear Normal at 5% Significance Level	
Theta Star	1.028		
MLE of Mean	36.64		
MLE of Standard Deviation	6.138		
nu star	498.9		
Approximate Chi Square Value (.05)	448.1	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	39.88
Adjusted Chi Square Value	433.4	95% Jackknife UCL	40.47
		95% Standard Bootstrap UCL	39.58
Anderson-Darling Test Statistic	0.4	95% Bootstrap-t UCL	42.59
Anderson-Darling 5% Critical Value	0.708	95% Hall's Bootstrap UCL	57
Kolmogorov-Smirnov Test Statistic	0.227	95% Percentile Bootstrap UCL	39.82
Kolmogorov-Smirnov 5% Critical Value	0.311	95% BCA Bootstrap UCL	41
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	45.23
		97.5% Chebyshev(Mean, Sd) UCL	48.95
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	56.25
95% Approximate Gamma UCL (Use when n >= 40)	40.79		
95% Adjusted Gamma UCL (Use when n < 40)	42.17		
Potential UCL to Use		Use 95% Student's-t UCL	40.47

Selenium POI 25 subsurface 1999

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	30.5	Minimum of Log Data	3.418
Maximum	47.1	Maximum of Log Data	3.852
Mean	36.64	Mean of log Data	3.593
Geometric Mean	36.35	SD of log Data	0.135
Median	35.2		
SD	5.223		
Std. Error of Mean	1.974		
Coefficient of Variation	0.143		
Skewness	1.441		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.879	Shapiro Wilk Test Statistic	0.919
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	40.48	95% H-UCL	40.75
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	44.78
95% Adjusted-CLT UCL (Chen-1995)	41.04	97.5% Chebyshev (MVUE) UCL	48.31
95% Modified-t UCL (Johnson-1978)	40.66	99% Chebyshev (MVUE) UCL	55.24
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	35.53	Data appear Normal at 5% Significance Level	
Theta Star	1.031		
MLE of Mean	36.64		
MLE of Standard Deviation	6.147		
nu star	497.5		
Approximate Chi Square Value (.05)	446.7	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	39.89
Adjusted Chi Square Value	432.1	95% Jackknife UCL	40.48
		95% Standard Bootstrap UCL	39.65
Anderson-Darling Test Statistic	0.404	95% Bootstrap-t UCL	42.93
Anderson-Darling 5% Critical Value	0.708	95% Hall's Bootstrap UCL	57.22
Kolmogorov-Smirnov Test Statistic	0.228	95% Percentile Bootstrap UCL	39.63
Kolmogorov-Smirnov 5% Critical Value	0.311	95% BCA Bootstrap UCL	40.53
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	45.25
		97.5% Chebyshev(Mean, Sd) UCL	48.97
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	56.29
95% Approximate Gamma UCL (Use when n >= 40)	40.8		
95% Adjusted Gamma UCL (Use when n < 40)	42.18		
Potential UCL to Use		Use 95% Student's-t UCL	40.48

Thallium POI 25 subsurface 1999

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	40.9	Minimum of Log Data	3.711
Maximum	75.7	Maximum of Log Data	4.327
Mean	47.6	Mean of log Data	3.839
Geometric Mean	46.5	SD of log Data	0.22
Median	43.2		
SD	12.54		
Std. Error of Mean	4.741		
Coefficient of Variation	0.264		
Skewness	2.515		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.591	Shapiro Wilk Test Statistic	0.634
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	56.81	95% H-UCL	57.12
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	64.66
95% Adjusted-CLT UCL (Chen-1995)	60.21	97.5% Chebyshev (MVUE) UCL	72.1
95% Modified-t UCL (Johnson-1978)	57.56	99% Chebyshev (MVUE) UCL	86.71
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	12.41	Data do not follow a Discernable Distribution (0.05)	
Theta Star	3.834		
MLE of Mean	47.6		
MLE of Standard Deviation	13.51		
nu star	173.8		
Approximate Chi Square Value (.05)	144.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	55.4
Adjusted Chi Square Value	136.2	95% Jackknife UCL	56.81
		95% Standard Bootstrap UCL	54.93
Anderson-Darling Test Statistic	1.314	95% Bootstrap-t UCL	89.87
Anderson-Darling 5% Critical Value	0.707	95% Hall's Bootstrap UCL	90.18
Kolmogorov-Smirnov Test Statistic	0.399	95% Percentile Bootstrap UCL	56.57
Kolmogorov-Smirnov 5% Critical Value	0.311	95% BCA Bootstrap UCL	58.04
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	68.27
		97.5% Chebyshev(Mean, Sd) UCL	77.21
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	94.77
95% Approximate Gamma UCL (Use when n >= 40)	57.33		
95% Adjusted Gamma UCL (Use when n < 40)	60.75		
Potential UCL to Use		Use 95% Student's-t UCL	56.81
		or 95% Modified-t UCL	57.56

Thallium POI 25 subsurface 1995

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	40.93	Minimum of Log Data	3.712
Maximum	75.72	Maximum of Log Data	4.327
Mean	47.61	Mean of log Data	3.84
Geometric Mean	46.5	SD of log Data	0.22
Median	43.18		
SD	12.55		
Std. Error of Mean	4.744		
Coefficient of Variation	0.264		
Skewness	2.513		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.591	Shapiro Wilk Test Statistic	0.634
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	56.82	95% H-UCL	57.14
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	64.68
95% Adjusted-CLT UCL (Chen-1995)	60.22	97.5% Chebyshev (MVUE) UCL	72.12
95% Modified-t UCL (Johnson-1978)	57.58	99% Chebyshev (MVUE) UCL	86.74
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	12.4	Data do not follow a Discernable Distribution (0.05)	
Theta Star	3.839		
MLE of Mean	47.61		
MLE of Standard Deviation	13.52		
nu star	173.6		
Approximate Chi Square Value (.05)	144.1	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	55.41
Adjusted Chi Square Value	136	95% Jackknife UCL	56.82
		95% Standard Bootstrap UCL	54.79
Anderson-Darling Test Statistic	1.312	95% Bootstrap-t UCL	89.22
Anderson-Darling 5% Critical Value	0.707	95% Hall's Bootstrap UCL	90
Kolmogorov-Smirnov Test Statistic	0.399	95% Percentile Bootstrap UCL	55.98
Kolmogorov-Smirnov 5% Critical Value	0.311	95% BCA Bootstrap UCL	58.06
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	68.28
		97.5% Chebyshev(Mean, Sd) UCL	77.23
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	94.81
95% Approximate Gamma UCL (Use when n >= 40)	57.34		
95% Adjusted Gamma UCL (Use when n < 40)	60.76		
Potential UCL to Use		Use 95% Student's-t UCL	56.82
		or 95% Modified-t UCL	57.58

Vanadium POI 25 subsurface 1999

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7
Raw Statistics		**Log-transformed Statistics**	
Minimum	42.8	Minimum of Log Data	3.757
Maximum	136	Maximum of Log Data	4.913
Mean	96.01	Mean of log Data	4.505
Geometric Mean	90.43	SD of log Data	0.4
Median	107		
SD	31.54		
Std. Error of Mean	11.92		
Coefficient of Variation	0.329		
Skewness	-0.833		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.887	Shapiro Wilk Test Statistic	0.827
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	119.2	95% H-UCL	142.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	160.8
95% Adjusted-CLT UCL (Chen-1995)	111.6	97.5% Chebyshev (MVUE) UCL	188.6
95% Modified-t UCL (Johnson-1978)	118.6	99% Chebyshev (MVUE) UCL	243
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.958	Data appear Normal at 5% Significance Level	
Theta Star	19.37		
MLE of Mean	96.01		
MLE of Standard Deviation	43.12		
nu star	69.41		
Approximate Chi Square Value (.05)	51.23	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	115.6
Adjusted Chi Square Value	46.55	95% Jackknife UCL	119.2
		95% Standard Bootstrap UCL	113.8
Anderson-Darling Test Statistic	0.664	95% Bootstrap-t UCL	115.7
Anderson-Darling 5% Critical Value	0.709	95% Hall's Bootstrap UCL	111.3
Kolmogorov-Smirnov Test Statistic	0.34	95% Percentile Bootstrap UCL	113.8
Kolmogorov-Smirnov 5% Critical Value	0.312	95% BCA Bootstrap UCL	111.3
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	148
		97.5% Chebyshev(Mean, Sd) UCL	170.5
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	214.6
95% Approximate Gamma UCL (Use when n >= 40)	130.1		
95% Adjusted Gamma UCL (Use when n < 40)	143.2		
Potential UCL to Use		Use 95% Student's-t UCL	119.2

Vanadium POI 25 subsurface 1995

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	42.76	Minimum of Log Data	3.756
Maximum	135.6	Maximum of Log Data	4.909
Mean	96	Mean of log Data	4.505
Geometric Mean	90.43	SD of log Data	0.4
Median	107.5		
SD	31.49		
Std. Error of Mean	11.9		
Coefficient of Variation	0.328		
Skewness	-0.854		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.884	Shapiro Wilk Test Statistic	0.824
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	119.1	95% H-UCL	142.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	160.8
95% Adjusted-CLT UCL (Chen-1995)	111.5	97.5% Chebyshev (MVUE) UCL	188.6
95% Modified-t UCL (Johnson-1978)	118.5	99% Chebyshev (MVUE) UCL	243
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.962	Data appear Normal at 5% Significance Level	
Theta Star	19.35		
MLE of Mean	96		
MLE of Standard Deviation	43.1		
nu star	69.47		
Approximate Chi Square Value (.05)	51.29	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	115.6
Adjusted Chi Square Value	46.6	95% Jackknife UCL	119.1
		95% Standard Bootstrap UCL	113.8
Anderson-Darling Test Statistic	0.676	95% Bootstrap-t UCL	115.7
Anderson-Darling 5% Critical Value	0.709	95% Hall's Bootstrap UCL	111.4
Kolmogorov-Smirnov Test Statistic	0.34	95% Percentile Bootstrap UCL	113.8
Kolmogorov-Smirnov 5% Critical Value	0.312	95% BCA Bootstrap UCL	110.8
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	147.9
		97.5% Chebyshev(Mean, Sd) UCL	170.3
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	214.4
95% Approximate Gamma UCL (Use when n >= 40)	130		
95% Adjusted Gamma UCL (Use when n < 40)	143.1		
Potential UCL to Use		Use 95% Student's-t UCL	119.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI 38 Major Tolman's.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 38
95% UCLs

Aluminum POI 38 Major Tolman's 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13

Raw Statistics		Log-transformed Statistics	
Minimum	18300	Minimum of Log Data	9.815
Maximum	30400	Maximum of Log Data	10.32
Mean	23385	Mean of log Data	10.05
Geometric Mean	23079	SD of log Data	0.17
Median	24700		
SD	3916		
Std. Error of Mean	1086		
Coefficient of Variation	0.167		
Skewness	0.0646		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.893	Shapiro Wilk Test Statistic	0.886
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	25320	95% H-UCL	25580
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	28196
95% Adjusted-CLT UCL (Chen-1995)	25192	97.5% Chebyshev (MVUE) UCL	30277
95% Modified-t UCL (Johnson-1978)	25323	99% Chebyshev (MVUE) UCL	34365
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	29.42	Data appear Normal at 5% Significance Level	
Theta Star	794.7		
MLE of Mean	23385		
MLE of Standard Deviation	4311		
nu star	765		
Approximate Chi Square Value (.05)	701.9	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	25171
Adjusted Chi Square Value	693.2	95% Jackknife UCL	25320
		95% Standard Bootstrap UCL	25103
Anderson-Darling Test Statistic	0.748	95% Bootstrap-t UCL	25317
Anderson-Darling 5% Critical Value	0.733	95% Hall's Bootstrap UCL	25143
Kolmogorov-Smirnov Test Statistic	0.218	95% Percentile Bootstrap UCL	25046
Kolmogorov-Smirnov 5% Critical Value	0.236	95% BCA Bootstrap UCL	25023
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	28119
		97.5% Chebyshev(Mean, Sd) UCL	30167
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	34191
95% Approximate Gamma UCL (Use when n >= 40)	25490		
95% Adjusted Gamma UCL (Use when n < 40)	25807		
Potential UCL to Use		Use 95% Student's-t UCL	25320

Arsenic POI 38 Major Tolman's 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	12
Raw Statistics		**Log-transformed Statistics**	
Minimum	2.7	Minimum of Log Data	0.993
Maximum	17.1	Maximum of Log Data	2.839
Mean	6.292	Mean of log Data	1.71
Geometric Mean	5.531	SD of log Data	0.498
Median	4.8		
SD	3.856		
Std. Error of Mean	1.069		
Coefficient of Variation	0.613		
Skewness	2.075		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.771	Shapiro Wilk Test Statistic	0.937
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	8.198	95% H-UCL	8.48
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	10.02
95% Adjusted-CLT UCL (Chen-1995)	8.709	97.5% Chebyshev (MVUE) UCL	11.68
95% Modified-t UCL (Johnson-1978)	8.301	99% Chebyshev (MVUE) UCL	14.93
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.157	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	1.993		
MLE of Mean	6.292		
MLE of Standard Deviation	3.541		
nu star	82.09		
Approximate Chi Square Value (.05)	62.21	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	8.051
Adjusted Chi Square Value	59.75	95% Jackknife UCL	8.198
		95% Standard Bootstrap UCL	7.929
Anderson-Darling Test Statistic	0.584	95% Bootstrap-t UCL	9.735
Anderson-Darling 5% Critical Value	0.737	95% Hall's Bootstrap UCL	14.51
Kolmogorov-Smirnov Test Statistic	0.217	95% Percentile Bootstrap UCL	8.208
Kolmogorov-Smirnov 5% Critical Value	0.238	95% BCA Bootstrap UCL	8.992
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	10.95
		97.5% Chebyshev(Mean, Sd) UCL	12.97
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	16.93
95% Approximate Gamma UCL (Use when n >= 40)	8.303		
95% Adjusted Gamma UCL (Use when n < 40)	8.645		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**8.303**

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 53
95% UCLs

Aluminum POI 53 Baker Valley 1999

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		**Log-transformed Statistics**	
Minimum	11900	Minimum of Log Data	9.384
Maximum	43900	Maximum of Log Data	10.69
Mean	21150	Mean of log Data	9.883
Geometric Mean	19592	SD of log Data	0.396
Median	17150		
SD	9575		
Std. Error of Mean	3028		
Coefficient of Variation	0.453		
Skewness	1.638		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.826	Shapiro Wilk Test Statistic	0.924
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	26700	95% H-UCL	27908
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	32630
95% Adjusted-CLT UCL (Chen-1995)	27806	97.5% Chebyshev (MVUE) UCL	37656
95% Modified-t UCL (Johnson-1978)	26962	99% Chebyshev (MVUE) UCL	47527
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.754	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	4449		
MLE of Mean	21150		
MLE of Standard Deviation	9700		
nu star	95.08		
Approximate Chi Square Value (.05)	73.59	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	26130
Adjusted Chi Square Value	70.31	95% Jackknife UCL	26700
		95% Standard Bootstrap UCL	25914
Anderson-Darling Test Statistic	0.484	95% Bootstrap-t UCL	29987
Anderson-Darling 5% Critical Value	0.728	95% Hall's Bootstrap UCL	31250
Kolmogorov-Smirnov Test Statistic	0.212	95% Percentile Bootstrap UCL	26220
Kolmogorov-Smirnov 5% Critical Value	0.267	95% BCA Bootstrap UCL	28040
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	34348
		97.5% Chebyshev(Mean, Sd) UCL	40059
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51276
95% Approximate Gamma UCL (Use when n >= 40)	27326		
95% Adjusted Gamma UCL (Use when n < 40)	28600		
Potential UCL to Use		**Use 95% Approximate Gamma UCL 27326**	

Antimony POI 53 Baker Valley 1999

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		Log-transformed Statistics	
Minimum	2.7	Minimum of Log Data	0.993
Maximum	36.3	Maximum of Log Data	3.592
Mean	10.7	Mean of log Data	1.891
Geometric Mean	6.624	SD of log Data	0.97
Median	4.35		
SD	12.14		
Std. Error of Mean	3.838		
Coefficient of Variation	1.134		
Skewness	1.59		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.707	Shapiro Wilk Test Statistic	0.836
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	17.74	95% H-UCL	28.36
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.92
95% Adjusted-CLT UCL (Chen-1995)	19.08	97.5% Chebyshev (MVUE) UCL	29.96
95% Modified-t UCL (Johnson-1978)	18.06	99% Chebyshev (MVUE) UCL	41.82
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.894	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	11.97		
MLE of Mean	10.7		
MLE of Standard Deviation	11.32		
nu star	17.87		
Approximate Chi Square Value (.05)	9.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	17.01
Adjusted Chi Square Value	8.246	95% Jackknife UCL	17.74
		95% Standard Bootstrap UCL	16.63
Anderson-Darling Test Statistic	0.965	95% Bootstrap-t UCL	31.13
Anderson-Darling 5% Critical Value	0.745	95% Hall's Bootstrap UCL	28.28
Kolmogorov-Smirnov Test Statistic	0.259	95% Percentile Bootstrap UCL	17.01
Kolmogorov-Smirnov 5% Critical Value	0.273	95% BCA Bootstrap UCL	19.32
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	27.43
		97.5% Chebyshev(Mean, Sd) UCL	34.67
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	48.89
95% Approximate Gamma UCL (Use when n >= 40)	20.56		
95% Adjusted Gamma UCL (Use when n < 40)	23.19		
Potential UCL to Use		Use 95% Approximate Gamma UCL	20.56

Arsenic POI 53 Baker Valley 1999

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		Log-transformed Statistics	
Minimum	2.8	Minimum of Log Data	1.03
Maximum	13.5	Maximum of Log Data	2.603
Mean	5.39	Mean of log Data	1.561
Geometric Mean	4.766	SD of log Data	0.487
Median	4.15		
SD	3.288		
Std. Error of Mean	1.04		
Coefficient of Variation	0.61		
Skewness	2.012		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.752	Shapiro Wilk Test Statistic	0.892
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	7.296	95% H-UCL	7.669
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	8.912
95% Adjusted-CLT UCL (Chen-1995)	7.807	97.5% Chebyshev (MVUE) UCL	10.48
95% Modified-t UCL (Johnson-1978)	7.406	99% Chebyshev (MVUE) UCL	13.55
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.021	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	1.784		
MLE of Mean	5.39		
MLE of Standard Deviation	3.101		
nu star	60.43		
Approximate Chi Square Value (.05)	43.55	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	7.1
Adjusted Chi Square Value	41.07	95% Jackknife UCL	7.296
		95% Standard Bootstrap UCL	7.006
Anderson-Darling Test Statistic	0.662	95% Bootstrap-t UCL	10.15
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	15.03
Kolmogorov-Smirnov Test Statistic	0.228	95% Percentile Bootstrap UCL	7.08
Kolmogorov-Smirnov 5% Critical Value	0.268	95% BCA Bootstrap UCL	7.77
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	9.922
		97.5% Chebyshev(Mean, Sd) UCL	11.88
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	15.73
95% Approximate Gamma UCL (Use when n >= 40)	7.479		
95% Adjusted Gamma UCL (Use when n < 40)	7.93		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**7.479**

Manganese POI 53 Baker Valley 1999

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		Log-transformed Statistics	
Minimum	128	Minimum of Log Data	4.852
Maximum	1380	Maximum of Log Data	7.23
Mean	592.3	Mean of log Data	6.09
Geometric Mean	441.6	SD of log Data	0.85
Median	491		
SD	441.8		
Std. Error of Mean	139.7		
Coefficient of Variation	0.746		
Skewness	0.718		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.904	Shapiro Wilk Test Statistic	0.942
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	848.4	95% H-UCL	1402
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1344
95% Adjusted-CLT UCL (Chen-1995)	856	97.5% Chebyshev (MVUE) UCL	1663
95% Modified-t UCL (Johnson-1978)	853.7	99% Chebyshev (MVUE) UCL	2290
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.363	Data appear Normal at 5% Significance Level	
Theta Star	434.6		
MLE of Mean	592.3		
MLE of Standard Deviation	507.3		
nu star	27.26		
Approximate Chi Square Value (.05)	16.35	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	822.1
Adjusted Chi Square Value	14.9	95% Jackknife UCL	848.4
		95% Standard Bootstrap UCL	815.9
Anderson-Darling Test Statistic	0.258	95% Bootstrap-t UCL	922.9
Anderson-Darling 5% Critical Value	0.737	95% Hall's Bootstrap UCL	852.7
Kolmogorov-Smirnov Test Statistic	0.133	95% Percentile Bootstrap UCL	825.6
Kolmogorov-Smirnov 5% Critical Value	0.27	95% BCA Bootstrap UCL	841.3
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1201
		97.5% Chebyshev(Mean, Sd) UCL	1465
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1982
95% Approximate Gamma UCL (Use when n >= 40)	987.4		
95% Adjusted Gamma UCL (Use when n < 40)	1083		
Potential UCL to Use		Use 95% Student's-t UCL	848.4

Vanadium POI 53 Baker Valley 1999

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		Log-transformed Statistics	
Minimum	52.8	Minimum of Log Data	3.967
Maximum	243	Maximum of Log Data	5.493
Mean	91.25	Mean of log Data	4.397
Geometric Mean	81.25	SD of log Data	0.458
Median	72.75		
SD	57.4		
Std. Error of Mean	18.15		
Coefficient of Variation	0.629		
Skewness	2.489		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.646	Shapiro Wilk Test Statistic	0.798
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	124.5	95% H-UCL	125.5
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	146.4
95% Adjusted-CLT UCL (Chen-1995)	136.4	97.5% Chebyshev (MVUE) UCL	171.1
95% Modified-t UCL (Johnson-1978)	126.9	99% Chebyshev (MVUE) UCL	219.7
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.193	Data do not follow a Discernable Distribution (0.05)	
Theta Star	28.58		
MLE of Mean	91.25		
MLE of Standard Deviation	51.07		
nu star	63.86		
Approximate Chi Square Value (.05)	46.48	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	121.1
Adjusted Chi Square Value	43.91	95% Jackknife UCL	124.5
		95% Standard Bootstrap UCL	118.9
Anderson-Darling Test Statistic	1.12	95% Bootstrap-t UCL	234.7
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	300.3
Kolmogorov-Smirnov Test Statistic	0.351	95% Percentile Bootstrap UCL	122.2
Kolmogorov-Smirnov 5% Critical Value	0.268	95% BCA Bootstrap UCL	137.9
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	170.4
		97.5% Chebyshev(Mean, Sd) UCL	204.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	271.9
95% Approximate Gamma UCL (Use when n >= 40)	125.4		
95% Adjusted Gamma UCL (Use when n < 40)	132.7		
Potential UCL to Use		**Use 95% Student's-t UCL**	**124.5**
		or 95% Modified-t UCL	126.9

Benzo[a]anthracene POI 53 Baker Valley 1999

General Statistics			
Number of Valid Data	10	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	8
		Percent Non-Detects	80.00%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.14	Minimum Detected	-1.966
Maximum Detected	3.8	Maximum Detected	1.335
Mean of Detected	1.97	Mean of Detected	-0.316
SD of Detected	2.588	SD of Detected	2.334
Minimum Non-Detect	0.38	Minimum Non-Detect	-0.968
Maximum Non-Detect	0.42	Maximum Non-Detect	-0.868
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	9
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	90.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.558	Mean	-1.333
SD	1.139	SD	0.945
95% DL/2 (t) UCL	1.218	95% H-Stat (DL/2) UCL	1.059
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A
		95% H-UCL	N/A
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	N/A	Data do not follow a Discernable Distribution (0.05)	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.506
5% K-S Critical Value	N/A	SD	1.098
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.491
		95% KM (t) UCL	1.406
Assuming Gamma Distribution		95% KM (z) UCL	1.314
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	3.061
Minimum	N/A	95% KM (bootstrap t) UCL	N/A
Maximum	N/A	95% KM (BCA) UCL	3.8
Mean	N/A	95% KM (Percentile Bootstrap) UCL	N/A
Median	N/A	95% KM (Chebyshev) UCL	2.646
SD	N/A	97.5% KM (Chebyshev) UCL	3.573
k star	N/A	99% KM (Chebyshev) UCL	5.392
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	**99% KM (Chebyshev) UCL**	**5.392**
95% Gamma Approximate UCL (Use when n >= 40)	N/A		
95% Adjusted Gamma UCL (Use when n < 40)	N/A		
Note: DL/2 is not a recommended method. Warning: Recommended UCL exceeds the maximum observation			

Benzo[b[fluoranthene POI 53 Baker Valley 1999

General Statistics			
Number of Valid Data	10	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	8
		Percent Non-Detects	80.00%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.17	Minimum Detected	-1.772
Maximum Detected	3.4	Maximum Detected	1.224
Mean of Detected	1.785	Mean of Detected	-0.274
SD of Detected	2.284	SD of Detected	2.118
Minimum Non-Detect	0.38	Minimum Non-Detect	-0.968
Maximum Non-Detect	0.42	Maximum Non-Detect	-0.868
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	9
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	90.00%

UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.521	Mean	-1.324
SD	1.012	SD	0.898
95% DL/2 (t) UCL	1.107	95% H-Stat (DL/2) UCL	0.947
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A
		95% H-UCL	N/A
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	N/A	Data do not follow a Discernable Distribution (0.05)	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.493
5% K-S Critical Value	N/A	SD	0.969
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.433
		95% KM (t) UCL	1.287
Assuming Gamma Distribution		95% KM (z) UCL	1.206
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2.747
Minimum	N/A	95% KM (bootstrap t) UCL	N/A
Maximum	N/A	95% KM (BCA) UCL	N/A
Mean	N/A	95% KM (Percentile Bootstrap) UCL	3.4
Median	N/A	95% KM (Chebyshev) UCL	2.382
SD	N/A	97.5% KM (Chebyshev) UCL	3.199
k star	N/A	99% KM (Chebyshev) UCL	4.805
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	**99% KM (Chebyshev) UCL**	**4.805**
95% Gamma Approximate UCL (Use when n >= 40)	N/A		
95% Adjusted Gamma UCL (Use when n < 40)	N/A		

Note: DL/2 is not a recommended method. Warning: Recommended UCL exceeds the maximum observation

Benzo[a]pyrene POI 53 Baker Valley 1999

General Statistics			
Number of Valid Data	10	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	8
		Percent Non-Detects	80.00%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.17	Minimum Detected	-1.772
Maximum Detected	2.8	Maximum Detected	1.03
Mean of Detected	1.485	Mean of Detected	-0.371
SD of Detected	1.86	SD of Detected	1.981
Minimum Non-Detect	0.38	Minimum Non-Detect	-0.968
Maximum Non-Detect	0.42	Maximum Non-Detect	-0.868
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	9
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	90.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.461	Mean	-1.344
SD	0.822	SD	0.836
95% DL/2 (t) UCL	0.937	95% H-Stat (DL/2) UCL	0.803
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A
		95% H-UCL	N/A
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	N/A	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.433
5% K-S Critical Value	N/A	SD	0.789
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.353
		95% KM (t) UCL	1.08
Assuming Gamma Distribution		95% KM (z) UCL	1.013
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2.269
Minimum	N/A	95% KM (bootstrap t) UCL	N/A
Maximum	N/A	95% KM (BCA) UCL	N/A
Mean	N/A	95% KM (Percentile Bootstrap) UCL	2.8
Median	N/A	95% KM (Chebyshev) UCL	1.971
SD	N/A	97.5% KM (Chebyshev) UCL	2.637
k star	N/A	99% KM (Chebyshev) UCL	3.944
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	**97.5% KM (Chebyshev) UCL**	**2.637**
95% Gamma Approximate UCL (Use when n >= 40)	N/A		
95% Adjusted Gamma UCL (Use when n < 40)	N/A		
Note: DL/2 is not a recommended method.			

Indeno[1,2,3-cd]pyrene POI 53 Baker Valley 1999

General Statistics			
Number of Valid Data	10	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	8
		Percent Non-Detects	80.00%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.14	Minimum Detected	-1.966
Maximum Detected	2	Maximum Detected	0.693
Mean of Detected	1.07	Mean of Detected	-0.636
SD of Detected	1.315	SD of Detected	1.88
Minimum Non-Detect	0.38	Minimum Non-Detect	-0.968
Maximum Non-Detect	0.42	Maximum Non-Detect	-0.868
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	9
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	90.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.378	Mean	-1.397
SD	0.57	SD	0.745
95% DL/2 (t) UCL	0.708	95% H-Stat (DL/2) UCL	0.624
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A
		95% H-UCL	N/A
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	N/A	Data do not follow a Discernable Distribution (0.05)	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.326
5% K-S Critical Value	N/A	SD	0.558
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.25
		95% KM (t) UCL	0.783
Assuming Gamma Distribution		95% KM (z) UCL	0.736
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.624
Minimum	N/A	95% KM (bootstrap t) UCL	N/A
Maximum	N/A	95% KM (BCA) UCL	2
Mean	N/A	95% KM (Percentile Bootstrap) UCL	2
Median	N/A	95% KM (Chebyshev) UCL	1.414
SD	N/A	97.5% KM (Chebyshev) UCL	1.884
k star	N/A	99% KM (Chebyshev) UCL	2.809
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	**97.5% KM (Chebyshev) UCL**	**1.884**
95% Gamma Approximate UCL (Use when n >= 40)	N/A		
95% Adjusted Gamma UCL (Use when n < 40)	N/A		
Note: DL/2 is not a recommended method.			

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

SOUTHERN AU (2000)
95% UCLs

Aluminum Southern AU subsurface 2000

General Statistics

Number of Valid Observations	7	Number of Distinct Observations	6

Raw Statistics		**Log-transformed Statistics**	
Minimum	13000	Minimum of Log Data	9.473
Maximum	26900	Maximum of Log Data	10.2
Mean	16943	Mean of log Data	9.709
Geometric Mean	16458	SD of log Data	0.25
Median	16000		
SD	4791		
Std. Error of Mean	1811		
Coefficient of Variation	0.283		
Skewness	1.82		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.794	Shapiro Wilk Test Statistic	0.859
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	20462	95% H-UCL	21018
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23879
95% Adjusted-CLT UCL (Chen-1995)	21253	97.5% Chebyshev (MVUE) UCL	26897
95% Modified-t UCL (Johnson-1978)	20669	99% Chebyshev (MVUE) UCL	32826

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	10.03	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	1689		
MLE of Mean	16943		
MLE of Standard Deviation	5349		
nu star	140.5		
Approximate Chi Square Value (.05)	114.1	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	19922
Adjusted Chi Square Value	106.9	95% Jackknife UCL	20462
		95% Standard Bootstrap UCL	19723
Anderson-Darling Test Statistic	0.546	95% Bootstrap-t UCL	23509
Anderson-Darling 5% Critical Value	0.707	95% Hall's Bootstrap UCL	31811
Kolmogorov-Smirnov Test Statistic	0.235	95% Percentile Bootstrap UCL	19914
Kolmogorov-Smirnov 5% Critical Value	0.312	95% BCA Bootstrap UCL	20643
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	24837
		97.5% Chebyshev(Mean, Sd) UCL	28252
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	34961
95% Approximate Gamma UCL (Use when n >= 40)	20862		
95% Adjusted Gamma UCL (Use when n < 40)	22264		

Potential UCL to Use	Use 95% Approximate Gamma UCL 20862

Aluminum Southern AU surface 2000

General Statistics			
Number of Valid Observations	31	Number of Distinct Observations	29

Raw Statistics		Log-transformed Statistics	
Minimum	3740	Minimum of Log Data	8.227
Maximum	27800	Maximum of Log Data	10.23
Mean	12737	Mean of log Data	9.338
Geometric Mean	11361	SD of log Data	0.497
Median	11200		
SD	6152		
Std. Error of Mean	1105		
Coefficient of Variation	0.483		
Skewness	0.853		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.928	Shapiro Wilk Test Statistic	0.974
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	14612	95% H-UCL	15316
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	18006
95% Adjusted-CLT UCL (Chen-1995)	14735	97.5% Chebyshev (MVUE) UCL	20259
95% Modified-t UCL (Johnson-1978)	14641	99% Chebyshev (MVUE) UCL	24683
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.118	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	3093		
MLE of Mean	12737		
MLE of Standard Deviation	6277		
nu star	255.3		
Approximate Chi Square Value (.05)	219.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0413	95% CLT UCL	14555
Adjusted Chi Square Value	217.4	95% Jackknife UCL	14612
		95% Standard Bootstrap UCL	14521
Anderson-Darling Test Statistic	0.25	95% Bootstrap-t UCL	14899
Anderson-Darling 5% Critical Value	0.749	95% Hall's Bootstrap UCL	14783
Kolmogorov-Smirnov Test Statistic	0.0988	95% Percentile Bootstrap UCL	14609
Kolmogorov-Smirnov 5% Critical Value	0.158	95% BCA Bootstrap UCL	14779
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	17553
		97.5% Chebyshev(Mean, Sd) UCL	19638
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	23731
95% Approximate Gamma UCL (Use when n >= 40)	14828		
95% Adjusted Gamma UCL (Use when n < 40)	14954		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**14828**

Arsenic Southern AU surface 2000

General Statistics			
Number of Valid Observations	31	Number of Distinct Observations	29

Raw Statistics		Log-transformed Statistics	
Minimum	0.76	Minimum of Log Data	-0.274
Maximum	59.1	Maximum of Log Data	4.079
Mean	9.844	Mean of log Data	1.865
Geometric Mean	6.454	SD of log Data	0.911
Median	5.7		
SD	11.41		
Std. Error of Mean	2.049		
Coefficient of Variation	1.159		
Skewness	3.075		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.66	Shapiro Wilk Test Statistic	0.984
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	13.32	95% H-UCL	14.38
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	17.32
95% Adjusted-CLT UCL (Chen-1995)	14.42	97.5% Chebyshev (MVUE) UCL	20.67
95% Modified-t UCL (Johnson-1978)	13.51	99% Chebyshev (MVUE) UCL	27.24
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.219	Data appear Lognormal at 5% Significance Level	
Theta Star	8.073		
MLE of Mean	9.844		
MLE of Standard Deviation	8.914		
nu star	75.6		
Approximate Chi Square Value (.05)	56.58	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0413	95% CLT UCL	13.21
Adjusted Chi Square Value	55.66	95% Jackknife UCL	13.32
		95% Standard Bootstrap UCL	13.15
Anderson-Darling Test Statistic	0.818	95% Bootstrap-t UCL	15.97
Anderson-Darling 5% Critical Value	0.768	95% Hall's Bootstrap UCL	28.53
Kolmogorov-Smirnov Test Statistic	0.165	95% Percentile Bootstrap UCL	13.44
Kolmogorov-Smirnov 5% Critical Value	0.161	95% BCA Bootstrap UCL	14.94
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	18.77
		97.5% Chebyshev(Mean, Sd) UCL	22.64
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	30.23
95% Approximate Gamma UCL (Use when n >= 40)	13.15		
95% Adjusted Gamma UCL (Use when n < 40)	13.37		
Potential UCL to Use		Use 95% H-UCL	14.38

Arsenic Southern AU subsurface 2000

General Statistics			
Number of Valid Data	7	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	2
		Percent Non-Detects	28.57%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	1.2	Minimum Detected	0.182
Maximum Detected	141	Maximum Detected	4.949
Mean of Detected	30.52	Mean of Detected	1.721
SD of Detected	61.78	SD of Detected	1.886
Minimum Non-Detect	2.36	Minimum Non-Detect	0.859
Maximum Non-Detect	2.54	Maximum Non-Detect	0.932
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	4
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	3
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	57.14%

UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.575	Shapiro Wilk Test Statistic	0.813
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	22.15	Mean	1.287
SD	52.43	SD	1.709
95% DL/2 (t) UCL	60.66	95% H-Stat (DL/2) UCL	912.3
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	1.286
		SD in Log Scale	1.71
		Mean in Original Scale	22.15
		SD in Original Scale	52.43
		95% t UCL	60.66
		95% Percentile Bootstrap UCL	61.25
		95% BCA Bootstrap UCL	62.57
		95% H-UCL	915.8
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.289	Data appear Lognormal at 5% Significance Level	
Theta Star	105.6		
nu star	2.891		
A-D Test Statistic	0.852	**Nonparametric Statistics**	
5% A-D Critical Value	0.727	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.727	Mean	22.27
5% K-S Critical Value	0.376	SD	48.49
Data not Gamma Distributed at 5% Significance Level		SE of Mean	20.49
		95% KM (t) UCL	62.09
Assuming Gamma Distribution		95% KM (z) UCL	55.98
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	60.74
Minimum	0.000001	95% KM (bootstrap t) UCL	1434
Maximum	141	95% KM (BCA) UCL	62.03
Mean	21.8	95% KM (Percentile Bootstrap) UCL	61.57
Median	2.1	95% KM (Chebyshev) UCL	111.6
SD	52.6	97.5% KM (Chebyshev) UCL	150.2
k star	0.172	99% KM (Chebyshev) UCL	226.2
Theta star	126.6		
Nu star	2.41	**Potential UCLs to Use**	
AppChi2	0.222	**99% KM (Chebyshev) UCL**	**226.2**
95% Gamma Approximate UCL (Use when n >= 40)	237.2		
95% Adjusted Gamma UCL (Use when n < 40)	437.7		

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Beryllium Southern AU subsurface 2000

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	6
Raw Statistics		**Log-transformed Statistics**	
Minimum	0.85	Minimum of Log Data	-0.163
Maximum	19	Maximum of Log Data	2.944
Mean	3.836	Mean of log Data	0.627
Geometric Mean	1.872	SD of log Data	1.049
Median	1.3		
SD	6.694		
Std. Error of Mean	2.53		
Coefficient of Variation	1.745		
Skewness	2.634		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.496	Shapiro Wilk Test Statistic	0.666
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	8.752	95% H-UCL	16.8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	7.999
95% Adjusted-CLT UCL (Chen-1995)	10.69	97.5% Chebyshev (MVUE) UCL	10.19
95% Modified-t UCL (Johnson-1978)	9.172	99% Chebyshev (MVUE) UCL	14.51
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.566	Data do not follow a Discernable Distribution (0.05)	
Theta Star	6.777		
MLE of Mean	3.836		
MLE of Standard Deviation	5.098		
nu star	7.924		
Approximate Chi Square Value (.05)	2.691	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	7.997
Adjusted Chi Square Value	1.862	95% Jackknife UCL	8.752
		95% Standard Bootstrap UCL	7.721
Anderson-Darling Test Statistic	1.531	95% Bootstrap-t UCL	96.09
Anderson-Darling 5% Critical Value	0.734	95% Hall's Bootstrap UCL	68.16
Kolmogorov-Smirnov Test Statistic	0.43	95% Percentile Bootstrap UCL	8.857
Kolmogorov-Smirnov 5% Critical Value	0.322	95% BCA Bootstrap UCL	11.42
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	14.86
		97.5% Chebyshev(Mean, Sd) UCL	19.64
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	29.01
95% Approximate Gamma UCL (Use when n >= 40)	11.29		
95% Adjusted Gamma UCL (Use when n < 40)	16.33		
Potential UCL to Use		Use 95% Hall's Bootstrap UCL	68.16

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Cobalt Southern AU surface 2000

General Statistics			
Number of Valid Observations	31	Number of Distinct Observations	31
Raw Statistics		**Log-transformed Statistics**	
Minimum	1.6	Minimum of Log Data	0.47
Maximum	121	Maximum of Log Data	4.796
Mean	34.4	Mean of log Data	3.134
Geometric Mean	22.97	SD of log Data	0.992
Median	26.1		
SD	31.51		
Std. Error of Mean	5.66		
Coefficient of Variation	0.916		
Skewness	1.679		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.802	Shapiro Wilk Test Statistic	0.966
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	44.01	95% H-UCL	58.13
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	69.46
95% Adjusted-CLT UCL (Chen-1995)	45.53	97.5% Chebyshev (MVUE) UCL	83.62
95% Modified-t UCL (Johnson-1978)	44.29	99% Chebyshev (MVUE) UCL	111.5
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.268	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	27.12		
MLE of Mean	34.4		
MLE of Standard Deviation	30.54		
nu star	78.64		
Approximate Chi Square Value (.05)	59.21	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0413	95% CLT UCL	43.71
Adjusted Chi Square Value	58.27	95% Jackknife UCL	44.01
		95% Standard Bootstrap UCL	43.62
Anderson-Darling Test Statistic	0.266	95% Bootstrap-t UCL	47.65
Anderson-Darling 5% Critical Value	0.767	95% Hall's Bootstrap UCL	45.83
Kolmogorov-Smirnov Test Statistic	0.0869	95% Percentile Bootstrap UCL	44.24
Kolmogorov-Smirnov 5% Critical Value	0.161	95% BCA Bootstrap UCL	45.1
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	59.07
		97.5% Chebyshev(Mean, Sd) UCL	69.74
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	90.71
95% Approximate Gamma UCL (Use when n >= 40)	45.69		
95% Adjusted Gamma UCL (Use when n < 40)	46.42		
Potential UCL to Use		**Use 95% Approximate Gamma UCL 45.69**	

Cobalt Southern AU subsurface 2000

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7
Raw Statistics		**Log-transformed Statistics**	
Minimum	12.6	Minimum of Log Data	2.534
Maximum	67.4	Maximum of Log Data	4.211
Mean	39.24	Mean of log Data	3.483
Geometric Mean	32.54	SD of log Data	0.692
Median	29.5		
SD	23.6		
Std. Error of Mean	8.921		
Coefficient of Variation	0.601		
Skewness	0.166		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.848	Shapiro Wilk Test Statistic	0.878
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	56.58	95% H-UCL	93.33
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	85.35
95% Adjusted-CLT UCL (Chen-1995)	54.52	97.5% Chebyshev (MVUE) UCL	105.1
95% Modified-t UCL (Johnson-1978)	56.67	99% Chebyshev (MVUE) UCL	143.8
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.711	Data appear Normal at 5% Significance Level	
Theta Star	22.94		
MLE of Mean	39.24		
MLE of Standard Deviation	30		
nu star	23.95		
Approximate Chi Square Value (.05)	13.81	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	53.92
Adjusted Chi Square Value	11.55	95% Jackknife UCL	56.58
		95% Standard Bootstrap UCL	52.97
Anderson-Darling Test Statistic	0.493	95% Bootstrap-t UCL	57.24
Anderson-Darling 5% Critical Value	0.713	95% Hall's Bootstrap UCL	49.51
Kolmogorov-Smirnov Test Statistic	0.27	95% Percentile Bootstrap UCL	52.31
Kolmogorov-Smirnov 5% Critical Value	0.314	95% BCA Bootstrap UCL	53.2
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	78.13
		97.5% Chebyshev(Mean, Sd) UCL	94.95
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	128
95% Approximate Gamma UCL (Use when n >= 40)	68.05		
95% Adjusted Gamma UCL (Use when n < 40)	81.34		
Potential UCL to Use		Use 95% Student's-t UCL	56.58

Iron Southern AU subsurface 2000

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7
Raw Statistics		**Log-transformed Statistics**	
Minimum	24400	Minimum of Log Data	10.1
Maximum	45600	Maximum of Log Data	10.73
Mean	36043	Mean of log Data	10.47
Geometric Mean	35371	SD of log Data	0.213
Median	35100		
SD	7376		
Std. Error of Mean	2788		
Coefficient of Variation	0.205		
Skewness	-0.0479		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.931	Shapiro Wilk Test Statistic	0.926
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	41460	95% H-UCL	43090
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	48708
95% Adjusted-CLT UCL (Chen-1995)	40575	97.5% Chebyshev (MVUE) UCL	54180
95% Modified-t UCL (Johnson-1978)	41452	99% Chebyshev (MVUE) UCL	64929
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	15.37	Data appear Normal at 5% Significance Level	
Theta Star	2345		
MLE of Mean	36043		
MLE of Standard Deviation	9193		
nu star	215.2		
Approximate Chi Square Value (.05)	182.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	40629
Adjusted Chi Square Value	173.1	95% Jackknife UCL	41460
		95% Standard Bootstrap UCL	40263
Anderson-Darling Test Statistic	0.329	95% Bootstrap-t UCL	42670
Anderson-Darling 5% Critical Value	0.707	95% Hall's Bootstrap UCL	44180
Kolmogorov-Smirnov Test Statistic	0.179	95% Percentile Bootstrap UCL	40400
Kolmogorov-Smirnov 5% Critical Value	0.311	95% BCA Bootstrap UCL	40243
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	48195
		97.5% Chebyshev(Mean, Sd) UCL	53453
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	63782
95% Approximate Gamma UCL (Use when n >= 40)	42559		
95% Adjusted Gamma UCL (Use when n < 40)	44818		
Potential UCL to Use		**Use 95% Student's-t UCL 41460**	

Iron Southern AU surface 2000

General Statistics			
Number of Valid Observations	31	Number of Distinct Observations	27
Raw Statistics		**Log-transformed Statistics**	
Minimum	7150	Minimum of Log Data	8.875
Maximum	64800	Maximum of Log Data	11.08
Mean	28460	Mean of log Data	10.17
Geometric Mean	26012	SD of log Data	0.44
Median	26200		
SD	12634		
Std. Error of Mean	2269		
Coefficient of Variation	0.444		
Skewness	1.421		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.876	Shapiro Wilk Test Statistic	0.952
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	32311	95% H-UCL	33346
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	38752
95% Adjusted-CLT UCL (Chen-1995)	32811	97.5% Chebyshev (MVUE) UCL	43162
95% Modified-t UCL (Johnson-1978)	32408	99% Chebyshev (MVUE) UCL	51823
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	5.189	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	5485		
MLE of Mean	28460		
MLE of Standard Deviation	12494		
nu star	321.7		
Approximate Chi Square Value (.05)	281.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0413	95% CLT UCL	32192
Adjusted Chi Square Value	279.1	95% Jackknife UCL	32311
		95% Standard Bootstrap UCL	32271
Anderson-Darling Test Statistic	0.6	95% Bootstrap-t UCL	33624
Anderson-Darling 5% Critical Value	0.747	95% Hall's Bootstrap UCL	33879
Kolmogorov-Smirnov Test Statistic	0.156	95% Percentile Bootstrap UCL	32331
Kolmogorov-Smirnov 5% Critical Value	0.158	95% BCA Bootstrap UCL	32398
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	38351
		97.5% Chebyshev(Mean, Sd) UCL	42630
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51037
95% Approximate Gamma UCL (Use when n >= 40)	32565		
95% Adjusted Gamma UCL (Use when n < 40)	32810		
Potential UCL to Use		**Use 95% Approximate Gamma UCL 32565**	

Lead Southern AU surface 2000

General Statistics			
Number of Valid Observations	31	Number of Distinct Observations	31
Raw Statistics		**Log-transformed Statistics**	
Minimum	6.5	Minimum of Log Data	1.872
Maximum	737	Maximum of Log Data	6.603
Mean	65.74	Mean of log Data	3.666
Geometric Mean	39.11	SD of log Data	0.843
Median	37.9		
SD	128.2		
Std. Error of Mean	23.03		
Coefficient of Variation	1.951		
Skewness	5.105		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.357	Shapiro Wilk Test Statistic	0.91
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	104.8	95% H-UCL	78.87
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	95.39
95% Adjusted-CLT UCL (Chen-1995)	126.2	97.5% Chebyshev (MVUE) UCL	112.9
95% Modified-t UCL (Johnson-1978)	108.3	99% Chebyshev (MVUE) UCL	147.2
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.015	Data do not follow a Discernable Distribution (0.05)	
Theta Star	64.78		
MLE of Mean	65.74		
MLE of Standard Deviation	65.26		
nu star	62.91		
Approximate Chi Square Value (.05)	45.67	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0413	95% CLT UCL	103.6
Adjusted Chi Square Value	44.85	95% Jackknife UCL	104.8
		95% Standard Bootstrap UCL	103.1
Anderson-Darling Test Statistic	2.698	95% Bootstrap-t UCL	235.5
Anderson-Darling 5% Critical Value	0.773	95% Hall's Bootstrap UCL	244
Kolmogorov-Smirnov Test Statistic	0.276	95% Percentile Bootstrap UCL	109.7
Kolmogorov-Smirnov 5% Critical Value	0.162	95% BCA Bootstrap UCL	138.7
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	166.1
		97.5% Chebyshev(Mean, Sd) UCL	209.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	294.9
95% Approximate Gamma UCL (Use when n >= 40)	90.56		
95% Adjusted Gamma UCL (Use when n < 40)	92.21		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	166.1

Manganese Southern AU surface 2000

General Statistics			
Number of Valid Observations	31	Number of Distinct Observations	29
Raw Statistics		**Log-transformed Statistics**	
Minimum	37.6	Minimum of Log Data	3.627
Maximum	1390	Maximum of Log Data	7.237
Mean	489.7	Mean of log Data	5.961
Geometric Mean	388.2	SD of log Data	0.799
Median	429		
SD	306		
Std. Error of Mean	54.96		
Coefficient of Variation	0.625		
Skewness	1.212		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.896	Shapiro Wilk Test Statistic	0.863
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	582.9	95% H-UCL	736.5
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	891.4
95% Adjusted-CLT UCL (Chen-1995)	592.8	97.5% Chebyshev (MVUE) UCL	1049
95% Modified-t UCL (Johnson-1978)	584.9	99% Chebyshev (MVUE) UCL	1358
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.104	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	232.7		
MLE of Mean	489.7		
MLE of Standard Deviation	337.6		
nu star	130.5		
Approximate Chi Square Value (.05)	105.1	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0413	95% CLT UCL	580.1
Adjusted Chi Square Value	103.8	95% Jackknife UCL	582.9
		95% Standard Bootstrap UCL	578.9
Anderson-Darling Test Statistic	0.8	95% Bootstrap-t UCL	595.7
Anderson-Darling 5% Critical Value	0.757	95% Hall's Bootstrap UCL	595.4
Kolmogorov-Smirnov Test Statistic	0.156	95% Percentile Bootstrap UCL	585.3
Kolmogorov-Smirnov 5% Critical Value	0.16	95% BCA Bootstrap UCL	590.9
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	729.2
		97.5% Chebyshev(Mean, Sd) UCL	832.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1037
95% Approximate Gamma UCL (Use when n >= 40)	608		
95% Adjusted Gamma UCL (Use when n < 40)	615.4		
Potential UCL to Use		**Use 95% Approximate Gamma UCL 608**	

Manganese Southern AU subsurface 2000

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7
Raw Statistics		**Log-transformed Statistics**	
Minimum	132	Minimum of Log Data	4.883
Maximum	1020	Maximum of Log Data	6.928
Mean	493.7	Mean of log Data	6.011
Geometric Mean	407.8	SD of log Data	0.695
Median	407		
SD	315.8		
Std. Error of Mean	119.4		
Coefficient of Variation	0.64		
Skewness	0.837		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.92	Shapiro Wilk Test Statistic	0.972
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	725.7	95% H-UCL	1179
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1074
95% Adjusted-CLT UCL (Chen-1995)	730.4	97.5% Chebyshev (MVUE) UCL	1323
95% Modified-t UCL (Johnson-1978)	732	99% Chebyshev (MVUE) UCL	1812
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.679	Data appear Normal at 5% Significance Level	
Theta Star	294.1		
MLE of Mean	493.7		
MLE of Standard Deviation	381		
nu star	23.5		
Approximate Chi Square Value (.05)	13.47	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	690.1
Adjusted Chi Square Value	11.25	95% Jackknife UCL	725.7
		95% Standard Bootstrap UCL	673.8
Anderson-Darling Test Statistic	0.203	95% Bootstrap-t UCL	905.6
Anderson-Darling 5% Critical Value	0.713	95% Hall's Bootstrap UCL	2357
Kolmogorov-Smirnov Test Statistic	0.162	95% Percentile Bootstrap UCL	682.6
Kolmogorov-Smirnov 5% Critical Value	0.314	95% BCA Bootstrap UCL	698.1
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1014
		97.5% Chebyshev(Mean, Sd) UCL	1239
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1681
95% Approximate Gamma UCL (Use when n >= 40)	861.4		
95% Adjusted Gamma UCL (Use when n < 40)	1032		
Potential UCL to Use		**Use 95% Student's-t UCL 725.7**	

Mercury Southern AU surface 2000

General Statistics			
Number of Valid Observations	31	Number of Distinct Observations	25
Raw Statistics		**Log-transformed Statistics**	
Minimum	0.08	Minimum of Log Data	-2.526
Maximum	3.7	Maximum of Log Data	1.308
Mean	0.482	Mean of log Data	-1.302
Geometric Mean	0.272	SD of log Data	0.949
Median	0.22		
SD	0.745		
Std. Error of Mean	0.134		
Coefficient of Variation	1.546		
Skewness	3.357		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.543	Shapiro Wilk Test Statistic	0.894
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.709	95% H-UCL	0.643
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.772
95% Adjusted-CLT UCL (Chen-1995)	0.789	97.5% Chebyshev (MVUE) UCL	0.926
95% Modified-t UCL (Johnson-1978)	0.723	99% Chebyshev (MVUE) UCL	1.226
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.932	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.518		
MLE of Mean	0.482		
MLE of Standard Deviation	0.5		
nu star	57.76		
Approximate Chi Square Value (.05)	41.29	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0413	95% CLT UCL	0.702
Adjusted Chi Square Value	40.52	95% Jackknife UCL	0.709
		95% Standard Bootstrap UCL	0.702
Anderson-Darling Test Statistic	2.361	95% Bootstrap-t UCL	1.039
Anderson-Darling 5% Critical Value	0.775	95% Hall's Bootstrap UCL	1.653
Kolmogorov-Smirnov Test Statistic	0.242	95% Percentile Bootstrap UCL	0.718
Kolmogorov-Smirnov 5% Critical Value	0.162	95% BCA Bootstrap UCL	0.785
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.066
		97.5% Chebyshev(Mean, Sd) UCL	1.318
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1.814
95% Approximate Gamma UCL (Use when n >= 40)	0.675		
95% Adjusted Gamma UCL (Use when n < 40)	0.688		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	1.066

Nickel Southern AU surface 2000

General Statistics			
Number of Valid Observations	31	Number of Distinct Observations	30

Raw Statistics		Log-transformed Statistics	
Minimum	2.5	Minimum of Log Data	0.916
Maximum	170	Maximum of Log Data	5.136
Mean	51.24	Mean of log Data	3.619
Geometric Mean	37.29	SD of log Data	0.857
Median	39		
SD	44.04		
Std. Error of Mean	7.909		
Coefficient of Variation	0.86		
Skewness	1.744		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.759	Shapiro Wilk Test Statistic	0.938
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	64.66	95% H-UCL	76.71
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	92.73
95% Adjusted-CLT UCL (Chen-1995)	66.89	97.5% Chebyshev (MVUE) UCL	109.9
95% Modified-t UCL (Johnson-1978)	65.07	99% Chebyshev (MVUE) UCL	143.7
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.577	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	32.49		
MLE of Mean	51.24		
MLE of Standard Deviation	40.8		
nu star	97.78		
Approximate Chi Square Value (.05)	75.97	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0413	95% CLT UCL	64.25
Adjusted Chi Square Value	74.9	95% Jackknife UCL	64.66
		95% Standard Bootstrap UCL	64.18
Anderson-Darling Test Statistic	0.8	95% Bootstrap-t UCL	70.52
Anderson-Darling 5% Critical Value	0.762	95% Hall's Bootstrap UCL	66.37
Kolmogorov-Smirnov Test Statistic	0.15	95% Percentile Bootstrap UCL	64.91
Kolmogorov-Smirnov 5% Critical Value	0.16	95% BCA Bootstrap UCL	66.15
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	85.71
		97.5% Chebyshev(Mean, Sd) UCL	100.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	129.9
95% Approximate Gamma UCL (Use when n >= 40)	65.94		
95% Adjusted Gamma UCL (Use when n < 40)	66.89		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**65.94**

Vanadium Southern AU surface 2000

General Statistics			
Number of Valid Observations	31	Number of Distinct Observations	31
Raw Statistics		**Log-transformed Statistics**	
Minimum	14.7	Minimum of Log Data	2.688
Maximum	293	Maximum of Log Data	5.68
Mean	63.95	Mean of log Data	3.988
Geometric Mean	53.96	SD of log Data	0.544
Median	53.1		
SD	50.68		
Std. Error of Mean	9.103		
Coefficient of Variation	0.793		
Skewness	3.521		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.61	Shapiro Wilk Test Statistic	0.933
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	79.4	95% H-UCL	76.05
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	90.13
95% Adjusted-CLT UCL (Chen-1995)	85.07	97.5% Chebyshev (MVUE) UCL	102.2
95% Modified-t UCL (Johnson-1978)	80.36	99% Chebyshev (MVUE) UCL	125.9
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.821	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	22.67		
MLE of Mean	63.95		
MLE of Standard Deviation	38.07		
nu star	174.9		
Approximate Chi Square Value (.05)	145.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0413	95% CLT UCL	78.92
Adjusted Chi Square Value	143.8	95% Jackknife UCL	79.4
		95% Standard Bootstrap UCL	78.79
Anderson-Darling Test Statistic	1.4	95% Bootstrap-t UCL	98.15
Anderson-Darling 5% Critical Value	0.752	95% Hall's Bootstrap UCL	155.3
Kolmogorov-Smirnov Test Statistic	0.158	95% Percentile Bootstrap UCL	80
Kolmogorov-Smirnov 5% Critical Value	0.159	95% BCA Bootstrap UCL	86.48
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	103.6
		97.5% Chebyshev(Mean, Sd) UCL	120.8
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	154.5
95% Approximate Gamma UCL (Use when n >= 40)	76.97		
95% Adjusted Gamma UCL (Use when n < 40)	77.77		
Potential UCL to Use		**Use 95% Approximate Gamma UCL 76.97**	

Vanadium Southern AU subsurface 2000

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7
Raw Statistics		**Log-transformed Statistics**	
Minimum	30.5	Minimum of Log Data	3.418
Maximum	105	Maximum of Log Data	4.654
Mean	76.46	Mean of log Data	4.281
Geometric Mean	72.29	SD of log Data	0.4
Median	79.3		
SD	22.95		
Std. Error of Mean	8.674		
Coefficient of Variation	0.3		
Skewness	-1.377		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.873	Shapiro Wilk Test Statistic	0.747
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	93.31	95% H-UCL	113.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	128.5
95% Adjusted-CLT UCL (Chen-1995)	85.9	97.5% Chebyshev (MVUE) UCL	150.6
95% Modified-t UCL (Johnson-1978)	92.56	99% Chebyshev (MVUE) UCL	194.1
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	5.287	Data appear Normal at 5% Significance Level	
Theta Star	14.46		
MLE of Mean	76.46		
MLE of Standard Deviation	33.25		
nu star	74.01		
Approximate Chi Square Value (.05)	55.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	90.72
Adjusted Chi Square Value	50.32	95% Jackknife UCL	93.31
		95% Standard Bootstrap UCL	90.01
Anderson-Darling Test Statistic	0.774	95% Bootstrap-t UCL	89.08
Anderson-Darling 5% Critical Value	0.709	95% Hall's Bootstrap UCL	87.19
Kolmogorov-Smirnov Test Statistic	0.337	95% Percentile Bootstrap UCL	88.31
Kolmogorov-Smirnov 5% Critical Value	0.312	95% BCA Bootstrap UCL	86.01
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	114.3
		97.5% Chebyshev(Mean, Sd) UCL	130.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	162.8
95% Approximate Gamma UCL (Use when n >= 40)	102.5		
95% Adjusted Gamma UCL (Use when n < 40)	112.4		
Potential UCL to Use		Use 95% Student's-t UCL	93.31

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	Sheet1.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

4801 GR
95% UCLs

Vanadium surface 4801 Glenbrook Rd 2000

General Statistics			
Number of Valid Observations	244	Number of Distinct Observations	184

Raw Statistics		Log-transformed Statistics	
Minimum	25.5	Minimum of Log Data	3.239
Maximum	192	Maximum of Log Data	5.257
Mean	64.53	Mean of log Data	4.118
Geometric Mean	61.42	SD of log Data	0.316
Median	62.6		
SD	20.92		
Std. Error of Mean	1.339		
Coefficient of Variation	0.324		
Skewness	1.364		

Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.0625	Lilliefors Test Statistic	0.0632
Lilliefors Critical Value	0.0567	Lilliefors Critical Value	0.0567
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	66.74	95% H-UCL	66.87
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	70.39
95% Adjusted-CLT UCL (Chen-1995)	66.86	97.5% Chebyshev (MVUE) UCL	72.91
95% Modified-t UCL (Johnson-1978)	66.76	99% Chebyshev (MVUE) UCL	77.87
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	10.16	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	6.349		
MLE of Mean	64.53		
MLE of Standard Deviation	20.24		
nu star	4960		
Approximate Chi Square Value (.05)	4797	Nonparametric Statistics	
Adjusted Level of Significance	0.049	95% CLT UCL	66.73
Adjusted Chi Square Value	4796	95% Jackknife UCL	66.74
		95% Standard Bootstrap UCL	66.65
Anderson-Darling Test Statistic	0.643	95% Bootstrap-t UCL	66.85
Anderson-Darling 5% Critical Value	0.753	95% Hall's Bootstrap UCL	67.02
Kolmogorov-Smirnov Test Statistic	0.0455	95% Percentile Bootstrap UCL	66.84
Kolmogorov-Smirnov 5% Critical Value	0.0585	95% BCA Bootstrap UCL	66.97
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	70.37
		97.5% Chebyshev(Mean, Sd) UCL	72.89
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	77.86

95% Approximate Gamma UCL (Use when n >= 40)	66.72						
95% Adjusted Gamma UCL (Use when n < 40)	66.73						
Potential UCL to Use		Use 95% Approximate Gamma UCL 66.72					

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Arsenic 4625 & 4633 Rockwood AUES

AUES ROCKWOOD PROPs
95% UCLs

General Statistics			
Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		Log-transformed Statistics	
Minimum	2	Minimum of Log Data	0.693
Maximum	133	Maximum of Log Data	4.89
Mean	51.1	Mean of log Data	2.928
Geometric Mean	18.68	SD of log Data	1.805
Median	30.1		
SD	57.34		
Std. Error of Mean	23.41		
Coefficient of Variation	1.122		
Skewness	0.659		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.836	Shapiro Wilk Test Statistic	0.878
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	98.27	95% H-UCL	26757
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	233.9
95% Adjusted-CLT UCL (Chen-1995)	96.33	97.5% Chebyshev (MVUE) UCL	309.2
95% Modified-t UCL (Johnson-1978)	99.32	99% Chebyshev (MVUE) UCL	457.1
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.417	Data appear Normal at 5% Significance Level	
Theta Star	122.5		
MLE of Mean	51.1		
MLE of Standard Deviation	79.11		
nu star	5.007		
Approximate Chi Square Value (.05)	1.155	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0122	95% CLT UCL	89.6
Adjusted Chi Square Value	0.621	95% Jackknife UCL	98.27
		95% Standard Bootstrap UCL	85.66
Anderson-Darling Test Statistic	0.462	95% Bootstrap-t UCL	118.9
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	107.2
Kolmogorov-Smirnov Test Statistic	0.277	95% Percentile Bootstrap UCL	85.8
Kolmogorov-Smirnov 5% Critical Value	0.346	95% BCA Bootstrap UCL	89.32
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	153.1
		97.5% Chebyshev(Mean, Sd) UCL	197.3
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	284
95% Approximate Gamma UCL (Use when n >= 40)	221.4		
95% Adjusted Gamma UCL (Use when n < 40)	411.9		
Potential UCL to Use		**Use 95% Student's-t UCL**	**98.27**

Cobalt 4625 & 4633 Rockwood AUES

General Statistics			
Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		Log-transformed Statistics	
Minimum	5.4	Minimum of Log Data	1.686
Maximum	18.5	Maximum of Log Data	2.918
Mean	12.35	Mean of log Data	2.425
Geometric Mean	11.31	SD of log Data	0.487
Median	14		
SD	5.066		
Std. Error of Mean	2.068		
Coefficient of Variation	0.41		
Skewness	-0.485		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.914	Shapiro Wilk Test Statistic	0.868
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	16.52	95% H-UCL	22.47
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.26
95% Adjusted-CLT UCL (Chen-1995)	15.31	97.5% Chebyshev (MVUE) UCL	27.93
95% Modified-t UCL (Johnson-1978)	16.45	99% Chebyshev (MVUE) UCL	37.1
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.027	Data appear Normal at 5% Significance Level	
Theta Star	4.079		
MLE of Mean	12.35		
MLE of Standard Deviation	7.098		
nu star	36.33		
Approximate Chi Square Value (.05)	23.53	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0122	95% CLT UCL	15.75
Adjusted Chi Square Value	19.9	95% Jackknife UCL	16.52
		95% Standard Bootstrap UCL	15.51
Anderson-Darling Test Statistic	0.476	95% Bootstrap-t UCL	15.87
Anderson-Darling 5% Critical Value	0.698	95% Hall's Bootstrap UCL	14.8
Kolmogorov-Smirnov Test Statistic	0.278	95% Percentile Bootstrap UCL	15.33
Kolmogorov-Smirnov 5% Critical Value	0.333	95% BCA Bootstrap UCL	15.23
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	21.36
		97.5% Chebyshev(Mean, Sd) UCL	25.27
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	32.93
95% Approximate Gamma UCL (Use when n >= 40)	19.06		
95% Adjusted Gamma UCL (Use when n < 40)	22.55		
Potential UCL to Use		**Use 95% Student's-t UCL**	**16.52**

Vanadium 4625 & 4633 Rockwood AUES

General Statistics			
Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		Log-transformed Statistics	
Minimum	33.7	Minimum of Log Data	3.517
Maximum	85.8	Maximum of Log Data	4.452
Mean	52.08	Mean of log Data	3.905
Geometric Mean	49.67	SD of log Data	0.33
Median	49.8		
SD	18.54		
Std. Error of Mean	7.568		
Coefficient of Variation	0.356		
Skewness	1.367		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.885	Shapiro Wilk Test Statistic	0.951
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	67.33	95% H-UCL	73.41
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	82.46
95% Adjusted-CLT UCL (Chen-1995)	69.05	97.5% Chebyshev (MVUE) UCL	95.65
95% Modified-t UCL (Johnson-1978)	68.04	99% Chebyshev (MVUE) UCL	121.6
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	5.462	Data appear Normal at 5% Significance Level	
Theta Star	9.536		
MLE of Mean	52.08		
MLE of Standard Deviation	22.29		
nu star	65.54		
Approximate Chi Square Value (.05)	47.91	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0122	95% CLT UCL	64.53
Adjusted Chi Square Value	42.52	95% Jackknife UCL	67.33
		95% Standard Bootstrap UCL	63.62
Anderson-Darling Test Statistic	0.291	95% Bootstrap-t UCL	75.38
Anderson-Darling 5% Critical Value	0.698	95% Hall's Bootstrap UCL	124.8
Kolmogorov-Smirnov Test Statistic	0.204	95% Percentile Bootstrap UCL	64.1
Kolmogorov-Smirnov 5% Critical Value	0.332	95% BCA Bootstrap UCL	66.48
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	85.07
		97.5% Chebyshev(Mean, Sd) UCL	99.35
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	127.4
95% Approximate Gamma UCL (Use when n >= 40)	71.25		
95% Adjusted Gamma UCL (Use when n < 40)	80.28		
Potential UCL to Use		**Use 95% Student's-t UCL**	**67.33**

Benzo[a]pyrene 4625 & 4633 Rockwood AUES

General Statistics			
Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		Log-transformed Statistics	
Minimum	41	Minimum of Log Data	3.714
Maximum	720	Maximum of Log Data	6.579
Mean	244.7	Mean of log Data	4.901
Geometric Mean	134.4	SD of log Data	1.216
Median	109		
SD	277.8		
Std. Error of Mean	113.4		
Coefficient of Variation	1.135		
Skewness	1.285		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.799	Shapiro Wilk Test Statistic	0.879
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	473.2	95% H-UCL	3982
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	735.6
95% Adjusted-CLT UCL (Chen-1995)	494.8	97.5% Chebyshev (MVUE) UCL	951
95% Modified-t UCL (Johnson-1978)	483.1	99% Chebyshev (MVUE) UCL	1374
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.595	Data appear Normal at 5% Significance Level	
Theta Star	411.2		
MLE of Mean	244.7		
MLE of Standard Deviation	317.2		
nu star	7.14		
Approximate Chi Square Value (.05)	2.248	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0122	95% CLT UCL	431.2
Adjusted Chi Square Value	1.389	95% Jackknife UCL	473.2
		95% Standard Bootstrap UCL	416.4
Anderson-Darling Test Statistic	0.484	95% Bootstrap-t UCL	1021
Anderson-Darling 5% Critical Value	0.716	95% Hall's Bootstrap UCL	1899
Kolmogorov-Smirnov Test Statistic	0.282	95% Percentile Bootstrap UCL	421.5
Kolmogorov-Smirnov 5% Critical Value	0.341	95% BCA Bootstrap UCL	468.2
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	739
		97.5% Chebyshev(Mean, Sd) UCL	952.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1373
95% Approximate Gamma UCL (Use when n >= 40)	777.2		
95% Adjusted Gamma UCL (Use when n < 40)	1258		
Potential UCL to Use		**Use 95% Student's-t UCL**	**473.2**

Benzo[a]anthracene 4625 & 4633 Rockwood AUES

General Statistics			
Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		Log-transformed Statistics	
Minimum	48	Minimum of Log Data	3.871
Maximum	1100	Maximum of Log Data	7.003
Mean	369.3	Mean of log Data	5.334
Geometric Mean	207.2	SD of log Data	1.208
Median	180		
SD	414.9		
Std. Error of Mean	169.4		
Coefficient of Variation	1.123		
Skewness	1.392		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.816	Shapiro Wilk Test Statistic	0.951
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	710.6	95% H-UCL	5900
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1122
95% Adjusted-CLT UCL (Chen-1995)	750.7	97.5% Chebyshev (MVUE) UCL	1450
95% Modified-t UCL (Johnson-1978)	726.7	99% Chebyshev (MVUE) UCL	2095
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.611	Data appear Normal at 5% Significance Level	
Theta Star	604.8		
MLE of Mean	369.3		
MLE of Standard Deviation	472.6		
nu star	7.328		
Approximate Chi Square Value (.05)	2.352	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0122	95% CLT UCL	647.9
Adjusted Chi Square Value	1.466	95% Jackknife UCL	710.6
		95% Standard Bootstrap UCL	625
Anderson-Darling Test Statistic	0.333	95% Bootstrap-t UCL	1531
Anderson-Darling 5% Critical Value	0.715	95% Hall's Bootstrap UCL	2156
Kolmogorov-Smirnov Test Statistic	0.242	95% Percentile Bootstrap UCL	648
Kolmogorov-Smirnov 5% Critical Value	0.341	95% BCA Bootstrap UCL	691.3
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1108
		97.5% Chebyshev(Mean, Sd) UCL	1427
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2055
95% Approximate Gamma UCL (Use when n >= 40)	1151		
95% Adjusted Gamma UCL (Use when n < 40)	1846		
Potential UCL to Use		**Use 95% Student's-t UCL 710.6**	

Benzo[b]fluoranthene 4625 & 4633 Rockwood AUES

General Statistics			
Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		Log-transformed Statistics	
Minimum	62	Minimum of Log Data	4.127
Maximum	1800	Maximum of Log Data	7.496
Mean	570.3	Mean of log Data	5.724
Geometric Mean	306.1	SD of log Data	1.256
Median	265		
SD	674.4		
Std. Error of Mean	275.3		
Coefficient of Variation	1.182		
Skewness	1.573		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.8	Shapiro Wilk Test Statistic	0.971
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1125	95% H-UCL	11227
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1770
95% Adjusted-CLT UCL (Chen-1995)	1212	97.5% Chebyshev (MVUE) UCL	2293
95% Modified-t UCL (Johnson-1978)	1155	99% Chebyshev (MVUE) UCL	3321
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.579	Data appear Normal at 5% Significance Level	
Theta Star	985.7		
MLE of Mean	570.3		
MLE of Standard Deviation	749.8		
nu star	6.943		
Approximate Chi Square Value (.05)	2.14	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0122	95% CLT UCL	1023
Adjusted Chi Square Value	1.309	95% Jackknife UCL	1125
		95% Standard Bootstrap UCL	980.7
Anderson-Darling Test Statistic	0.297	95% Bootstrap-t UCL	2749
Anderson-Darling 5% Critical Value	0.717	95% Hall's Bootstrap UCL	3386
Kolmogorov-Smirnov Test Statistic	0.215	95% Percentile Bootstrap UCL	998.7
Kolmogorov-Smirnov 5% Critical Value	0.342	95% BCA Bootstrap UCL	1138
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1770
		97.5% Chebyshev(Mean, Sd) UCL	2290
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3310
95% Approximate Gamma UCL (Use when n >= 40)	1851		
95% Adjusted Gamma UCL (Use when n < 40)	3026		
Potential UCL to Use		**Use 95% Student's-t UCL**	**1125**

Indeno(1,2,3-cd)pyrene 4625 & 4633 Rockwood AUES

General Statistics			
Number of Valid Data	6	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	2
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	32	Minimum Detected	3.466
Maximum Detected	660	Maximum Detected	6.492
Mean of Detected	283	Mean of Detected	5.128
SD of Detected	278.7	SD of Detected	1.31
Minimum Non-Detect	86	Minimum Non-Detect	4.454
Maximum Non-Detect	88	Maximum Non-Detect	4.477
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	3
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	3
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	50.00%

UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.928	Shapiro Wilk Test Statistic	0.978
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	203.2	Mean	4.677
SD	248.8	SD	1.233
95% DL/2 (t) UCL	407.9	95% H-Stat (DL/2) UCL	3486
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	83.42	Mean in Log Scale	4.546
SD	358.6	SD in Log Scale	1.358
95% MLE (t) UCL	378.5	Mean in Original Scale	198.5
95% MLE (Tiku) UCL	447	SD in Original Scale	252.5
		95% t UCL	406.2
		95% Percentile Bootstrap UCL	360.2
		95% BCA Bootstrap UCL	408.2
		95% H UCL	6200
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.443	Data appear Normal at 5% Significance Level	
Theta Star	639.3		
nu star	3.541		

A-D Test Statistic	0.201	**Nonparametric Statistics**	
5% A-D Critical Value	0.666	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.666	Mean	199.3
5% K-S Critical Value	0.402	SD	229.9
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	108.4
		95% KM (t) UCL	417.7
Assuming Gamma Distribution		95% KM (z) UCL	377.6
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	403.2
Minimum	0.000001	95% KM (bootstrap t) UCL	821.3
Maximum	660	95% KM (BCA) UCL	490
Mean	188.7	95% KM (Percentile Bootstrap) UCL	433.3
Median	76	95% KM (Chebyshev) UCL	671.7
SD	260.7	97.5% KM (Chebyshev) UCL	876.1
k star	0.173	99% KM (Chebyshev) UCL	1278
Theta star	1093		
Nu star	2.071	**Potential UCLs to Use**	
AppChi2	0.161	**95% KM (t) UCL**	**417.7**
95% Gamma Approximate UCL (Use when n >= 40)	2433	95% KM (Percentile Bootstrap) UCL	433.3
95% Adjusted Gamma UCL (Use when n < 40)	N/A		

Note: DL/2 is not a recommended method.

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

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

For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

AUES CDC-LOT 12
95% UCLs

Arsenic Southern AU surface AUES

General Statistics			
Number of Valid Data	32	Number of Detected Data	31
Number of Distinct Detected Data	31	Number of Non-Detect Data	1
		Percent Non-Detects	3.13%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	3.1	Minimum Detected	1.131
Maximum Detected	399	Maximum Detected	5.989
Mean of Detected	92.76	Mean of Detected	3.683
SD of Detected	97.9	SD of Detected	1.551
Minimum Non-Detect	1.3	Minimum Non-Detect	0.262
Maximum Non-Detect	1.3	Maximum Non-Detect	0.262
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.849	Shapiro Wilk Test Statistic	0.895
5% Shapiro Wilk Critical Value	0.929	5% Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	89.88	Mean	3.555
SD	97.67	SD	1.691
95% DL/2 (t) UCL	119.2	95% H-Stat (DL/2) UCL	405.8
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	88.21	Mean in Log Scale	3.564
SD	98.44	SD in Log Scale	1.668
95% MLE (t) UCL	117.7	Mean in Original Scale	89.89
95% MLE (Tiku) UCL	116	SD in Original Scale	97.67
		95% t UCL	119.2
		95% Percentile Bootstrap UCL	118.9
		95% BCA Bootstrap UCL	119.8
		95% H UCL	385.3
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.665	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	139.5		
nu star	41.21		
A-D Test Statistic	0.864	**Nonparametric Statistics**	
5% A-D Critical Value	0.791	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.791	Mean	89.96
5% K-S Critical Value	0.164	SD	96.06
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	17.26
		95% KM (t) UCL	119.2
Assuming Gamma Distribution		95% KM (z) UCL	118.4
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	119.2
Minimum	0.000001	95% KM (bootstrap t) UCL	125.6
Maximum	399	95% KM (BCA) UCL	120.1
Mean	89.86	95% KM (Percentile Bootstrap) UCL	118.7
Median	52.75	95% KM (Chebyshev) UCL	165.2
SD	97.69	97.5% KM (Chebyshev) UCL	197.8
k star	0.448	99% KM (Chebyshev) UCL	261.7
Theta star	200.8		
Nu star	28.64	**Potential UCLs to Use**	
AppChi2	17.43	**95% KM (Chebyshev) UCL**	**165.2**
95% Gamma Approximate UCL (Use when n >= 40)	147.7		
95% Adjusted Gamma UCL (Use when n < 40)	151.8		

Note: DL/2 is not a recommended method.

Cobalt Southern AU surface AUES

General Statistics			
Number of Valid Observations	32	Number of Distinct Observations	29

Raw Statistics		Log-transformed Statistics	
Minimum	0.91	Minimum of Log Data	-0.0943
Maximum	27.8	Maximum of Log Data	3.325
Mean	7.157	Mean of log Data	1.751
Geometric Mean	5.758	SD of log Data	0.695
Median	6.5		
SD	5.196		
Std. Error of Mean	0.919		
Coefficient of Variation	0.726		
Skewness	2.358		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.791	Shapiro Wilk Test Statistic	0.965
Shapiro Wilk Critical Value	0.93	Shapiro Wilk Critical Value	0.93
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	8.714	95% H-UCL	9.535
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	11.48
95% Adjusted-CLT UCL (Chen-1995)	9.077	97.5% Chebyshev (MVUE) UCL	13.3
95% Modified-t UCL (Johnson-1978)	8.778	99% Chebyshev (MVUE) UCL	16.89
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.244	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	3.19		
MLE of Mean	7.157		
MLE of Standard Deviation	4.778		
nu star	143.6		
Approximate Chi Square Value (.05)	116.9	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0416	95% CLT UCL	8.668
Adjusted Chi Square Value	115.6	95% Jackknife UCL	8.714
		95% Standard Bootstrap UCL	8.593
Anderson-Darling Test Statistic	0.472	95% Bootstrap-t UCL	9.514
Anderson-Darling 5% Critical Value	0.756	95% Hall's Bootstrap UCL	12.36
Kolmogorov-Smirnov Test Statistic	0.156	95% Percentile Bootstrap UCL	8.763
Kolmogorov-Smirnov 5% Critical Value	0.157	95% BCA Bootstrap UCL	9.091
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	11.16
		97.5% Chebyshev(Mean, Sd) UCL	12.89
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	16.3
95% Approximate Gamma UCL (Use when n >= 40)	8.791		
95% Adjusted Gamma UCL (Use when n < 40)	8.889		
Potential UCL to Use		**Use 95% Approximate Gamma UCL 8.791**	

Nickel Southern AU surface AUES

General Statistics			
Number of Valid Observations	32	Number of Distinct Observations	32

Raw Statistics		Log-transformed Statistics	
Minimum	1.3	Minimum of Log Data	0.262
Maximum	345	Maximum of Log Data	5.844
Mean	27.45	Mean of log Data	2.565
Geometric Mean	13	SD of log Data	1.033
Median	10.95		
SD	60.8		
Std. Error of Mean	10.75		
Coefficient of Variation	2.215		
Skewness	4.909		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.377	Shapiro Wilk Test Statistic	0.91
Shapiro Wilk Critical Value	0.93	Shapiro Wilk Critical Value	0.93
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	45.67	95% H-UCL	35.05
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	41.62
95% Adjusted-CLT UCL (Chen-1995)	55.1	97.5% Chebyshev (MVUE) UCL	50.26
95% Modified-t UCL (Johnson-1978)	47.23	99% Chebyshev (MVUE) UCL	67.25
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.741	Data do not follow a Discernable Distribution (0.05)	
Theta Star	37.03		
MLE of Mean	27.45		
MLE of Standard Deviation	31.88		
nu star	47.44		
Approximate Chi Square Value (.05)	32.63	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0416	95% CLT UCL	45.13
Adjusted Chi Square Value	31.97	95% Jackknife UCL	45.67
		95% Standard Bootstrap UCL	44.93
Anderson-Darling Test Statistic	3.152	95% Bootstrap-t UCL	86.66
Anderson-Darling 5% Critical Value	0.786	95% Hall's Bootstrap UCL	101.5
Kolmogorov-Smirnov Test Statistic	0.32	95% Percentile Bootstrap UCL	47.93
Kolmogorov-Smirnov 5% Critical Value	0.161	95% BCA Bootstrap UCL	59.99
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	74.3
		97.5% Chebyshev(Mean, Sd) UCL	94.57
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	134.4
95% Approximate Gamma UCL (Use when n >= 40)	39.91		
95% Adjusted Gamma UCL (Use when n < 40)	40.73		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	74.3

Vanadium Southern AU surface AUES

General Statistics			
Number of Valid Observations	32	Number of Distinct Observations	30

Raw Statistics		Log-transformed Statistics	
Minimum	6.3	Minimum of Log Data	1.841
Maximum	78.6	Maximum of Log Data	4.364
Mean	36.04	Mean of log Data	3.417
Geometric Mean	30.49	SD of log Data	0.657
Median	33.75		
SD	18.19		
Std. Error of Mean	3.215		
Coefficient of Variation	0.505		
Skewness	0.331		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.959	Shapiro Wilk Test Statistic	0.875
Shapiro Wilk Critical Value	0.93	Shapiro Wilk Critical Value	0.93
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	41.49	95% H-UCL	48.29
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	57.96
95% Adjusted-CLT UCL (Chen-1995)	41.53	97.5% Chebyshev (MVUE) UCL	66.79
95% Modified-t UCL (Johnson-1978)	41.53	99% Chebyshev (MVUE) UCL	84.15
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.872	Data appear Normal at 5% Significance Level	
Theta Star	12.55		
MLE of Mean	36.04		
MLE of Standard Deviation	21.27		
nu star	183.8		
Approximate Chi Square Value (.05)	153.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0416	95% CLT UCL	41.33
Adjusted Chi Square Value	151.9	95% Jackknife UCL	41.49
		95% Standard Bootstrap UCL	41.24
Anderson-Darling Test Statistic	0.851	95% Bootstrap-t UCL	41.93
Anderson-Darling 5% Critical Value	0.753	95% Hall's Bootstrap UCL	41.61
Kolmogorov-Smirnov Test Statistic	0.183	95% Percentile Bootstrap UCL	41.49
Kolmogorov-Smirnov 5% Critical Value	0.156	95% BCA Bootstrap UCL	41.34
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	50.06
		97.5% Chebyshev(Mean, Sd) UCL	56.12
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	68.03
95% Approximate Gamma UCL (Use when n >= 40)	43.18		
95% Adjusted Gamma UCL (Use when n < 40)	43.6		
Potential UCL to Use		**Use 95% Student's-t UCL**	**41.49**

Benzo[a]anthracene Southern AU surface AUES

General Statistics			
Number of Valid Data	24	Number of Detected Data	22
Number of Distinct Detected Data	20	Number of Non-Detect Data	2
		Percent Non-Detects	8.33%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	15	Minimum Detected	2.708
Maximum Detected	2000	Maximum Detected	7.601
Mean of Detected	210.8	Mean of Detected	4.623
SD of Detected	413.4	SD of Detected	1.103
Minimum Non-Detect	80	Minimum Non-Detect	4.382
Maximum Non-Detect	89	Maximum Non-Detect	4.489
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	13
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	11
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	54.17%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.426	Shapiro Wilk Test Statistic	0.965
5% Shapiro Wilk Critical Value	0.911	5% Shapiro Wilk Critical Value	0.911
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	196.8	Mean	4.55
SD	397.9	SD	1.083
95% DL/2 (t) UCL	336	95% H-Stat (DL/2) UCL	309.7
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	4.554
		SD in Log Scale	1.08
		Mean in Original Scale	197
		SD in Original Scale	397.8
		95% t UCL	336.1
		95% Percentile Bootstrap UCL	341.1
		95% BCA Bootstrap UCL	452.6
		95% H-UCL	309.1
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.733	**Data appear Lognormal at 5% Significance Level**	
Theta Star	287.7		
nu star	32.25		
A-D Test Statistic	1.197	**Nonparametric Statistics**	
5% A-D Critical Value	0.78	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.78	Mean	197.3
5% K-S Critical Value	0.192	SD	389.3
Data not Gamma Distributed at 5% Significance Level		SE of Mean	81.36
		95% KM (t) UCL	336.8
Assuming Gamma Distribution		95% KM (z) UCL	331.2
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	336.5
Minimum	0.000001	95% KM (bootstrap t) UCL	729.6
Maximum	2000	95% KM (BCA) UCL	370.3
Mean	193.3	95% KM (Percentile Bootstrap) UCL	348.8
Median	78.5	95% KM (Chebyshev) UCL	552
SD	399.5	97.5% KM (Chebyshev) UCL	705.4
k star	0.303	99% KM (Chebyshev) UCL	1007
Theta star	638.3		
Nu star	14.53	**Potential UCLs to Use**	
AppChi2	6.938	**97.5% KM (Chebyshev) UCL**	**705.4**
95% Gamma Approximate UCL (Use when n >= 40)	404.8		
95% Adjusted Gamma UCL (Use when n < 40)	427.4		

Note: DL/2 is not a recommended method.

Benzo[a]pyrene Southern AU surface AUES

General Statistics			
Number of Valid Data	22	Number of Detected Data	20
Number of Distinct Detected Data	19	Number of Non-Detect Data	2
		Percent Non-Detects	9.09%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	13	Minimum Detected	2.565
Maximum Detected	1100	Maximum Detected	7.003
Mean of Detected	144.2	Mean of Detected	4.302
SD of Detected	241.5	SD of Detected	1.085
Minimum Non-Detect	78	Minimum Non-Detect	4.357
Maximum Non-Detect	120	Maximum Non-Detect	4.787
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	16
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	6
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	72.73%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.519	Shapiro Wilk Test Statistic	0.965
5% Shapiro Wilk Critical Value	0.905	5% Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	135.5	Mean	4.264
SD	231.4	SD	1.042
95% DL/2 (t) UCL	220.4	95% H-Stat (DL/2) UCL	223
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	4.245
		SD in Log Scale	1.05
		Mean in Original Scale	134.7
		SD in Original Scale	231.7
		95% t UCL	219.7
		95% Percentile Bootstrap UCL	225.8
		95% BCA Bootstrap UCL	282.8
		95% H-UCL	222.3
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.779	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	185.1		
nu star	31.15		
A-D Test Statistic	0.953	**Nonparametric Statistics**	
5% A-D Critical Value	0.774	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.774	Mean	134.9
5% K-S Critical Value	0.2	SD	226.4
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	49.56
		95% KM (t) UCL	220.2
Assuming Gamma Distribution		95% KM (z) UCL	216.4
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	220
Minimum	3.711	95% KM (bootstrap t) UCL	394.1
Maximum	1100	95% KM (BCA) UCL	230.4
Mean	133.5	95% KM (Percentile Bootstrap) UCL	225.3
Median	57.32	95% KM (Chebyshev) UCL	350.9
SD	232.4	97.5% KM (Chebyshev) UCL	444.4
k star	0.718	99% KM (Chebyshev) UCL	628
Theta star	185.9		
Nu star	31.59	**Potential UCLs to Use**	
AppChi2	19.75	**95% KM (Chebyshev) UCL**	**350.9**
95% Gamma Approximate UCL (Use when n >= 40)	213.5		
95% Adjusted Gamma UCL (Use when n < 40)	221.3		
Note: DL/2 is not a recommended method.			

Benzo[b]fluoranthene Southern AU surface AUES			
General Statistics			
Number of Valid Data	23	Number of Detected Data	22
Number of Distinct Detected Data	18	Number of Non-Detect Data	1
		Percent Non-Detects	4.35%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	12	Minimum Detected	2.485
Maximum Detected	2300	Maximum Detected	7.741
Mean of Detected	255.3	Mean of Detected	4.828
SD of Detected	478.3	SD of Detected	1.111
Minimum Non-Detect	89	Minimum Non-Detect	4.489
Maximum Non-Detect	89	Maximum Non-Detect	4.489
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.451	Shapiro Wilk Test Statistic	0.966
5% Shapiro Wilk Critical Value	0.911	5% Shapiro Wilk Critical Value	0.911
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	246.1	Mean	4.784
SD	469.4	SD	1.107
95% DL/2 (t) UCL	414.2	95% H-Stat (DL/2) UCL	413.8
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	20.89	Mean in Log Scale	4.787
SD	660.3	SD in Log Scale	1.104
95% MLE (t) UCL	257.3	Mean in Original Scale	246.3
95% MLE (Tiku) UCL	296.4	SD in Original Scale	469.3
		95% t UCL	414.3
		95% Percentile Bootstrap UCL	421.4
		95% BCA Bootstrap UCL	557
		95% H UCL	412.7
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.745	Data appear Lognormal at 5% Significance Level	
Theta Star	342.6		
nu star	32.78		
A-D Test Statistic	1.236	Nonparametric Statistics	
5% A-D Critical Value	0.779	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.779	Mean	246.6
5% K-S Critical Value	0.192	SD	458.9
Data not Gamma Distributed at 5% Significance Level		SE of Mean	97.94
		95% KM (t) UCL	414.8
Assuming Gamma Distribution		95% KM (z) UCL	407.7
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	414.6
Minimum	0.000001	95% KM (bootstrap t) UCL	825
Maximum	2300	95% KM (BCA) UCL	443.5
Mean	244.2	95% KM (Percentile Bootstrap) UCL	425.1
Median	92	95% KM (Chebyshev) UCL	673.5
SD	470.3	97.5% KM (Chebyshev) UCL	858.2
k star	0.41	99% KM (Chebyshev) UCL	1221
Theta star	595.6		
Nu star	18.86	Potential UCLs to Use	
AppChi2	10.01	97.5% KM (Chebyshev) UCL	858.2
95% Gamma Approximate UCL (Use when n >= 40)	459.8		
95% Adjusted Gamma UCL (Use when n < 40)	482.3		
Note: DL/2 is not a recommended method.			

Indeno(1,2,3-cd)pyrene Southern AU surface AUES

General Statistics			
Number of Valid Data	17	Number of Detected Data	10
Number of Distinct Detected Data	10	Number of Non-Detect Data	7
		Percent Non-Detects	41.18%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	11	Minimum Detected	2.398
Maximum Detected	1100	Maximum Detected	7.003
Mean of Detected	157.4	Mean of Detected	4.09
SD of Detected	332.5	SD of Detected	1.231
Minimum Non-Detect	78	Minimum Non-Detect	4.357
Maximum Non-Detect	160	Maximum Non-Detect	5.075
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	16
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	94.12%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.449	Shapiro Wilk Test Statistic	0.886
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	113.1	Mean	4.003
SD	255.4	SD	0.943
95% DL/2 (t) UCL	221.3	95% H-Stat (DL/2) UCL	157.3
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	3.868
		SD in Log Scale	0.966
		Mean in Original Scale	107
		SD in Original Scale	257
		95% t UCL	215.9
		95% Percentile Bootstrap UCL	228.7
		95% BCA Bootstrap UCL	293.8
		95% H-UCL	143.8
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.51	Data appear Lognormal at 5% Significance Level	
Theta Star	308.8		
nu star	10.19		
A-D Test Statistic	1.302	**Nonparametric Statistics**	
5% A-D Critical Value	0.766	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.766	Mean	109.2
5% K-S Critical Value	0.278	SD	249.1
Data not Gamma Distributed at 5% Significance Level		SE of Mean	63.84
		95% KM (t) UCL	220.6
Assuming Gamma Distribution		95% KM (z) UCL	214.2
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	218.3
Minimum	0.000001	95% KM (bootstrap t) UCL	761.1
Maximum	1100	95% KM (BCA) UCL	227.8
Mean	100.6	95% KM (Percentile Bootstrap) UCL	229.2
Median	39	95% KM (Chebyshev) UCL	387.5
SD	259.3	97.5% KM (Chebyshev) UCL	507.9
k star	0.24	99% KM (Chebyshev) UCL	744.4
Theta star	419.1		
Nu star	8.159	**Potential UCLs to Use**	
AppChi2	2.827	**97.5% KM (Chebyshev) UCL**	**507.9**
95% Gamma Approximate UCL (Use when n >= 40)	290.2		
95% Adjusted Gamma UCL (Use when n < 40)	327.1		

Phenanthrene Southern AU surface AUES

General Statistics			
Number of Valid Data	24	Number of Detected Data	22
Number of Distinct Detected Data	20	Number of Non-Detect Data	2
		Percent Non-Detects	8.33%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	15	Minimum Detected	2.708
Maximum Detected	1600	Maximum Detected	7.378
Mean of Detected	183.3	Mean of Detected	4.524
SD of Detected	328	SD of Detected	1.127
Minimum Non-Detect	80	Minimum Non-Detect	4.382
Maximum Non-Detect	89	Maximum Non-Detect	4.489
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	12
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	12
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	50.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.45	Shapiro Wilk Test Statistic	0.956
5% Shapiro Wilk Critical Value	0.911	5% Shapiro Wilk Critical Value	0.911
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	171.6	Mean	4.459
SD	315.9	SD	1.099
95% DL/2 (t) UCL	282.1	95% H-Stat (DL/2) UCL	291.9
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	4.446
		SD in Log Scale	1.109
		Mean in Original Scale	171
		SD in Original Scale	316.1
		95% t UCL	281.7
		95% Percentile Bootstrap UCL	299
		95% BCA Bootstrap UCL	364.2
		95% H-UCL	293.7
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.769	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	238.2		
nu star	33.86		
A-D Test Statistic	0.867	**Nonparametric Statistics**	
5% A-D Critical Value	0.778	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.778	Mean	171.2
5% K-S Critical Value	0.192	SD	309.5
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	64.67
		95% KM (t) UCL	282
Assuming Gamma Distribution		95% KM (z) UCL	277.5
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	281.8
Minimum	0.000001	95% KM (bootstrap t) UCL	498.7
Maximum	1600	95% KM (BCA) UCL	301.4
Mean	168	95% KM (Percentile Bootstrap) UCL	290.3
Median	87.5	95% KM (Chebyshev) UCL	453.1
SD	317.6	97.5% KM (Chebyshev) UCL	575
k star	0.308	99% KM (Chebyshev) UCL	814.6
Theta star	545.3		
Nu star	14.79	**Potential UCLs to Use**	
AppChi2	7.118	**95% KM (Chebyshev) UCL**	**453.1**
95% Gamma Approximate UCL (Use when n >= 40)	349.2		
95% Adjusted Gamma UCL (Use when n < 40)	368.6		
Note: DL/2 is not a recommended method.			

Benzo[g,h,i]perylene Southern AU surface AUES

General Statistics			
Number of Valid Data	17	Number of Detected Data	9
Number of Distinct Detected Data	9	Number of Non-Detect Data	8
		Percent Non-Detects	47.06%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	18	Minimum Detected	2.89
Maximum Detected	680	Maximum Detected	6.522
Mean of Detected	113.3	Mean of Detected	3.973
SD of Detected	213.2	SD of Detected	1.056
Minimum Non-Detect	78	Minimum Non-Detect	4.357
Maximum Non-Detect	160	Maximum Non-Detect	5.075
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	16
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	94.12%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.467	Shapiro Wilk Test Statistic	0.786
5% Shapiro Wilk Critical Value	0.829	5% Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	82.88	Mean	3.916
SD	154.7	SD	0.768
95% DL/2 (t) UCL	148.4	95% H-Stat (DL/2) UCL	105.4
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	3.879
		SD in Log Scale	0.753
		Mean in Original Scale	80.48
		SD in Original Scale	155
		95% t UCL	146.1
		95% Percentile Bootstrap UCL	154.7
		95% BCA Bootstrap UCL	195.1
		95% H-UCL	99.33
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.598	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	189.6		
nu star	10.76		
A-D Test Statistic	1.479	**Nonparametric Statistics**	
5% A-D Critical Value	0.75	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.75	Mean	80
5% K-S Critical Value	0.289	SD	151
Data not Gamma Distributed at 5% Significance Level		SE of Mean	39.09
		95% KM (t) UCL	148.2
Assuming Gamma Distribution		95% KM (z) UCL	144.3
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	146.4
Minimum	18	95% KM (bootstrap t) UCL	401.2
Maximum	680	95% KM (BCA) UCL	155
Mean	88.07	95% KM (Percentile Bootstrap) UCL	155.2
Median	59.65	95% KM (Chebyshev) UCL	250.4
SD	153.3	97.5% KM (Chebyshev) UCL	324.1
k star	1.068	99% KM (Chebyshev) UCL	468.9
Theta star	82.43		
Nu star	36.32	**Potential UCLs to Use**	
AppChi2	23.53	**97.5% KM (Chebyshev) UCL**	**324.1**
95% Gamma Approximate UCL (Use when n >= 40)	136		
95% Adjusted Gamma UCL (Use when n < 40)	142.5		
Note: DL/2 is not a recommended method.			

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI 1 Sedgwick Trench.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

AUES SEDGWICK TRENCH
95% UCLs

Cobalt POI 1 Sedgwick Trench - AUES Samples

General Statistics			
Number of Valid Observations	5	Number of Distinct Observations	5
Raw Statistics		**Log-transformed Statistics**	
Minimum	10.9	Minimum of Log Data	2.389
Maximum	21.1	Maximum of Log Data	3.049
Mean	15.98	Mean of log Data	2.747
Geometric Mean	15.6	SD of log Data	0.248
Median	15.5		
SD	3.835		
Std. Error of Mean	1.715		
Coefficient of Variation	0.24		
Skewness	0.054		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.994	Shapiro Wilk Test Statistic	0.985
Shapiro Wilk Critical Value	0.762	Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	19.64	95% H-UCL	21.38
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.71
95% Adjusted-CLT UCL (Chen-1995)	18.85	97.5% Chebyshev (MVUE) UCL	27.05
95% Modified-t UCL (Johnson-1978)	19.64	99% Chebyshev (MVUE) UCL	33.62
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	8.518	Data appear Normal at 5% Significance Level	
Theta Star	1.876		
MLE of Mean	15.98		
MLE of Standard Deviation	5.475		
nu star	85.18		
Approximate Chi Square Value (.05)	64.91	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0086	95% CLT UCL	18.8
Adjusted Chi Square Value	57.22	95% Jackknife UCL	19.64
		95% Standard Bootstrap UCL	18.51
Anderson-Darling Test Statistic	0.181	95% Bootstrap-t UCL	20.1
Anderson-Darling 5% Critical Value	0.679	95% Hall's Bootstrap UCL	21
Kolmogorov-Smirnov Test Statistic	0.146	95% Percentile Bootstrap UCL	18.52
Kolmogorov-Smirnov 5% Critical Value	0.357	95% BCA Bootstrap UCL	18.52
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	23.46
		97.5% Chebyshev(Mean, Sd) UCL	26.69
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	33.04
95% Approximate Gamma UCL (Use when n >= 40)	20.97		
95% Adjusted Gamma UCL (Use when n < 40)	23.79		
Potential UCL to Use		**Use 95% Student's-t UCL 19.64**	

t-Test Site vs Background Comparison for Full Data Sets without NDs

STEPS 1 & 2
TABLE A.2 (1995)
BACKGROUND TEST
RESULTS

User Selected Options

From File	POI 21-22-23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 21/22/23 subsurface 1995
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	16	23
Number of Distinct Observations	16	21
Minimum	13467	5940
Maximum	24662	16300
Mean	19136	11552
Median	19728	11500
SD	3333	3283
SE of Mean	833.2	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	37	7.053	1.687	0
Welch-Satterthwaite (Unequal Variance)	32.1	7.033	1.694	0

Pooled SD 3303.172

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	11108871
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
15	22	1.031	0.925

Conclusion with Alpha = 0.05

* Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 21-22-23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Cobalt POI 21/22/23 subsurface 1995
Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Observations	16	23
Number of Distinct Observations	16	23
Minimum	19.69	2.5
Maximum	426.5	20
Mean	115.9	10.17
Median	67.54	8.5
SD	116.4	5.323
SE of Mean	29.11	1.11

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	37	4.377	1.687	0
Welch-Satterthwaite (Unequal Variance)	15	3.632	1.753	0.001

Pooled SD 74.241

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	13554
Variance of Background	28.34

Numerator DF	Denominator DF	F-Test Value	P-Value
15	22	478.317	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 21-22-23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI 21/22/23 subsurface 1995
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	16	23
Number of Distinct Observations	16	23
Minimum	222	163
Maximum	3248	1000
Mean	1175	453
Median	788.2	368
SD	1033	229.3
SE of Mean	258.3	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	37	3.255	1.687	0.001
Welch-Satterthwaite (Unequal Variance)	16	2.748	1.746	0.007

Pooled SD 681.243

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	1067637
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
15	22	20.304	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 21-22-23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Nickel POI 21/22/23 subsurface 1995
Background Data: NickelBG

Raw Statistics

	Site	Background
Number of Valid Observations	16	23
Number of Distinct Observations	16	22
Minimum	36.38	8.9
Maximum	334.5	43
Mean	152.2	25.17
Median	141.3	28.7
SD	83.76	8.895
SE of Mean	20.94	1.855

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	37	7.256	1.687	0
Welch-Satterthwaite (Unequal Variance)	15.2	6.042	1.753	0

Pooled SD 53.769

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	7015
Variance of Background	79.11

Numerator DF	Denominator DF	F-Test Value	P-Value
15	22	88.675	0

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 21-22-23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Thallium POI 21/22/23 subsurface 1995
Background Data: ThalliumBG

Raw Statistics

	Site	Background
Number of Valid Data	16	23
Number of Non-Detect Data	15	22
Number of Detect Data	1	1
Minimum Non-Detect	5.29	2.1
Maximum Non-Detect	14.03	3.1
Percent Non detects	93.75%	95.65%
Minimum Detected	7.39	0.82
Maximum Detected	7.39	0.82
Mean of Detected Data	7.39	0.82
Median of Detected Data	7.39	0.82
SD of Detected Data	N/A	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 14.03 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	320
WMW Test U-Stat	-0.0143
WMW Critical Value (0.050)	1.645
P-Value	0.506

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 21-22-23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI 21/22/23 subsurface 1995
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	16	23
Number of Distinct Observations	16	23
Minimum	47.23	27.6
Maximum	194.9	85
Mean	125.1	55.43
Median	122.1	54.1
SD	42.2	14.98
SE of Mean	10.55	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	37	7.317	1.687	0
Welch-Satterthwaite (Unequal Variance)	17.7	6.332	1.734	0

Pooled SD 29.246

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	1781
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
15	22	7.941	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 25 subsurface 1995
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	21
Minimum	19341	5940
Maximum	37428	16300
Mean	24509	11552
Median	23504	11500
SD	5937	3283
SE of Mean	2244	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	7.499	1.701	0
Welch-Satterthwaite (Unequal Variance)	7.2	5.523	1.895	0

Pooled SD 4002.507

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	35248342
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	3.271	0.037

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Antimony POI 25 subsurface 1995
Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Data	7	23
Number of Non-Detect Data	0	10
Number of Detect Data	7	13
Minimum Non-Detect	N/A	5
Maximum Non-Detect	N/A	7.4
Percent Non detects	0.00%	43.48%
Minimum Detected	7.17	0.36
Maximum Detected	16.45	2.3
Mean of Detected Data	10.14	0.808
Median of Detected Data	8.88	0.7
SD of Detected Data	3.286	0.502

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 7.4 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	177.5
WMW Test U-Stat	3.359
WMW Critical Value (0.050)	1.645
P-Value	0.00039137

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

P-Value < alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Cobalt POI 25 subsurface 1995
Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	23
Minimum	11.96	2.5
Maximum	80.57	20
Mean	41.85	10.17
Median	38.64	8.5
SD	22.13	5.323
SE of Mean	8.363	1.11

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	6.507	1.701	0
Welch-Satterthwaite (Unequal Variance)	6.2	3.755	1.943	0.004

Pooled SD 11.277

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	489.6
Variance of Background	28.34

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	17.277	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Mercury POI 25 subsurface 1995
Background Data: MercuryBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	21
Minimum	16.53	0.0065
Maximum	28.22	0.29
Mean	20.93	0.0865
Median	20.26	0.065
SD	3.577	0.0679
SE of Mean	1.352	0.0142

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	29.139	1.701	0
Welch-Satterthwaite (Unequal Variance)	6	15.415	1.943	0

Pooled SD 1.657

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	12.8
Variance of Background	0.00461

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	2775.778	0

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Thallium POI 25 subsurface 1995
Background Data: ThalliumBG

Raw Statistics

	Site	Background
Number of Valid Data	7	23
Number of Non-Detect Data	0	22
Number of Detect Data	7	1
Minimum Non-Detect	N/A	2.1
Maximum Non-Detect	N/A	3.1
Percent Non detects	0.00%	95.65%
Minimum Detected	40.93	0.82
Maximum Detected	75.72	0.82
Mean of Detected Data	47.61	0.82
Median of Detected Data	43.18	0.82
SD of Detected Data	12.55	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 3.1 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	189
WMW Test U-Stat	3.923
WMW Critical Value (0.050)	1.645
P-Value	4.3778E-05

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

P-Value < alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI 25 subsurface 1995
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	23
Minimum	42.76	27.6
Maximum	135.6	85
Mean	96	55.43
Median	107.5	54.1
SD	31.49	14.98
SE of Mean	11.9	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	4.768	1.701	0
Welch-Satterthwaite (Unequal Variance)	6.8	3.298	1.895	0.007

Pooled SD 19.714

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	991.3
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	4.42	0.009

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI AU 1995
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	14	23
Number of Distinct Observations	14	21
Minimum	8679	5940
Maximum	56138	16300
Mean	27620	11552
Median	23236	11500
SD	14575	3283
SE of Mean	3895	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	35	5.121	1.69	0
Welch-Satterthwaite (Unequal Variance)	13.8	4.063	1.761	0.001

Pooled SD 9255.998

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	212400000
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
13	22	19.713	0

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Antimony POI AU 1995
Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Data	14	23
Number of Non-Detect Data	14	10
Number of Detect Data	0	13
Minimum Non-Detect	8.4	5
Maximum Non-Detect	10.34	7.4
Percent Non detects	100.00%	43.48%
Minimum Detected	N/A	0.36
Maximum Detected	N/A	2.3
Mean of Detected Data	N/A	0.808
Median of Detected Data	N/A	0.7
SD of Detected Data	N/A	0.502

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 10.34 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	266
WMW Test U-Stat	-0.0157
WMW Critical Value (0.050)	1.645
P-Value	0.506

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[a]anthracene POI AU 1995

Background Data: Benzo[a]anthraceneBG

Raw Statistics

	Site	Background
Number of Valid Data	14	23
Number of Non-Detect Data	13	8
Number of Detect Data	1	15
Minimum Non-Detect	400	360
Maximum Non-Detect	400	430
Percent Non detects	92.86%	34.78%
Minimum Detected	2400	43
Maximum Detected	2400	590
Mean of Detected Data	2400	213
Median of Detected Data	2400	190
SD of Detected Data	N/A	132.5

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 430 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	271
WMW Test U-Stat	0.141
WMW Critical Value (0.050)	1.645
P-Value	0.444

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[a]pyrene POI AU 1995

Background Data: Benzo[a]pyreneBG

Raw Statistics

	Site	Background
Number of Valid Data	14	23
Number of Non-Detect Data	13	7
Number of Detect Data	1	16
Minimum Non-Detect	400	360
Maximum Non-Detect	400	510
Percent Non detects	92.86%	30.43%
Minimum Detected	2000	40
Maximum Detected	2000	530
Mean of Detected Data	2000	202.4
Median of Detected Data	2000	180
SD of Detected Data	N/A	126.7

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	271
WMW Test U-Stat	0.141
WMW Critical Value (0.050)	1.645
P-Value	0.444

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[b]fluoranthene POI AU 1995

Background Data: Benzo[b]fluorantheneBG

Raw Statistics

	Site	Background
Number of Valid Data	14	23
Number of Non-Detect Data	13	5
Number of Detect Data	1	18
Minimum Non-Detect	400	360
Maximum Non-Detect	400	430
Percent Non detects	92.86%	21.74%
Minimum Detected	1700	40
Maximum Detected	1700	620
Mean of Detected Data	1700	184.4
Median of Detected Data	1700	155
SD of Detected Data	N/A	144.1

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 430 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	271
WMW Test U-Stat	0.141
WMW Critical Value (0.050)	1.645
P-Value	0.444

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Cobalt POI AU 1995
Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Data	14	23
Number of Non-Detect Data	1	0
Number of Detect Data	13	23
Minimum Non-Detect	1.59	N/A
Maximum Non-Detect	1.59	N/A
Percent Non detects	7.14%	0.00%
Minimum Detected	3.15	2.5
Maximum Detected	193.1	20
Mean of Detected Data	48.94	10.17
Median of Detected Data	37.24	8.5
SD of Detected Data	51.08	5.323

Wilcoxon-Mann-Whitney Site vs Background Test

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	365
WMW Test U-Stat	3.085
WMW Critical Value (0.050)	1.645
P-Value	0.00102

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

P-Value < alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI AU 1995
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	14	23
Number of Distinct Observations	14	23
Minimum	32.19	163
Maximum	3070	1000
Mean	815.4	453
Median	430.9	368
SD	902.9	229.3
SE of Mean	241.3	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	35	1.845	1.69	0.037
Welch-Satterthwaite (Unequal Varianc	14	1.473	1.761	0.081

Pooled SD 579.502

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

*** Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background**

If variances not equal, use Welch-Satterthwaite

Test of Equality of Variances

Variance of Site	815151
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
13	22	15.502	0

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Mercury POI AU 1995
Background Data: MercuryBG

Raw Statistics

	Site	Background
Number of Valid Data	14	23
Number of Non-Detect Data	5	0
Number of Detect Data	9	23
Minimum Non-Detect	0.09	N/A
Maximum Non-Detect	0.11	N/A
Percent Non detects	35.71%	0.00%
Minimum Detected	0.1	0.0065
Maximum Detected	9.74	0.29
Mean of Detected Data	1.318	0.0865
Median of Detected Data	0.27	0.065
SD of Detected Data	3.163	0.0679

Wilcoxon-Mann-Whitney Site vs Background Test

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	324.5
WMW Test U-Stat	1.816
WMW Critical Value (0.050)	1.645
P-Value	0.0347

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

P-Value < alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Phenanthrene POI AU 1995

Background Data: PhenanthreneBG

Raw Statistics

	Site	Background
Number of Valid Data	14	23
Number of Non-Detect Data	13	10
Number of Detect Data	1	13
Minimum Non-Detect	400	360
Maximum Non-Detect	400	510
Percent Non detects	92.86%	43.48%
Minimum Detected	2000	100
Maximum Detected	2000	750
Mean of Detected Data	2000	252.3
Median of Detected Data	2000	190
SD of Detected Data	N/A	178.1

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	271
WMW Test U-Stat	0.141
WMW Critical Value (0.050)	1.645
P-Value	0.444

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Thallium POI AU 1995
Background Data: ThalliumBG

Raw Statistics

	Site	Background
Number of Valid Data	14	23
Number of Non-Detect Data	12	22
Number of Detect Data	2	1
Minimum Non-Detect	14.95	2.1
Maximum Non-Detect	18.41	3.1
Percent Non detects	85.71%	95.65%
Minimum Detected	18.82	0.82
Maximum Detected	28.56	0.82
Mean of Detected Data	23.69	0.82
Median of Detected Data	23.69	0.82
SD of Detected Data	6.887	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 18.41 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	289
WMW Test U-Stat	0.705
WMW Critical Value (0.050)	1.645
P-Value	0.241

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI AU 1995
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	14	23
Number of Distinct Observations	14	23
Minimum	17.07	27.6
Maximum	488	85
Mean	124.2	55.43
Median	96.54	54.1
SD	124.7	14.98
SE of Mean	33.32	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	35	2.639	1.69	0.006
Welch-Satterthwaite (Unequal Variance)	13.2	2.056	1.771	0.03

Pooled SD 76.893

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	15539
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
13	22	69.284	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 22.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

TABLE A.3 (1996) BACKGROUND TEST RESULTS

Area of Concern Data: Arsenic POI 22 1996

Background Data: ArsenicBG

Raw Statistics

	Site	Background
Number of Valid Observations	5	23
Number of Distinct Observations	5	19
Minimum	1.9	2.1
Maximum	26.9	8.2
Mean	7.4	4.683
Median	2.4	4.6
SD	10.92	1.555
SE of Mean	4.884	0.324

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	26	1.22	1.706	0.117
Welch-Satterthwaite (Unequal Varian	4	0.555	2.132	0.304

Pooled SD 4.516

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	119.2
Variance of Background	2.418

Numerator DF	Denominator DF	F-Test Value	P-Value
4	22	49.318	0

Conclusion with Alpha = 0.05

* Two variances are not equal

TABLE A.4 (1999) BACKGROUND TEST RESULTS

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 53 Baker Valley 1999
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	10	23
Number of Distinct Observations	10	21
Minimum	11900	5940
Maximum	43900	16300
Mean	21150	11552
Median	17150	11500
SD	9575	3283
SE of Mean	3028	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	31	4.329	1.696	0
Welch-Satterthwaite (Unequal Variance)	9.9	3.092	1.812	0.006

Pooled SD 5853.471

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	91676111
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
9	22	8.507	0

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Antimony POI 53 Baker Valley 1999
Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Data	10	23
Number of Non-Detect Data	0	10
Number of Detect Data	10	13
Minimum Non-Detect	N/A	5
Maximum Non-Detect	N/A	7.4
Percent Non detects	0.00%	43.48%
Minimum Detected	2.7	0.36
Maximum Detected	36.3	2.3
Mean of Detected Data	10.7	0.808
Median of Detected Data	4.35	0.7
SD of Detected Data	12.14	0.502

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 7.4 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	204.5
WMW Test U-Stat	1.332
WMW Critical Value (0.050)	1.645
P-Value	0.0914

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Arsenic POI 53 Baker Valley 1999
Background Data: ArsenicBG

Raw Statistics

	Site	Background
Number of Valid Observations	10	23
Number of Distinct Observations	10	19
Minimum	2.8	2.1
Maximum	13.5	8.2
Mean	5.39	4.683
Median	4.15	4.6
SD	3.288	1.555
SE of Mean	1.04	0.324

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	31	0.848	1.696	0.202
Welch-Satterthwaite (Unequal Variance)	10.8	0.65	1.796	0.265

Pooled SD 2.203

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	10.81
Variance of Background	2.418

Numerator DF	Denominator DF	F-Test Value	P-Value
9	22	4.471	0.004

Conclusion with Alpha = 0.05

* Two variances are not equal

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[a]anthracene POI 53 Baker Valley 1999

Background Data: Benzo[a]anthraceneBG

Raw Statistics

	Site	Background
Number of Valid Data	10	23
Number of Non-Detect Data	8	8
Number of Detect Data	2	15
Minimum Non-Detect	380	360
Maximum Non-Detect	420	430
Percent Non detects	80.00%	34.78%
Minimum Detected	140	43
Maximum Detected	3800	590
Mean of Detected Data	1970	213
Median of Detected Data	1970	190
SD of Detected Data	2588	132.5

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 430 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	177
WMW Test U-Stat	0.255
WMW Critical Value (0.050)	1.645
P-Value	0.4

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[a]pyrene POI 53 Baker Valley 1999

Background Data: Benzo[a]pyreneBG

Raw Statistics

	Site	Background
Number of Valid Data	10	23
Number of Non-Detect Data	8	7
Number of Detect Data	2	16
Minimum Non-Detect	380	360
Maximum Non-Detect	420	510
Percent Non detects	80.00%	30.43%
Minimum Detected	170	40
Maximum Detected	2800	530
Mean of Detected Data	1485	202.4
Median of Detected Data	1485	180
SD of Detected Data	1860	126.7

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	177
WMW Test U-Stat	0.255
WMW Critical Value (0.050)	1.645
P-Value	0.4

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[b[fluoranthene POI 53 Baker Valley 199

Background Data: Benzo[b]fluorantheneBG

Raw Statistics

	Site	Background
Number of Valid Data	10	23
Number of Non-Detect Data	8	5
Number of Detect Data	2	18
Minimum Non-Detect	380	360
Maximum Non-Detect	420	430
Percent Non detects	80.00%	21.74%
Minimum Detected	170	40
Maximum Detected	3400	620
Mean of Detected Data	1785	184.4
Median of Detected Data	1785	155
SD of Detected Data	2284	144.1

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 430 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	177
WMW Test U-Stat	0.255
WMW Critical Value (0.050)	1.645
P-Value	0.4

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Dibenz[a,h]anthracene POI 53 Baker Valley 19

Background Data: Dibenz[a,h]anthraceneBG

Raw Statistics

	Site	Background
Number of Valid Data	10	23
Number of Non-Detect Data	9	22
Number of Detect Data	1	1
Minimum Non-Detect	379	360
Maximum Non-Detect	420	510
Percent Non detects	90.00%	95.65%
Minimum Detected	1100	150
Maximum Detected	1100	150
Mean of Detected Data	1100	150
Median of Detected Data	1100	150
SD of Detected Data	N/A	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	181.5
WMW Test U-Stat	0.431
WMW Critical Value (0.050)	1.645
P-Value	0.333

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Indeno[1,2,3-cd]pyrene POI 53 Baker Valley 1999

Background Data: Indeno(1,2,3-cd)pyreneBG

Raw Statistics

	Site	Background
Number of Valid Data	10	23
Number of Non-Detect Data	8	13
Number of Detect Data	2	10
Minimum Non-Detect	380	360
Maximum Non-Detect	420	510
Percent Non detects	80.00%	56.52%
Minimum Detected	140	110
Maximum Detected	2000	440
Mean of Detected Data	1070	193
Median of Detected Data	1070	175
SD of Detected Data	1315	105

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	181.5
WMW Test U-Stat	0.431
WMW Critical Value (0.050)	1.645
P-Value	0.333

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI 53 Baker Valley 1999
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	10	23
Number of Distinct Observations	10	23
Minimum	128	163
Maximum	1380	1000
Mean	592.3	453
Median	491	368
SD	441.8	229.3
SE of Mean	139.7	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	31	1.2	1.696	0.12
Welch-Satterthwaite (Unequal Variance)	11.2	0.944	1.796	0.183

Pooled SD 306.582

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	195216
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
9	22	3.713	0.012

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Thallium POI 53 Baker Valley 1999
Background Data: ThalliumBG

Raw Statistics

	Site	Background
Number of Valid Data	10	23
Number of Non-Detect Data	10	22
Number of Detect Data	0	1
Minimum Non-Detect	0.82	2.1
Maximum Non-Detect	1.5	3.1
Percent Non detects	100.00%	95.65%
Minimum Detected	N/A	0.82
Maximum Detected	N/A	0.82
Mean of Detected Data	N/A	0.82
Median of Detected Data	N/A	0.82
SD of Detected Data	N/A	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 3.1 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	170
WMW Test U-Stat	-0.0196
WMW Critical Value (0.050)	1.645
P-Value	0.508

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI 53 Baker Valley 1999
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	10	23
Number of Distinct Observations	10	23
Minimum	52.8	27.6
Maximum	243	85
Mean	91.25	55.43
Median	72.75	54.1
SD	57.4	14.98
SE of Mean	18.15	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	31	2.831	1.696	0.004
Welch-Satterthwaite (Unequal Variance)	9.5	1.945	1.812	0.041

Pooled SD 33.402

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	3295
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
9	22	14.691	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI AU 1999
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	21
Minimum	9120	5940
Maximum	57700	16300
Mean	28541	11552
Median	26400	11500
SD	14024	3283
SE of Mean	3890	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	5.602	1.691	0
Welch-Satterthwaite (Unequal Variance)	12.7	4.302	1.771	0

Pooled SD 8739.977

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	196700000
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	18.251	0

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Antimony POI AU 1999
Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	1	10
Number of Detect Data	12	13
Minimum Non-Detect	9.8	5
Maximum Non-Detect	9.8	7.4
Percent Non detects	7.69%	43.48%
Minimum Detected	6.9	0.36
Maximum Detected	40.4	2.3
Mean of Detected Data	20.96	0.808
Median of Detected Data	17.7	0.7
SD of Detected Data	11.23	0.502

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 9.8 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	355.5
WMW Test U-Stat	3.771
WMW Critical Value (0.050)	1.645
P-Value	8.1289E-05

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

P-Value < alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Arsenic POI AU 1999
Background Data: ArsenicBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	19
Minimum	1.7	2.1
Maximum	13.5	8.2
Mean	7.038	4.683
Median	8.4	4.6
SD	3.842	1.555
SE of Mean	1.066	0.324

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	2.609	1.691	0.007
Welch-Satterthwaite (Unequal Variance)	14.3	2.115	1.761	0.026

Pooled SD 2.603

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	14.76
Variance of Background	2.418

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	6.104	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[a]anthracene POI AU 1999

Background Data: Benzo[a]anthraceneBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	10	8
Number of Detect Data	3	15
Minimum Non-Detect	371	360
Maximum Non-Detect	478	430
Percent Non detects	76.92%	34.78%
Minimum Detected	29	43
Maximum Detected	3800	590
Mean of Detected Data	1323	213
Median of Detected Data	140	190
SD of Detected Data	2146	132.5

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 478 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	246
WMW Test U-Stat	0.165
WMW Critical Value (0.050)	1.645
P-Value	0.435

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[a]pyrene POI AU 1999

Background Data: Benzo[a]pyreneBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	10	7
Number of Detect Data	3	16
Minimum Non-Detect	371	360
Maximum Non-Detect	478	510
Percent Non detects	76.92%	30.43%
Minimum Detected	26	40
Maximum Detected	2800	530
Mean of Detected Data	998.7	202.4
Median of Detected Data	170	180
SD of Detected Data	1562	126.7

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	246
WMW Test U-Stat	0.165
WMW Critical Value (0.050)	1.645
P-Value	0.435

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[b]fluoranthene POI AU 1999

Background Data: Benzo[b]fluorantheneBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	10	5
Number of Detect Data	3	18
Minimum Non-Detect	371	360
Maximum Non-Detect	478	430
Percent Non detects	76.92%	21.74%
Minimum Detected	30	40
Maximum Detected	3400	620
Mean of Detected Data	1200	184.4
Median of Detected Data	170	155
SD of Detected Data	1907	144.1

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 478 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	246
WMW Test U-Stat	0.165
WMW Critical Value (0.050)	1.645
P-Value	0.435

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Dibenz[a,h]anthracene POI AU 1999

Background Data: Dibenz[a,h]anthraceneBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	12	22
Number of Detect Data	1	1
Minimum Non-Detect	371	360
Maximum Non-Detect	478	510
Percent Non detects	92.31%	95.65%
Minimum Detected	1100	150
Maximum Detected	1100	150
Mean of Detected Data	1100	150
Median of Detected Data	1100	150
SD of Detected Data	N/A	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	252
WMW Test U-Stat	0.362
WMW Critical Value (0.050)	1.645
P-Value	0.359

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Indeno[1,2,3-cd]pyrene POI AU 1999

Background Data: Indeno(1,2,3-cd)pyreneBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	11	13
Number of Detect Data	2	10
Minimum Non-Detect	371	360
Maximum Non-Detect	478	510
Percent Non detects	84.62%	56.52%
Minimum Detected	140	110
Maximum Detected	2000	440
Mean of Detected Data	1070	193
Median of Detected Data	1070	175
SD of Detected Data	1315	105

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	252
WMW Test U-Stat	0.362
WMW Critical Value (0.050)	1.645
P-Value	0.359

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI AU 1999
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	23
Minimum	23.9	163
Maximum	1760	1000
Mean	632	453
Median	475	368
SD	530.9	229.3
SE of Mean	147.2	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	1.412	1.691	0.084
Welch-Satterthwaite (Unequal Variance)	14.6	1.156	1.753	0.133

Pooled SD 365.388

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	281872
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	5.361	0.001

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Thallium POI AU 1999
Background Data: ThalliumBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	13	22
Number of Detect Data	0	1
Minimum Non-Detect	1.4	2.1
Maximum Non-Detect	17.5	3.1
Percent Non detects	100.00%	95.65%
Minimum Detected	N/A	0.82
Maximum Detected	N/A	0.82
Mean of Detected Data	N/A	0.82
Median of Detected Data	N/A	0.82
SD of Detected Data	N/A	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 17.5 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	240.5
WMW Test U-Stat	-0.0165
WMW Critical Value (0.050)	1.645
P-Value	0.507

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI AU 1999
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	23
Minimum	28	27.6
Maximum	627	85
Mean	141.3	55.43
Median	78.8	54.1
SD	158	14.98
SE of Mean	43.82	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	2.614	1.691	0.007
Welch-Satterthwaite (Unequal Variance)	12.1	1.954	1.782	0.037

Pooled SD 94.624

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	24958
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	111.28	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 38 Major Tolman's.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 38 Major Tolman's 1999
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	21
Minimum	18300	5940
Maximum	30400	16300
Mean	23385	11552
Median	24700	11500
SD	3916	3283
SE of Mean	1086	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	9.69	1.691	0
Welch-Satterthwaite (Unequal Variance)	21.6	9.217	1.717	0

Pooled SD 3519.144

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	15333077
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	1.423	0.456

Conclusion with Alpha = 0.05

* Two variances appear to be equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 38 Major Tolman's.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Antimony POI 38 Major Tolman's 1999
Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	13	10
Number of Detect Data	0	13
Minimum Non-Detect	12.5	5
Maximum Non-Detect	13.7	7.4
Percent Non detects	100.00%	43.48%
Minimum Detected	N/A	0.36
Maximum Detected	N/A	2.3
Mean of Detected Data	N/A	0.808
Median of Detected Data	N/A	0.7
SD of Detected Data	N/A	0.502

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 13.7 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	240.5
WMW Test U-Stat	-0.0165
WMW Critical Value (0.050)	1.645
P-Value	0.507

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 38 Major Tolman's.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Arsenic POI 38 Major Tolman's 1999
Background Data: ArsenicBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	12	19
Minimum	2.7	2.1
Maximum	17.1	8.2
Mean	6.292	4.683
Median	4.8	4.6
SD	3.856	1.555
SE of Mean	1.069	0.324

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	1.778	1.691	0.042
Welch-Satterthwaite (Unequal Varianc	14.2	1.441	1.761	0.086

Pooled SD 2.610

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

*** Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background**

If variances not equal, use Welch-Satterthwaite

Test of Equality of Variances

Variance of Site	14.87
Variance of Background	2.418

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	6.148	0

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 38 Major Tolman's.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Thallium POI 38 Major Tolman's 1999
Background Data: ThalliumBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	13	22
Number of Detect Data	0	1
Minimum Non-Detect	1.3	2.1
Maximum Non-Detect	1.5	3.1
Percent Non detects	100.00%	95.65%
Minimum Detected	N/A	0.82
Maximum Detected	N/A	0.82
Mean of Detected Data	N/A	0.82
Median of Detected Data	N/A	0.82
SD of Detected Data	N/A	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 3.1 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	240.5
WMW Test U-Stat	-0.0165
WMW Critical Value (0.050)	1.645
P-Value	0.507

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 1 Sedgwick Trench.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Antimony POI 1 Sedgwick Trench 1999
Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	13	10
Number of Detect Data	0	13
Minimum Non-Detect	9.5	5
Maximum Non-Detect	10.9	7.4
Percent Non detects	100.00%	43.48%
Minimum Detected	N/A	0.36
Maximum Detected	N/A	2.3
Mean of Detected Data	N/A	0.808
Median of Detected Data	N/A	0.7
SD of Detected Data	N/A	0.502

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 10.9 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	240.5
WMW Test U-Stat	-0.0165
WMW Critical Value (0.050)	1.645
P-Value	0.507

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 1 Sedgwick Trench.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 1 Sedgwick Trench 1999
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	21
Minimum	15300	5940
Maximum	26900	16300
Mean	20062	11552
Median	19800	11500
SD	3009	3283
SE of Mean	834.6	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	7.69	1.691	0
Welch-Satterthwaite (Unequal Vari	26.9	7.883	1.703	0

Pooled SD 3188.871

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	9055897
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
22	12	1.19	0.776

Conclusion with Alpha = 0.05

* Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 1 Sedgwick Trench.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI 1 Sedgwick Trench 1999
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	23
Minimum	289	163
Maximum	1100	1000
Mean	510.8	453
Median	447	368
SD	216.3	229.3
SE of Mean	59.99	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	0.741	1.691	0.232
Welch-Satterthwaite (Unequal Vari	26.3	0.754	1.706	0.229

Pooled SD 224.804

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	46786
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
22	12	1.124	0.861

Conclusion with Alpha = 0.05

* Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 7.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 7 1999
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	21
Minimum	15900	5940
Maximum	51900	16300
Mean	29038	11552
Median	24400	11500
SD	9810	3283
SE of Mean	2721	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	7.876	1.691	0
Welch-Satterthwaite (Unequal Variance)	13.5	6.232	1.761	0

Pooled SD 6398.535

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	96244231
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	8.931	0

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 7.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Antimony POI 7 1999
Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	0	10
Number of Detect Data	13	13
Minimum Non-Detect	N/A	5
Maximum Non-Detect	N/A	7.4
Percent Non detects	0.00%	43.48%
Minimum Detected	7.9	0.36
Maximum Detected	44.2	2.3
Mean of Detected Data	18.82	0.808
Median of Detected Data	14.1	0.7
SD of Detected Data	11.29	0.502

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 7.4 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	390
WMW Test U-Stat	4.907
WMW Critical Value (0.050)	1.645
P-Value	4.6175E-07

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

P-Value < alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 7.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI 7 1999
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	23
Minimum	318	163
Maximum	2040	1000
Mean	797.5	453
Median	717	368
SD	486.7	229.3
SE of Mean	135	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	2.895	1.691	0.003
Welch-Satterthwaite (Unequal Variance)	15.1	2.406	1.753	0.015

Pooled SD 342.971

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	236881
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	4.505	0.002

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 7.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Thallium POI 7 1999
Background Data: ThalliumBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	11	22
Number of Detect Data	2	1
Minimum Non-Detect	1.4	2.1
Maximum Non-Detect	1.8	3.1
Percent Non detects	84.62%	95.65%
Minimum Detected	1.5	0.82
Maximum Detected	2.1	0.82
Mean of Detected Data	1.8	0.82
Median of Detected Data	1.8	0.82
SD of Detected Data	0.424	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 3.1 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	240.5
WMW Test U-Stat	-0.0165
WMW Critical Value (0.050)	1.645
P-Value	0.507

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 7.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI 7 1999
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	23
Minimum	15.7	27.6
Maximum	307	85
Mean	88.04	55.43
Median	58.7	54.1
SD	86.11	14.98
SE of Mean	23.88	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	1.788	1.691	0.041
Welch-Satterthwaite (Unequal Variance)	12.4	1.354	1.782	0.1

Pooled SD 52.554

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	7414
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	33.058	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 10-11.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 10/11 1999
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	21
Minimum	14400	5940
Maximum	28400	16300
Mean	22900	11552
Median	23100	11500
SD	4038	3283
SE of Mean	1120	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	9.167	1.691	0
Welch-Satterthwaite (Unequal Variance)	21	8.645	1.721	0

Pooled SD 3567.714

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	16308333
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	1.513	0.385

Conclusion with Alpha = 0.05

* Two variances appear to be equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 10-11.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Antimony POI 10/11 1999
Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	10	10
Number of Detect Data	3	13
Minimum Non-Detect	9.6	5
Maximum Non-Detect	11.5	7.4
Percent Non detects	76.92%	43.48%
Minimum Detected	11.2	0.36
Maximum Detected	13.5	2.3
Mean of Detected Data	12.17	0.808
Median of Detected Data	11.8	0.7
SD of Detected Data	1.193	0.502

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 11.5 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	263.5
WMW Test U-Stat	0.741
WMW Critical Value (0.050)	1.645
P-Value	0.229

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 10-11.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI 10/11 1999
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	12	23
Minimum	233	163
Maximum	2580	1000
Mean	845.5	453
Median	551	368
SD	649.7	229.3
SE of Mean	180.2	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	2.644	1.691	0.006
Welch-Satterthwaite (Unequal Variance)	13.7	2.105	1.761	0.027

Pooled SD 427.790

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	422109
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	8.027	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 16.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 16 1999
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	21
Minimum	14100	5940
Maximum	23800	16300
Mean	19185	11552
Median	19600	11500
SD	2765	3283
SE of Mean	766.9	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	7.073	1.691	0
Welch-Satterthwaite (Unequal Variance)	28.8	7.425	1.699	0

Pooled SD 3109.893

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	7646410
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
22	12	1.409	0.546

Conclusion with Alpha = 0.05

* Two variances appear to be equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 16.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Antimony POI 16 1999
Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	13	10
Number of Detect Data	0	13
Minimum Non-Detect	9.1	5
Maximum Non-Detect	11.1	7.4
Percent Non detects	100.00%	43.48%
Minimum Detected	N/A	0.36
Maximum Detected	N/A	2.3
Mean of Detected Data	N/A	0.808
Median of Detected Data	N/A	0.7
SD of Detected Data	N/A	0.502

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 11.1 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	240.5
WMW Test U-Stat	-0.0165
WMW Critical Value (0.050)	1.645
P-Value	0.507

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI 16.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[a]pyrene POI 16 1999

Background Data: Benzo[a]pyreneBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	8	7
Number of Detect Data	5	16
Minimum Non-Detect	370	360
Maximum Non-Detect	414	510
Percent Non detects	61.54%	30.43%
Minimum Detected	32	40
Maximum Detected	600	530
Mean of Detected Data	170.8	202.4
Median of Detected Data	68	180
SD of Detected Data	242.6	126.7

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	246
WMW Test U-Stat	0.165
WMW Critical Value (0.050)	1.645
P-Value	0.435

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 19.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 19 1999
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	12	21
Minimum	11200	5940
Maximum	33900	16300
Mean	20231	11552
Median	20800	11500
SD	7555	3283
SE of Mean	2095	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	4.803	1.691	0
Welch-Satterthwaite (Unequal Variance)	14.6	3.937	1.753	0.001

Pooled SD 5207.290

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	57072308
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	5.296	0.001

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 19.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Antimony POI 19 1999
Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	12	10
Number of Detect Data	1	13
Minimum Non-Detect	12	5
Maximum Non-Detect	12	7.4
Percent Non detects	92.31%	43.48%
Minimum Detected	5.6	0.36
Maximum Detected	5.6	2.3
Mean of Detected Data	5.6	0.808
Median of Detected Data	5.6	0.7
SD of Detected Data	N/A	0.502

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 12 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	240.5
WMW Test U-Stat	-0.0165
WMW Critical Value (0.050)	1.645
P-Value	0.507

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 19.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Arsenic POI 19 1999
Background Data: ArsenicBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	10	19
Minimum	1.9	2.1
Maximum	16	8.2
Mean	4.108	4.683
Median	2.8	4.6
SD	3.747	1.555
SE of Mean	1.039	0.324

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	-0.649	1.691	0.74
Welch-Satterthwaite (Unequal Variance)	14.4	-0.528	1.761	0.697

Pooled SD 2.553

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	14.04
Variance of Background	2.418

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	5.807	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 19.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI 19 1999
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	23
Minimum	309	163
Maximum	1450	1000
Mean	540.3	453
Median	452	368
SD	305	229.3
SE of Mean	84.58	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	0.974	1.691	0.169
Welch-Satterthwaite (Unequal Variance)	19.8	0.899	1.725	0.19

Pooled SD 258.555

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	93009
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	1.769	0.238

Conclusion with Alpha = 0.05

* Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 19.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI 19 1999
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	23
Minimum	10.8	27.6
Maximum	140	85
Mean	57.03	55.43
Median	50.9	54.1
SD	39.47	14.98
SE of Mean	10.95	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	0.175	1.691	0.431
Welch-Satterthwaite (Unequal Variance)	14	0.141	1.761	0.445

Pooled SD 26.363

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1558
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	6.947	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 20.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 20 1999
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	12	21
Minimum	7570	5940
Maximum	36400	16300
Mean	15697	11552
Median	15100	11500
SD	7730	3283
SE of Mean	2144	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	2.255	1.691	0.015
Welch-Satterthwaite (Unequal Variance)	14.5	1.842	1.761	0.043

Pooled SD 5297.213

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	59748673
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	5.545	0.001

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 20.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI 20 1999
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	23
Minimum	71	163
Maximum	1550	1000
Mean	477.2	453
Median	362	368
SD	378	229.3
SE of Mean	104.8	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	0.241	1.691	0.406
Welch-Satterthwaite (Unequal Variance)	17.1	0.211	1.74	0.418

Pooled SD 290.628

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	142914
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	2.718	0.041

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 20.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Mercury POI 20 1999
Background Data: MercuryBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	12	0
Number of Detect Data	1	23
Minimum Non-Detect	0.06	N/A
Maximum Non-Detect	0.1	N/A
Percent Non detects	92.31%	0.00%
Minimum Detected	2.9	0.0065
Maximum Detected	2.9	0.29
Mean of Detected Data	2.9	0.0865
Median of Detected Data	2.9	0.065
SD of Detected Data	N/A	0.0679

Wilcoxon-Mann-Whitney Site vs Background Test

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	228
WMW Test U-Stat	-0.428
WMW Critical Value (0.050)	1.645
P-Value	0.666

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 20.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Thallium POI 20 1999
Background Data: ThalliumBG

Raw Statistics

	Site	Background
Number of Valid Data	13	23
Number of Non-Detect Data	12	22
Number of Detect Data	1	1
Minimum Non-Detect	0.87	2.1
Maximum Non-Detect	2	3.1
Percent Non detects	92.31%	95.65%
Minimum Detected	2.5	0.82
Maximum Detected	2.5	0.82
Mean of Detected Data	2.5	0.82
Median of Detected Data	2.5	0.82
SD of Detected Data	N/A	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 3.1 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	240.5
WMW Test U-Stat	-0.0165
WMW Critical Value (0.050)	1.645
P-Value	0.507

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 20.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI 20 1999
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	23
Minimum	50.5	27.6
Maximum	112	85
Mean	73.76	55.43
Median	68.5	54.1
SD	17.46	14.98
SE of Mean	4.841	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	3.324	1.691	0.001
Welch-Satterthwaite (Unequal Variance)	22	3.183	1.717	0.002

Pooled SD 15.896

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	304.7
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	1.359	0.514

Conclusion with Alpha = 0.05

* Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 21-22-23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 21/22/23 subsurface 1999
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	15	23
Number of Distinct Observations	15	23
Minimum	4830	20600
Maximum	22684	53800
Mean	15202	36157
Median	15597	36000
SD	5210	10413
SE of Mean	1345	2171

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	36	-7.204	1.688	1
Welch-Satterthwaite (Unequal Variance)	34.2	-8.204	1.691	1

Pooled SD 8764.804

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	27143438
Variance of Background	108400000

Numerator DF	Denominator DF	F-Test Value	P-Value
22	14	3.995	0.01

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 21-22-23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI 21/22/23 subsurface 1999
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	15	23
Number of Distinct Observations	15	23
Minimum	222	163
Maximum	3248	1000
Mean	1084	453
Median	705	368
SD	1003	229.3
SE of Mean	258.9	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	36	2.925	1.688	0.003
Welch-Satterthwaite (Unequal Variance)	15	2.398	1.753	0.015

Pooled SD 650.507

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	1005494
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
14	22	19.122	0

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 21-22-23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Thallium POI 21/22/23 subsurface 1999
Background Data: ThalliumBG

Raw Statistics

	Site	Background
Number of Valid Data	15	23
Number of Non-Detect Data	12	22
Number of Detect Data	3	1
Minimum Non-Detect	0.24	2.1
Maximum Non-Detect	12.7	3.1
Percent Non detects	80.00%	95.65%
Minimum Detected	0.25	0.82
Maximum Detected	7.4	0.82
Mean of Detected Data	2.667	0.82
Median of Detected Data	0.35	0.82
SD of Detected Data	4.099	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 12.7 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	292.5
WMW Test U-Stat	-0.0149
WMW Critical Value (0.050)	1.645
P-Value	0.506

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 21-22-23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI 21/22/23 subsurface 1999
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	15	23
Number of Distinct Observations	15	23
Minimum	36.1	27.6
Maximum	195	85
Mean	99.15	55.43
Median	98.7	54.1
SD	39.98	14.98
SE of Mean	10.32	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	36	4.783	1.688	0
Welch-Satterthwaite (Unequal Variance)	16.6	4.055	1.74	0

Pooled SD 27.544

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	1598
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
14	22	7.127	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 24.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 24 1999
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	11	23
Number of Distinct Observations	11	21
Minimum	14100	5940
Maximum	28510	16300
Mean	18737	11552
Median	17600	11500
SD	4186	3283
SE of Mean	1262	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	32	5.46	1.694	0
Welch-Satterthwaite (Unequal Variance)	16.1	5.004	1.746	0

Pooled SD 3589.536

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	17524082
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
10	22	1.626	0.328

Conclusion with Alpha = 0.05

* Two variances appear to be equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 24.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Antimony POI 24 1999
Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Data	11	23
Number of Non-Detect Data	1	10
Number of Detect Data	10	13
Minimum Non-Detect	9.8	5
Maximum Non-Detect	9.8	7.4
Percent Non detects	9.09%	43.48%
Minimum Detected	6.3	0.36
Maximum Detected	28.6	2.3
Mean of Detected Data	16.9	0.808
Median of Detected Data	14.75	0.7
SD of Detected Data	6.934	0.502

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 9.8 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	296
WMW Test U-Stat	3.792
WMW Critical Value (0.050)	1.645
P-Value	7.4811E-05

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

P-Value < alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 24.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Arsenic POI 24 1999
Background Data: ArsenicBG

Raw Statistics

	Site	Background
Number of Valid Observations	11	23
Number of Distinct Observations	11	19
Minimum	7.5	2.1
Maximum	103	8.2
Mean	26.69	4.683
Median	11.5	4.6
SD	34.76	1.555
SE of Mean	10.48	0.324

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	32	3.083	1.694	0.002
Welch-Satterthwaite (Unequal Variance)	10	2.099	1.812	0.031

Pooled SD 19.476

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	1208
Variance of Background	2.418

Numerator DF	Denominator DF	F-Test Value	P-Value
10	22	499.798	0

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 24.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Thallium POI 24 1999
Background Data: ThalliumBG

Raw Statistics

	Site	Background
Number of Valid Data	11	23
Number of Non-Detect Data	11	22
Number of Detect Data	0	1
Minimum Non-Detect	10	2.1
Maximum Non-Detect	17.5	3.1
Percent Non detects	100.00%	95.65%
Minimum Detected	N/A	0.82
Maximum Detected	N/A	0.82
Mean of Detected Data	N/A	0.82
Median of Detected Data	N/A	0.82
SD of Detected Data	N/A	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 17.5 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	192.5
WMW Test U-Stat	-0.0184
WMW Critical Value (0.050)	1.645
P-Value	0.507

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 24.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI 24 1999
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	11	23
Number of Distinct Observations	11	23
Minimum	33.9	27.6
Maximum	135	85
Mean	79.68	55.43
Median	70.1	54.1
SD	29.31	14.98
SE of Mean	8.839	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	32	3.218	1.694	0.001
Welch-Satterthwaite (Unequal Variance)	12.6	2.588	1.771	0.012

Pooled SD 20.560

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	859.3
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
10	22	3.831	0.008

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 25 subsurface 1999
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	21
Minimum	19341	5940
Maximum	37428	16300
Mean	24509	11552
Median	23504	11500
SD	5937	3283
SE of Mean	2244	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	7.499	1.701	0
Welch-Satterthwaite (Unequal Variance)	7.2	5.523	1.895	0

Pooled SD 4002.554

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	35250069
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	3.271	0.037

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Antimony POI 25 subsurface 1999
Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Data	7	23
Number of Non-Detect Data	0	10
Number of Detect Data	7	13
Minimum Non-Detect	N/A	5
Maximum Non-Detect	N/A	7.4
Percent Non detects	0.00%	43.48%
Minimum Detected	7.2	0.36
Maximum Detected	16.5	2.3
Mean of Detected Data	10.16	0.808
Median of Detected Data	8.9	0.7
SD of Detected Data	3.295	0.502

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 7.4 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	177.5
WMW Test U-Stat	3.359
WMW Critical Value (0.050)	1.645
P-Value	0.00039137

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

P-Value < alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI 25 subsurface 1999
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	23
Minimum	517	163
Maximum	1564	1000
Mean	904.9	453
Median	873	368
SD	320	229.3
SE of Mean	121	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	4.162	1.701	0
Welch-Satterthwaite (Unequal Variance)	8	3.474	1.86	0.004

Pooled SD 251.517

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	102413
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	1.948	0.235

Conclusion with Alpha = 0.05

* Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Mercury POI 25 subsurface 1999
Background Data: MercuryBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	21
Minimum	16.5	0.0065
Maximum	28.2	0.29
Mean	20.93	0.0865
Median	20.3	0.065
SD	3.572	0.0679
SE of Mean	1.35	0.0142

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	29.177	1.701	0
Welch-Satterthwaite (Unequal Variance)	6	15.435	1.943	0

Pooled SD 1.655

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	12.76
Variance of Background	0.00461

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	2768.59	0

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Thallium POI 25 subsurface 1999
Background Data: ThalliumBG

Raw Statistics

	Site	Background
Number of Valid Data	7	23
Number of Non-Detect Data	0	22
Number of Detect Data	7	1
Minimum Non-Detect	N/A	2.1
Maximum Non-Detect	N/A	3.1
Percent Non detects	0.00%	95.65%
Minimum Detected	40.9	0.82
Maximum Detected	75.7	0.82
Mean of Detected Data	47.6	0.82
Median of Detected Data	43.2	0.82
SD of Detected Data	12.54	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 3.1 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	189
WMW Test U-Stat	3.923
WMW Critical Value (0.050)	1.645
P-Value	4.3778E-05

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

P-Value < alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 25.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI 25 subsurface 1999
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	23
Minimum	42.8	27.6
Maximum	136	85
Mean	96.01	55.43
Median	107	54.1
SD	31.54	14.98
SE of Mean	11.92	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	4.765	1.701	0
Welch-Satterthwaite (Unequal Variance)	6.8	3.293	1.895	0.007

Pooled SD 19.734

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	995
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	4.437	0.009

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI 23 1999
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	5	23
Number of Distinct Observations	5	23
Minimum	450	163
Maximum	1120	1000
Mean	683.6	453
Median	549	368
SD	284.7	229.3
SE of Mean	127.3	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	26	1.958	1.706	0.03
Welch-Satterthwaite (Unequal Variance)	5.2	1.696	2.015	0.074

Pooled SD 238.675

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	81070
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
4	22	1.542	0.45

Conclusion with Alpha = 0.05

* Two variances appear to be equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	POI 23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Thallium POI 23 1999
Background Data: ThalliumBG

Raw Statistics

	Site	Background
Number of Valid Data	5	23
Number of Non-Detect Data	5	22
Number of Detect Data	0	1
Minimum Non-Detect	0.22	2.1
Maximum Non-Detect	1.3	3.1
Percent Non detects	100.00%	95.65%
Minimum Detected	N/A	0.82
Maximum Detected	N/A	0.82
Mean of Detected Data	N/A	0.82
Median of Detected Data	N/A	0.82
SD of Detected Data	N/A	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 3.1 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	72.5
WMW Test U-Stat	-0.03
WMW Critical Value (0.050)	1.645
P-Value	0.512

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	POI 23.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI 23 1999
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	5	23
Number of Distinct Observations	5	23
Minimum	59.2	27.6
Maximum	86.5	85
Mean	72.98	55.43
Median	67.5	54.1
SD	12.63	14.98
SE of Mean	5.646	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	26	2.43	1.706	0.011
Welch-Satterthwaite (Unequal Variance)	6.7	2.721	1.895	0.015

Pooled SD 14.639

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	159.4
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
22	4	1.407	0.813

Conclusion with Alpha = 0.05

* Two variances appear to be equal

TABLE A.5
BACKGROUND TEST
RESULTS

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum Southern AU surface 2000
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	31	23
Number of Distinct Observations	29	21
Minimum	3740	5940
Maximum	27800	16300
Mean	12737	11552
Median	11200	11500
SD	6152	3283
SE of Mean	1105	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	52	0.838	1.675	0.203
Welch-Satterthwaite (Unequal Variance)	47.8	0.912	1.677	0.183

Pooled SD 5137.602

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	37848868
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
30	22	3.512	0.003

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Arsenic Southern AU surface 2000
Background Data: ArsenicBG

Raw Statistics

	Site	Background
Number of Valid Observations	31	23
Number of Distinct Observations	29	19
Minimum	0.76	2.1
Maximum	59.1	8.2
Mean	9.844	4.683
Median	5.7	4.6
SD	11.41	1.555
SE of Mean	2.049	0.324

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	52	2.15	1.675	0.018
Welch-Satterthwaite (Unequal Variance)	31.5	2.488	1.696	0.009

Pooled SD 8.723

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	130.1
Variance of Background	2.418

Numerator DF	Denominator DF	F-Test Value	P-Value
30	22	53.818	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Cobalt Southern AU surface 2000
Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Observations	31	23
Number of Distinct Observations	31	23
Minimum	1.6	2.5
Maximum	121	20
Mean	34.4	10.17
Median	26.1	8.5
SD	31.51	5.323
SE of Mean	5.66	1.11

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	52	3.641	1.675	0
Welch-Satterthwaite (Unequal Variance)	32.3	4.201	1.694	0

Pooled SD 24.184

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	993
Variance of Background	28.34

Numerator DF	Denominator DF	F-Test Value	P-Value
30	22	35.042	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Iron Southern AU surface 2000
Background Data: IronBG

Raw Statistics

	Site	Background
Number of Valid Observations	31	23
Number of Distinct Observations	27	22
Minimum	7150	14000
Maximum	64800	36200
Mean	28460	24643
Median	26200	23100
SD	12634	6635
SE of Mean	2269	1383

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	52	1.318	1.675	0.097
Welch-Satterthwaite (Unequal Variance)	47.5	1.436	1.678	0.079

Pooled SD 10521.972

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	159600000
Variance of Background	44020751

Numerator DF	Denominator DF	F-Test Value	P-Value
30	22	3.626	0.003

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese Southern AU surface 2000
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	31	23
Number of Distinct Observations	29	23
Minimum	37.6	163
Maximum	1390	1000
Mean	489.7	453
Median	429	368
SD	306	229.3
SE of Mean	54.96	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	52	0.483	1.675	0.316
Welch-Satterthwaite (Unequal Variance)	52	0.504	1.675	0.308

Pooled SD 276.170

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	93640
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
30	22	1.781	0.165

Conclusion with Alpha = 0.05

* Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium Southern AU surface 2000
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	31	23
Number of Distinct Observations	31	23
Minimum	14.7	27.6
Maximum	293	85
Mean	63.95	55.43
Median	53.1	54.1
SD	50.68	14.98
SE of Mean	9.103	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	52	0.78	1.675	0.22
Welch-Satterthwaite (Unequal Variance)	36.8	0.886	1.687	0.191

Pooled SD 39.709

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	2569
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
30	22	11.453	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum Southern AU subsurface 2000
Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	6	21
Minimum	13000	5940
Maximum	26900	16300
Mean	16943	11552
Median	16000	11500
SD	4791	3283
SE of Mean	1811	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	3.413	1.701	0.001
Welch-Satterthwaite (Unequal Variance)	7.8	2.784	1.86	0.012

Pooled SD 3658.693

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	22956190
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	2.13	0.181

Conclusion with Alpha = 0.05

* Two variances appear to be equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Arsenic Southern AU subsurface 2000
Background Data: ArsenicBG

Raw Statistics

	Site	Background
Number of Valid Data	7	23
Number of Non-Detect Data	2	0
Number of Detect Data	5	23
Minimum Non-Detect	2.36	N/A
Maximum Non-Detect	2.54	N/A
Percent Non detects	28.57%	0.00%
Minimum Detected	1.2	2.1
Maximum Detected	141	8.2
Mean of Detected Data	30.52	4.683
Median of Detected Data	2.8	4.6
SD of Detected Data	61.78	1.555

Wilcoxon-Mann-Whitney Site vs Background Test

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	74.5
WMW Test U-Stat	-1.692
WMW Critical Value (0.050)	1.645
P-Value	0.955

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Beryllium Southern AU subsurface 2000
Background Data: BerylliumBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	6	16
Minimum	0.85	0.71
Maximum	19	2.4
Mean	3.836	1.354
Median	1.3	1.2
SD	6.694	0.515
SE of Mean	2.53	0.107

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	1.835	1.701	0.039
Welch-Satterthwaite (Unequal Varianc	6	0.98	1.943	0.182

Pooled SD 3.132

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

*** Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background**

If variances not equal, use Welch-Satterthwaite

Test of Equality of Variances

Variance of Site	44.81
Variance of Background	0.266

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	168.67	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Cobalt Southern AU subsurface 2000
Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	23
Minimum	12.6	2.5
Maximum	67.4	20
Mean	39.24	10.17
Median	29.5	8.5
SD	23.6	5.323
SE of Mean	8.921	1.11

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	5.659	1.701	0
Welch-Satterthwaite (Unequal Variance)	6.2	3.234	1.943	0.009

Pooled SD 11.901

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	557.1
Variance of Background	28.34

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	19.659	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Iron Southern AU subsurface 2000
Background Data: IronBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	22
Minimum	24400	14000
Maximum	45600	36200
Mean	36043	24643
Median	35100	23100
SD	7376	6635
SE of Mean	2788	1383

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	3.883	1.701	0
Welch-Satterthwaite (Unequal Variance)	9.2	3.663	1.833	0.003

Pooled SD 6800.456

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	54406190
Variance of Background	44020751

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	1.236	0.653

Conclusion with Alpha = 0.05

* Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese Southern AU subsurface 2000
Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	23
Minimum	132	163
Maximum	1020	1000
Mean	493.7	453
Median	407	368
SD	315.8	229.3
SE of Mean	119.4	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	0.377	1.701	0.354
Welch-Satterthwaite (Unequal Variance)	8	0.317	1.86	0.38

Pooled SD 250.373

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	99734
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	1.897	0.253

Conclusion with Alpha = 0.05

* Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Mercury Southern AU subsurface 2000
Background Data: MercuryBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	4	21
Minimum	0.08	0.0065
Maximum	1.8	0.29
Mean	0.336	0.0865
Median	0.08	0.065
SD	0.646	0.0679
SE of Mean	0.244	0.0142

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	1.893	1.701	0.034
Welch-Satterthwaite (Unequal Varianc	6	1.019	1.943	0.174

Pooled SD 0.305

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

*** Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background**

If variances not equal, use Welch-Satterthwaite

Test of Equality of Variances

Variance of Site	0.417
Variance of Background	0.00461

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	90.504	0

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium Southern AU subsurface 2000
Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	23
Minimum	30.5	27.6
Maximum	105	85
Mean	76.46	55.43
Median	79.3	54.1
SD	22.95	14.98
SE of Mean	8.674	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	2.866	1.701	0.004
Welch-Satterthwaite (Unequal Variance)	7.6	2.281	1.86	0.027

Pooled SD 17.002

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	526.7
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	2.348	0.133

Conclusion with Alpha = 0.05

* Two variances appear to be equal

TABLE A.6
BACKGROUND TEST
RESULTS

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Sheet1.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium surface 4801 Glenbrook Rd 2000

Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	244	23
Number of Distinct Observations	184	23
Minimum	25.5	27.6
Maximum	192	85
Mean	64.53	55.43
Median	62.6	54.1
SD	20.92	14.98
SE of Mean	1.339	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	265	2.037	1.651	0.021
Welch-Satterthwaite (Unequal Varian	30.7	2.679	1.696	0.006

Pooled SD 20.493

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

*** Welch-Satterthwaite Test: Reject H0, Conclude Site > Background**

Test of Equality of Variances

Variance of Site	437.7
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
243	22	1.951	0.065

Conclusion with Alpha = 0.05

* Two variances appear to be equal

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	4625 & 4633 Rockwood.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

TABLES A.7, A.8, and A.9
BACKGROUND TEST RESULTS

Area of Concern Data: Benzo[a]anthracene 4625 & 4633 Rockwood AUES

Background Data: Benzo[a]anthraceneBG

Raw Statistics

	Site	Background
Number of Valid Data	6	23
Number of Non-Detect Data	0	8
Number of Detect Data	6	15
Minimum Non-Detect	N/A	360
Maximum Non-Detect	N/A	430
Percent Non detects	0.00%	34.78%
Minimum Detected	48	43
Maximum Detected	1100	590
Mean of Detected Data	369.3	213
Median of Detected Data	180	190
SD of Detected Data	414.9	132.5

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 430 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	111
WMW Test U-Stat	1.104
WMW Critical Value (0.050)	1.645
P-Value	0.135

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	4625 & 4633 Rockwood.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[a]pyrene 4625 & 4633 Rockwood AUES

Background Data: Benzo[a]pyreneBG

Raw Statistics

	Site	Background
Number of Valid Data	6	23
Number of Non-Detect Data	0	7
Number of Detect Data	6	16
Minimum Non-Detect	N/A	360
Maximum Non-Detect	N/A	510
Percent Non detects	0.00%	30.43%
Minimum Detected	41	40
Maximum Detected	720	530
Mean of Detected Data	244.7	202.4
Median of Detected Data	109	180
SD of Detected Data	277.8	126.7

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	99
WMW Test U-Stat	0.458
WMW Critical Value (0.050)	1.645
P-Value	0.324

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	4625 & 4633 Rockwood.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[b]fluoranthene 4625 & 4633 Rockwood AUES

Background Data: Benzo[b]fluorantheneBG

Raw Statistics

	Site	Background
Number of Valid Data	6	23
Number of Non-Detect Data	0	5
Number of Detect Data	6	18
Minimum Non-Detect	N/A	360
Maximum Non-Detect	N/A	430
Percent Non detects	0.00%	21.74%
Minimum Detected	62	40
Maximum Detected	1800	620
Mean of Detected Data	570.3	184.4
Median of Detected Data	265	155
SD of Detected Data	674.4	144.1

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 430 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	111
WMW Test U-Stat	1.104
WMW Critical Value (0.050)	1.645
P-Value	0.135

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	Sheet1.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[ghi]perylene 4625 & 4633 Rockwood AUES
Background Data: Benzo[ghi]peryleneBG

Raw Statistics

	Site	Background
Number of Valid Data	6	23
Number of Non-Detect Data	1	10
Number of Detect Data	5	13
Minimum Non-Detect	88	360
Maximum Non-Detect	88	510
Percent Non detects	16.67%	43.48%
Minimum Detected	23	110
Maximum Detected	350	480
Mean of Detected Data	155.2	198.5
Median of Detected Data	87	180
SD of Detected Data	132.7	108.1

Wilcoxon-Mann-Whitney Site vs Background Test
All observations <= 510 (Max DL) are ranked the same
Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	90
WMW Test U-Stat	-0.0269
WMW Critical Value (0.050)	1.645
P-Value	0.511

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Site <= Background
P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	4625 & 4633 Rockwood.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Indeno(1,2,3-cd)pyrene 4625 & 4633 Rockwood AUES

Background Data: Indeno(1,2,3-cd)pyreneBG

Raw Statistics

	Site	Background
Number of Valid Data	6	23
Number of Non-Detect Data	2	13
Number of Detect Data	4	10
Minimum Non-Detect	86	360
Maximum Non-Detect	88	510
Percent Non detects	33.33%	56.52%
Minimum Detected	32	110
Maximum Detected	660	440
Mean of Detected Data	283	193
Median of Detected Data	220	175
SD of Detected Data	278.7	105

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	101.5
WMW Test U-Stat	0.592
WMW Critical Value (0.050)	1.645
P-Value	0.277

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	4625 & 4633 Rockwood.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Arsenic 4625 & 4633 Rockwood AUES

Background Data: ArsenicBG

Raw Statistics

	Site	Background
Number of Valid Observations	6	23
Number of Distinct Observations	6	19
Minimum	2	2.1
Maximum	133	8.2
Mean	51.1	4.683
Median	30.1	4.6
SD	57.34	1.555
SE of Mean	23.41	0.324

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	27	4.097	1.703	0
Welch-Satterthwaite (Unequal Varian	5	1.983	2.015	0.052

Pooled SD 24.715

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

*** Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background**

If variances not equal, use Welch-Satterthwaite

Test of Equality of Variances

Variance of Site	3288
Variance of Background	2.418

Numerator DF	Denominator DF	F-Test Value	P-Value
5	22	1359.794	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	4625 & 4633 Rockwood.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Cobalt 4625 & 4633 Rockwood AUES

Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Observations	6	23
Number of Distinct Observations	6	23
Minimum	5.4	2.5
Maximum	18.5	20
Mean	12.35	10.17
Median	14	8.5
SD	5.066	5.323
SE of Mean	2.068	1.11

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	27	0.901	1.703	0.188
Welch-Satterthwaite (Unequal Varian	8.1	0.929	1.86	0.19

Pooled SD 5.277

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	25.66
Variance of Background	28.34

Numerator DF	Denominator DF	F-Test Value	P-Value
22	5	1.104	1.01

Conclusion with Alpha = 0.05

* Two variances appear to be equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	4625 & 4633 Rockwood.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium 4625 & 4633 Rockwood AUES

Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	6	23
Number of Distinct Observations	6	23
Minimum	33.7	27.6
Maximum	85.8	85
Mean	52.08	55.43
Median	49.8	54.1
SD	18.54	14.98
SE of Mean	7.568	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	27	-0.465	1.703	0.677
Welch-Satterthwaite (Unequal Varian	6.8	-0.408	1.895	0.652

Pooled SD 15.697

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	343.7
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
5	22	1.532	0.441

Conclusion with Alpha = 0.05

* Two variances appear to be equal

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[a]anthracene Southern AU surface AUES

Background Data: Benzo[a]anthraceneBG

Raw Statistics

	Site	Background
Number of Valid Data	24	23
Number of Non-Detect Data	2	8
Number of Detect Data	22	15
Minimum Non-Detect	80	360
Maximum Non-Detect	89	430
Percent Non detects	8.33%	34.78%
Minimum Detected	15	43
Maximum Detected	2000	590
Mean of Detected Data	210.8	213
Median of Detected Data	90	190
SD of Detected Data	413.4	132.5

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 430 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	587
WMW Test U-Stat	0.223
WMW Critical Value (0.050)	1.645
P-Value	0.412

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[a]pyrene Southern AU surface AUES

Background Data: Benzo[a]pyreneBG

Raw Statistics

	Site	Background
Number of Valid Data	22	23
Number of Non-Detect Data	2	7
Number of Detect Data	20	16
Minimum Non-Detect	78	360
Maximum Non-Detect	120	510
Percent Non detects	9.09%	30.43%
Minimum Detected	13	40
Maximum Detected	1100	530
Mean of Detected Data	144.2	202.4
Median of Detected Data	73.5	180
SD of Detected Data	241.5	126.7

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	507
WMW Test U-Stat	0.0114
WMW Critical Value (0.050)	1.645
P-Value	0.495

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[b]fluoranthene Southern AU surface AUES

Background Data: Benzo[b]fluorantheneBG

Raw Statistics

	Site	Background
Number of Valid Data	23	23
Number of Non-Detect Data	1	5
Number of Detect Data	22	18
Minimum Non-Detect	89	360
Maximum Non-Detect	89	430
Percent Non detects	4.35%	21.74%
Minimum Detected	12	40
Maximum Detected	2300	620
Mean of Detected Data	255.3	184.4
Median of Detected Data	101	155
SD of Detected Data	478.3	144.1

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 430 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	552.5
WMW Test U-Stat	0.253
WMW Critical Value (0.050)	1.645
P-Value	0.4

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Benzo[g,h,i]perylene Southern AU surface AUES

Background Data: Benzo[g,h,i]peryleneBG

Raw Statistics

	Site	Background
Number of Valid Data	17	23
Number of Non-Detect Data	8	10
Number of Detect Data	9	13
Minimum Non-Detect	78	360
Maximum Non-Detect	160	510
Percent Non detects	47.06%	43.48%
Minimum Detected	18	110
Maximum Detected	680	480
Mean of Detected Data	113.3	198.5
Median of Detected Data	37	180
SD of Detected Data	213.2	108.1

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	360
WMW Test U-Stat	0.301
WMW Critical Value (0.050)	1.645
P-Value	0.382

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Indeno(1,2,3-cd)pyrene Southern AU surface AUES

Background Data: Indeno(1,2,3-cd)pyreneBG

Raw Statistics

	Site	Background
Number of Valid Data	17	23
Number of Non-Detect Data	7	13
Number of Detect Data	10	10
Minimum Non-Detect	78	360
Maximum Non-Detect	160	510
Percent Non detects	41.18%	56.52%
Minimum Detected	11	110
Maximum Detected	1100	440
Mean of Detected Data	157.4	193
Median of Detected Data	53	175
SD of Detected Data	332.5	105

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	360
WMW Test U-Stat	0.301
WMW Critical Value (0.050)	1.645
P-Value	0.382

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Phenanthrene Southern AU surface AUES

Background Data: PhenanthreneBG

Raw Statistics

	Site	Background
Number of Valid Data	24	23
Number of Non-Detect Data	2	10
Number of Detect Data	22	13
Minimum Non-Detect	80	360
Maximum Non-Detect	89	510
Percent Non detects	8.33%	43.48%
Minimum Detected	15	100
Maximum Detected	1600	750
Mean of Detected Data	183.3	252.3
Median of Detected Data	96.5	190
SD of Detected Data	328	178.1

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 510 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	576
WMW Test U-Stat	-0.0106
WMW Critical Value (0.050)	1.645
P-Value	0.504

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

P-Value >= alpha (0.05)

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Arsenic Southern AU surface AUES

Background Data: ArsenicBG

Raw Statistics

	Site	Background
Number of Valid Observations	32	23
Number of Distinct Observations	32	19
Minimum	1.3	2.1
Maximum	399	8.2
Mean	89.9	4.683
Median	52.75	4.6
SD	97.65	1.555
SE of Mean	17.26	0.324

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	53	4.174	1.674	0
Welch-Satterthwaite (Unequal Varian	31	4.936	1.696	0

Pooled SD 74.691

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	9536
Variance of Background	2.418

Numerator DF	Denominator DF	F-Test Value	P-Value
31	22	3944.026	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Cobalt Southern AU surface AUES

Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Observations	32	23
Number of Distinct Observations	29	23
Minimum	0.91	2.5
Maximum	27.8	20
Mean	7.157	10.17
Median	6.5	8.5
SD	5.196	5.323
SE of Mean	0.919	1.11

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	53	-2.1	1.674	0.98
Welch-Satterthwaite (Unequal Varian	46.9	-2.091	1.678	0.979

Pooled SD 5.249

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	27
Variance of Background	28.34

Numerator DF	Denominator DF	F-Test Value	P-Value
22	31	1.049	0.886

Conclusion with Alpha = 0.05

* Two variances appear to be equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 1 Sedgwick Trench.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Cobalt POI 1 Sedgwick Trench AUES

Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Observations	5	23
Number of Distinct Observations	5	23
Minimum	10.9	2.5
Maximum	21.1	20
Mean	15.98	10.17
Median	15.5	8.5
SD	3.835	5.323
SE of Mean	1.715	1.11

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	26	2.299	1.706	0.015
Welch-Satterthwaite (Unequal Varian	7.8	2.844	1.86	0.011

Pooled SD 5.122

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	14.71
Variance of Background	28.34

Numerator DF	Denominator DF	F-Test Value	P-Value
22	4	1.927	0.555

Conclusion with Alpha = 0.05

* Two variances appear to be equal

STEP 3a:

95% UCL RESULTS
BACKGROUND TEST RESULTS

(BY POI OR AREA OF INVESTIGATION)

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	POI 1 Sedgwick Trench.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

STEP 3a
POI 1 - SEDGWICK TR
95% UCL

Aluminum POI 1 Sedgwick Trench 1999

General Statistics

Number of Valid Observations	11	Number of Distinct Observations	11

Raw Statistics		Log-transformed Statistics	
Minimum	16800	Minimum of Log Data	9.729
Maximum	26900	Maximum of Log Data	10.2
Mean	20700	Mean of log Data	9.93
Geometric Mean	20541	SD of log Data	0.129
Median	20000		
SD	2764		
Std. Error of Mean	833.4		
Coefficient of Variation	0.134		
Skewness	1.018		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.941	Shapiro Wilk Test Statistic	0.97
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22210	95% H-UCL	22291
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	24201
95% Adjusted-CLT UCL (Chen-1995)	22344	97.5% Chebyshev (MVUE) UCL	25717
95% Modified-t UCL (Johnson-1978)	22253	99% Chebyshev (MVUE) UCL	28696

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	47.42	Data appear Normal at 5% Significance Level	
Theta Star	436.5		
MLE of Mean	20700		
MLE of Standard Deviation	3006		
nu star	1043		
Approximate Chi Square Value (.05)	969.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	22071
Adjusted Chi Square Value	957.7	95% Jackknife UCL	22210
		95% Standard Bootstrap UCL	21986
Anderson-Darling Test Statistic	0.234	95% Bootstrap-t UCL	22660
Anderson-Darling 5% Critical Value	0.728	95% Hall's Bootstrap UCL	23302
Kolmogorov-Smirnov Test Statistic	0.138	95% Percentile Bootstrap UCL	22100
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	22318
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	24333
		97.5% Chebyshev(Mean, Sd) UCL	25905
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	28992
95% Approximate Gamma UCL (Use when n >= 40)	22280		
95% Adjusted Gamma UCL (Use when n < 40)	22551		
Potential UCL to Use		Use 95% Student's-t UCL	22210

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	Normal UCL Statistics for Full Data Sets
User Selected Options	
From File	POI 19.wst
Full Precision	OFF
Confidence Coefficient	95%

POI 19
95% UCL

Aluminum POI 19 1999

Number of Valid Observations	12
Number of Distinct Observations	11
Minimum	11200
Maximum	33800
Mean	19183
Geometric Mean	18122
Median	19700
SD	6832
Variance	46681515
Std. Error of Mean	1972
Coefficient of Variation	0.356
Skewness	0.711
Shapiro Wilk Test Statistic	0.917
5% Shapiro Wilk Critical Value	0.859

Data appear Normal at 5% Significance Level

95% UCL (Assuming Normal Distribution)

Student's-t UCL	22725

Potential UCL to Use

Student's-t UCL	**22725**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	POI 38 Major Tolman's.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 38
95% UCL

Aluminum POI 38 Major Tolman's 1999

General Statistics

Number of Valid Observations	12	Number of Distinct Observations	12

Raw Statistics		Log-transformed Statistics	
Minimum	18300	Minimum of Log Data	9.815
Maximum	30400	Maximum of Log Data	10.32
Mean	23792	Mean of log Data	10.07
Geometric Mean	23508	SD of log Data	0.163
Median	25300		
SD	3792		
Std. Error of Mean	1095		
Coefficient of Variation	0.159		
Skewness	-0.0761		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.904	Shapiro Wilk Test Statistic	0.895
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	25757	95% H-UCL	26045
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	28687
95% Adjusted-CLT UCL (Chen-1995)	25566	97.5% Chebyshev (MVUE) UCL	30804
95% Modified-t UCL (Johnson-1978)	25753	99% Chebyshev (MVUE) UCL	34961

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	31.49	Data appear Normal at 5% Significance Level	
Theta Star	755.6		
MLE of Mean	23792		
MLE of Standard Deviation	4240		
nu star	755.7		
Approximate Chi Square Value (.05)	692.9	Nonparametric Statistics	
Adjusted Level of Significance	0.029	95% CLT UCL	25592
Adjusted Chi Square Value	683.7	95% Jackknife UCL	25757
		95% Standard Bootstrap UCL	25490
Anderson-Darling Test Statistic	0.685	95% Bootstrap-t UCL	25656
Anderson-Darling 5% Critical Value	0.73	95% Hall's Bootstrap UCL	25546
Kolmogorov-Smirnov Test Statistic	0.229	95% Percentile Bootstrap UCL	25483
Kolmogorov-Smirnov 5% Critical Value	0.245	95% BCA Bootstrap UCL	25533
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	28563
		97.5% Chebyshev(Mean, Sd) UCL	30627
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	34683
95% Approximate Gamma UCL (Use when n >= 40)	25948		
95% Adjusted Gamma UCL (Use when n < 40)	26296		

Potential UCL to Use		Use 95% Student's-t UCL	25757

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Arsenic POI 38 Major Tolman's 1999

General Statistics			
Number of Valid Observations	12	Number of Distinct Observations	11

Raw Statistics		Log-transformed Statistics	
Minimum	2.7	Minimum of Log Data	0.993
Maximum	17.1	Maximum of Log Data	2.839
Mean	6.425	Mean of log Data	1.724
Geometric Mean	5.607	SD of log Data	0.518
Median	5.2		
SD	3.996		
Std. Error of Mean	1.154		
Coefficient of Variation	0.622		
Skewness	1.952		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.789	Shapiro Wilk Test Statistic	0.944
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	8.497	95% H-UCL	8.984
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	10.56
95% Adjusted-CLT UCL (Chen-1995)	9.017	97.5% Chebyshev (MVUE) UCL	12.39
95% Modified-t UCL (Johnson-1978)	8.605	99% Chebyshev (MVUE) UCL	15.98
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.928	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	2.194		
MLE of Mean	6.425		
MLE of Standard Deviation	3.755		
nu star	70.27		
Approximate Chi Square Value (.05)	51.97	**Nonparametric Statistics**	
Adjusted Level of Significance	0.029	95% CLT UCL	8.322
Adjusted Chi Square Value	49.58	95% Jackknife UCL	8.497
		95% Standard Bootstrap UCL	8.22
Anderson-Darling Test Statistic	0.494	95% Bootstrap-t UCL	10.23
Anderson-Darling 5% Critical Value	0.736	95% Hall's Bootstrap UCL	15.46
Kolmogorov-Smirnov Test Statistic	0.202	95% Percentile Bootstrap UCL	8.333
Kolmogorov-Smirnov 5% Critical Value	0.247	95% BCA Bootstrap UCL	8.983
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	11.45
		97.5% Chebyshev(Mean, Sd) UCL	13.63
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	17.9
95% Approximate Gamma UCL (Use when n >= 40)	8.687		
95% Adjusted Gamma UCL (Use when n < 40)	9.107		
Potential UCL to Use		Use 95% Approximate Gamma UCL	8.687

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 53
95% UCL

Aluminum POI 53 Baker Valley 1999

General Statistics			
Number of Valid Observations	8	Number of Distinct Observations	8
Raw Statistics		**Log-transformed Statistics**	
Minimum	11900	Minimum of Log Data	9.384
Maximum	43900	Maximum of Log Data	10.69
Mean	20125	Mean of log Data	9.82
Geometric Mean	18393	SD of log Data	0.422
Median	15800		
SD	10559		
Std. Error of Mean	3733		
Coefficient of Variation	0.525		
Skewness	2.037		

Warning: There are only 8 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.736	Shapiro Wilk Test Statistic	0.852
Shapiro Wilk Critical Value	0.818	Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	27198	95% H-UCL	28704
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	32908
95% Adjusted-CLT UCL (Chen-1995)	29138	97.5% Chebyshev (MVUE) UCL	38548
95% Modified-t UCL (Johnson-1978)	27646	99% Chebyshev (MVUE) UCL	49628
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.656	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	5505		
MLE of Mean	20125		
MLE of Standard Deviation	10525		
nu star	58.5		
Approximate Chi Square Value (.05)	41.91	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0195	95% CLT UCL	26265
Adjusted Chi Square Value	38.39	95% Jackknife UCL	27198
		95% Standard Bootstrap UCL	25888
Anderson-Darling Test Statistic	0.745	95% Bootstrap-t UCL	48624
Anderson-Darling 5% Critical Value	0.718	95% Hall's Bootstrap UCL	59618
Kolmogorov-Smirnov Test Statistic	0.283	95% Percentile Bootstrap UCL	26075
Kolmogorov-Smirnov 5% Critical Value	0.295	95% BCA Bootstrap UCL	28388
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	36397
		97.5% Chebyshev(Mean, Sd) UCL	43438
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	57269
95% Approximate Gamma UCL (Use when n >= 40)	28088		
95% Adjusted Gamma UCL (Use when n < 40)	30667		
Potential UCL to Use		Use 95% Approximate Gamma UCL	28088

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Vanadium POI 53 Baker Valley 1999

General Statistics			
Number of Valid Observations	8	Number of Distinct Observations	8

Raw Statistics		Log-transformed Statistics	
Minimum	52.8	Minimum of Log Data	3.967
Maximum	243	Maximum of Log Data	5.493
Mean	97.69	Mean of log Data	4.451
Geometric Mean	85.74	SD of log Data	0.503
Median	75.55		
SD	63.24		
Std. Error of Mean	22.36		
Coefficient of Variation	0.647		
Skewness	2.169		

Warning: There are only 8 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.704	Shapiro Wilk Test Statistic	0.84
Shapiro Wilk Critical Value	0.818	Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	140	95% H-UCL	152.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	170.5
95% Adjusted-CLT UCL (Chen-1995)	152.8	97.5% Chebyshev (MVUE) UCL	202.9
95% Modified-t UCL (Johnson-1978)	142.9	99% Chebyshev (MVUE) UCL	266.6

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.579	Data appear Lognormal at 5% Significance Level	
Theta Star	37.87		
MLE of Mean	97.69		
MLE of Standard Deviation	60.83		
nu star	41.27		
Approximate Chi Square Value (.05)	27.54	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0195	95% CLT UCL	134.5
Adjusted Chi Square Value	24.74	95% Jackknife UCL	140
		95% Standard Bootstrap UCL	131.8
Anderson-Darling Test Statistic	0.794	95% Bootstrap-t UCL	270.9
Anderson-Darling 5% Critical Value	0.719	95% Hall's Bootstrap UCL	357.7
Kolmogorov-Smirnov Test Statistic	0.341	95% Percentile Bootstrap UCL	134.8
Kolmogorov-Smirnov 5% Critical Value	0.295	95% BCA Bootstrap UCL	152
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	195.1
		97.5% Chebyshev(Mean, Sd) UCL	237.3
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	320.1
95% Approximate Gamma UCL (Use when n >= 40)	146.4		
95% Adjusted Gamma UCL (Use when n < 40)	162.9		
Potential UCL to Use		Use 95% H-UCL	152.4

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.

H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.

It is therefore recommended to avoid the use of H-statistic based 95% UCLs.

Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

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

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI AU
95% UCL

Aluminum POI AU 1999

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	10
Raw Statistics		**Log-transformed Statistics**	
Minimum	9120	Minimum of Log Data	9.118
Maximum	57700	Maximum of Log Data	10.96
Mean	29272	Mean of log Data	10.13
Geometric Mean	25034	SD of log Data	0.616
Median	27250		
SD	16068		
Std. Error of Mean	5081		
Coefficient of Variation	0.549		
Skewness	0.404		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.946	Shapiro Wilk Test Statistic	0.952
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	38587	95% H-UCL	49460
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	55400
95% Adjusted-CLT UCL (Chen-1995)	38324	97.5% Chebyshev (MVUE) UCL	66556
95% Modified-t UCL (Johnson-1978)	38695	99% Chebyshev (MVUE) UCL	88469
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.415	Data appear Normal at 5% Significance Level	
Theta Star	12122		
MLE of Mean	29272		
MLE of Standard Deviation	18837		
nu star	48.3		
Approximate Chi Square Value (.05)	33.34	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	37630
Adjusted Chi Square Value	31.2	95% Jackknife UCL	38587
		95% Standard Bootstrap UCL	37236
Anderson-Darling Test Statistic	0.241	95% Bootstrap-t UCL	39468
Anderson-Darling 5% Critical Value	0.731	95% Hall's Bootstrap UCL	38014
Kolmogorov-Smirnov Test Statistic	0.163	95% Percentile Bootstrap UCL	37350
Kolmogorov-Smirnov 5% Critical Value	0.268	95% BCA Bootstrap UCL	37842
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	51421
		97.5% Chebyshev(Mean, Sd) UCL	61005
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	79830
95% Approximate Gamma UCL (Use when n >= 40)	42398		
95% Adjusted Gamma UCL (Use when n < 40)	45315		
Potential UCL to Use		Use 95% Student's-t UCL	38587

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Aluminum POI AU 1995

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		Log-transformed Statistics	
Minimum	8679	Minimum of Log Data	9.069
Maximum	56138	Maximum of Log Data	10.94
Mean	29026	Mean of log Data	10.09
Geometric Mean	24009	SD of log Data	0.681
Median	25978		
SD	17191		
Std. Error of Mean	5436		
Coefficient of Variation	0.592		
Skewness	0.261		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.912	Shapiro Wilk Test Statistic	0.911
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	38991	95% H-UCL	53403
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	57958
95% Adjusted-CLT UCL (Chen-1995)	38447	97.5% Chebyshev (MVUE) UCL	70285
95% Modified-t UCL (Johnson-1978)	39066	99% Chebyshev (MVUE) UCL	94498
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.02	Data appear Normal at 5% Significance Level	
Theta Star	14371		
MLE of Mean	29026		
MLE of Standard Deviation	20424		
nu star	40.4		
Approximate Chi Square Value (.05)	26.83	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	37968
Adjusted Chi Square Value	24.92	95% Jackknife UCL	38991
		95% Standard Bootstrap UCL	37595
Anderson-Darling Test Statistic	0.417	95% Bootstrap-t UCL	38966
Anderson-Darling 5% Critical Value	0.733	95% Hall's Bootstrap UCL	36952
Kolmogorov-Smirnov Test Statistic	0.177	95% Percentile Bootstrap UCL	37893
Kolmogorov-Smirnov 5% Critical Value	0.269	95% BCA Bootstrap UCL	38236
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	52722
		97.5% Chebyshev(Mean, Sd) UCL	62976
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	83116
95% Approximate Gamma UCL (Use when n >= 40)	43698		
95% Adjusted Gamma UCL (Use when n < 40)	47042		
Potential UCL to Use		Use 95% Student's-t UCL	38991

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Antimony POI AU 1999

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	10
Raw Statistics		**Log-transformed Statistics**	
Minimum	6.9	Minimum of Log Data	1.932
Maximum	40.4	Maximum of Log Data	3.699
Mean	21.46	Mean of log Data	2.903
Geometric Mean	18.24	SD of log Data	0.622
Median	17.7		
SD	12.16		
Std. Error of Mean	3.846		
Coefficient of Variation	0.567		
Skewness	0.394		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.914	Shapiro Wilk Test Statistic	0.941
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	28.51	95% H-UCL	36.42
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	40.69
95% Adjusted-CLT UCL (Chen-1995)	28.3	97.5% Chebyshev (MVUE) UCL	48.93
95% Modified-t UCL (Johnson-1978)	28.59	99% Chebyshev (MVUE) UCL	65.11
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.326	Data appear Normal at 5% Significance Level	
Theta Star	9.225		
MLE of Mean	21.46		
MLE of Standard Deviation	14.07		
nu star	46.53		
Approximate Chi Square Value (.05)	31.87	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	27.79
Adjusted Chi Square Value	29.78	95% Jackknife UCL	28.51
		95% Standard Bootstrap UCL	27.54
Anderson-Darling Test Statistic	0.305	95% Bootstrap-t UCL	29.21
Anderson-Darling 5% Critical Value	0.732	95% Hall's Bootstrap UCL	27.04
Kolmogorov-Smirnov Test Statistic	0.172	95% Percentile Bootstrap UCL	27.67
Kolmogorov-Smirnov 5% Critical Value	0.268	95% BCA Bootstrap UCL	27.92
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	38.23
		97.5% Chebyshev(Mean, Sd) UCL	45.48
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	59.73
95% Approximate Gamma UCL (Use when n >= 40)	31.32		
95% Adjusted Gamma UCL (Use when n < 40)	33.53		
Potential UCL to Use		Use 95% Student's-t UCL	28.51

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Arsenic POI AU 1999

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		Log-transformed Statistics	
Minimum	1.7	Minimum of Log Data	0.531
Maximum	11.4	Maximum of Log Data	2.434
Mean	6.45	Mean of log Data	1.664
Geometric Mean	5.279	SD of log Data	0.717
Median	6.6		
SD	3.736		
Std. Error of Mean	1.181		
Coefficient of Variation	0.579		
Skewness	-0.0345		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.891	Shapiro Wilk Test Statistic	0.88
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	8.616	95% H-UCL	12.58
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	13.37
95% Adjusted-CLT UCL (Chen-1995)	8.379	97.5% Chebyshev (MVUE) UCL	16.29
95% Modified-t UCL (Johnson-1978)	8.613	99% Chebyshev (MVUE) UCL	22.03
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.922	Data appear Normal at 5% Significance Level	
Theta Star	3.356		
MLE of Mean	6.45		
MLE of Standard Deviation	4.653		
nu star	38.43		
Approximate Chi Square Value (.05)	25.24	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	8.393
Adjusted Chi Square Value	23.39	95% Jackknife UCL	8.616
		95% Standard Bootstrap UCL	8.319
Anderson-Darling Test Statistic	0.534	95% Bootstrap-t UCL	8.687
Anderson-Darling 5% Critical Value	0.733	95% Hall's Bootstrap UCL	8.137
Kolmogorov-Smirnov Test Statistic	0.243	95% Percentile Bootstrap UCL	8.28
Kolmogorov-Smirnov 5% Critical Value	0.269	95% BCA Bootstrap UCL	8.29
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	11.6
		97.5% Chebyshev(Mean, Sd) UCL	13.83
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	18.2
95% Approximate Gamma UCL (Use when n >= 40)	9.823		
95% Adjusted Gamma UCL (Use when n < 40)	10.6		
Potential UCL to Use		Use 95% Student's-t UCL	8.616

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Cobalt POI AU 1995

General Statistics			
Number of Valid Data	10	Number of Detected Data	9
Number of Distinct Detected Data	9	Number of Non-Detect Data	1
		Percent Non-Detects	10.00%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	3.15	Minimum Detected	1.147
Maximum Detected	193.1	Maximum Detected	5.263
Mean of Detected	52.98	Mean of Detected	3.352
SD of Detected	61.3	SD of Detected	1.275
Minimum Non-Detect	1.59	Minimum Non-Detect	0.464
Maximum Non-Detect	1.59	Maximum Non-Detect	0.464
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.776	Shapiro Wilk Test Statistic	0.976
5% Shapiro Wilk Critical Value	0.829	5% Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	47.76	Mean	2.994
SD	60.11	SD	1.652
95% DL/2 (t) UCL	82.61	95% H-Stat (DL/2) UCL	962.3
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	44.19	Mean in Log Scale	3.039
SD	61.58	SD in Log Scale	1.557
95% MLE (t) UCL	79.89	Mean in Original Scale	47.81
95% MLE (Tiku) UCL	78.35	SD in Original Scale	60.07
		95% t UCL	82.63
		95% Percentile Bootstrap UCL	79.12
		95% BCA Bootstrap UCL	88.21
		95% H UCL	668.1
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.702	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	75.5		
nu star	12.63		
A-D Test Statistic	0.23	**Nonparametric Statistics**	
5% A-D Critical Value	0.745	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.745	Mean	48
5% K-S Critical Value	0.287	SD	56.83
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	19.06
		95% KM (t) UCL	82.94
Assuming Gamma Distribution		95% KM (z) UCL	79.35
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	82.52
Minimum	0.000001	95% KM (bootstrap t) UCL	142.6
Maximum	193.1	95% KM (BCA) UCL	84.18
Mean	47.68	95% KM (Percentile Bootstrap) UCL	79.53
Median	28.17	95% KM (Chebyshev) UCL	131.1
SD	60.18	97.5% KM (Chebyshev) UCL	167
k star	0.282	99% KM (Chebyshev) UCL	237.7
Theta star	168.9		
Nu star	5.646	**Potential UCLs to Use**	
AppChi2	1.462	**95% KM (Chebyshev) UCL**	**131.1**
95% Gamma Approximate UCL (Use when n >= 40)	184.2		
95% Adjusted Gamma UCL (Use when n < 40)	239.2		

Note: DL/2 is not a recommended method.

Mercury POI AU 1995

General Statistics			
Number of Valid Data	10	Number of Detected Data	6
Number of Distinct Detected Data	6	Number of Non-Detect Data	4
		Percent Non-Detects	40.00%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.1	Minimum Detected	-2.303
Maximum Detected	9.74	Maximum Detected	2.276
Mean of Detected	1.89	Mean of Detected	-0.762
SD of Detected	3.851	SD of Detected	1.649
Minimum Non-Detect	0.09	Minimum Non-Detect	-2.408
Maximum Non-Detect	0.11	Maximum Non-Detect	-2.207
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	5
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	5
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	50.00%
It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.			
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.543	Shapiro Wilk Test Statistic	0.858
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.155	Mean	-1.647
SD	3.023	SD	1.679
95% DL/2 (t) UCL	2.907	95% H-Stat (DL/2) UCL	10.5
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-2.287
		SD in Log Scale	2.359
		Mean in Original Scale	1.139
		SD in Original Scale	3.029
		95% t UCL	2.895
		95% Percentile Bootstrap UCL	3.033
		95% BCA Bootstrap UCL	4.006
		95% H-UCL	227.4
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.341	**Data appear Lognormal at 5% Significance Level**	
Theta Star	5.54		
nu star	4.094		
A-D Test Statistic	0.866	**Nonparametric Statistics**	
5% A-D Critical Value	0.742	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.742	Mean	1.174
5% K-S Critical Value	0.35	SD	2.861
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.991
		95% KM (t) UCL	2.991
Assuming Gamma Distribution		95% KM (z) UCL	2.804
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2.913
Minimum	0.000001	95% KM (bootstrap t) UCL	22.23
Maximum	9.74	95% KM (BCA) UCL	3.102
Mean	1.134	95% KM (Percentile Bootstrap) UCL	3.072
Median	0.115	95% KM (Chebyshev) UCL	5.493
SD	3.032	97.5% KM (Chebyshev) UCL	7.362
k star	0.157	99% KM (Chebyshev) UCL	11.03
Theta star	7.238		
Nu star	3.134	**Potential UCLs to Use**	
AppChi2	0.413	**99% KM (Chebyshev) UCL**	**11.03**
95% Gamma Approximate UCL (Use when n >= 40)	8.603		
95% Adjusted Gamma UCL (Use when n < 40)	12.5		
Warning: Recommended UCL exceeds the maximum observation			
Note: DL/2 is not a recommended method.			

Vanadium POI AU 1999

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	10
Raw Statistics		**Log-transformed Statistics**	
Minimum	28	Minimum of Log Data	3.332
Maximum	627	Maximum of Log Data	6.441
Mean	151.8	Mean of log Data	4.583
Geometric Mean	97.83	SD of log Data	0.925
Median	78.3		
SD	180.1		
Std. Error of Mean	56.96		
Coefficient of Variation	1.187		
Skewness	2.431		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.678	Shapiro Wilk Test Statistic	0.947
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	256.2	95% H-UCL	373.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	331.3
95% Adjusted-CLT UCL (Chen-1995)	292.3	97.5% Chebyshev (MVUE) UCL	413.3
95% Modified-t UCL (Johnson-1978)	263.5	99% Chebyshev (MVUE) UCL	574.2
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.962	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	157.7		
MLE of Mean	151.8		
MLE of Standard Deviation	154.7		
nu star	19.25		
Approximate Chi Square Value (.05)	10.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	245.5
Adjusted Chi Square Value	9.181	95% Jackknife UCL	256.2
		95% Standard Bootstrap UCL	241.6
Anderson-Darling Test Statistic	0.56	95% Bootstrap-t UCL	442
Anderson-Darling 5% Critical Value	0.743	95% Hall's Bootstrap UCL	595.1
Kolmogorov-Smirnov Test Statistic	0.24	95% Percentile Bootstrap UCL	250.2
Kolmogorov-Smirnov 5% Critical Value	0.272	95% BCA Bootstrap UCL	284.6
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	400
		97.5% Chebyshev(Mean, Sd) UCL	507.5
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	718.5
95% Approximate Gamma UCL (Use when n >= 40)	283.7		
95% Adjusted Gamma UCL (Use when n < 40)	318.2		
Potential UCL to Use		Use 95% Approximate Gamma UCL	283.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Vanadium POI AU 1995

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	10
Raw Statistics		**Log-transformed Statistics**	
Minimum	17.07	Minimum of Log Data	2.837
Maximum	488	Maximum of Log Data	6.19
Mean	133	Mean of log Data	4.36
Geometric Mean	78.29	SD of log Data	1.096
Median	64.6		
SD	147.5		
Std. Error of Mean	46.65		
Coefficient of Variation	1.109		
Skewness	1.772		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.78	Shapiro Wilk Test Statistic	0.944
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	218.5	95% H-UCL	476.8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	339.8
95% Adjusted-CLT UCL (Chen-1995)	237.6	97.5% Chebyshev (MVUE) UCL	430.1
95% Modified-t UCL (Johnson-1978)	222.8	99% Chebyshev (MVUE) UCL	607.4
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.823	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	161.6		
MLE of Mean	133		
MLE of Standard Deviation	146.6		
nu star	16.46		
Approximate Chi Square Value (.05)	8.284	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	209.7
Adjusted Chi Square Value	7.298	95% Jackknife UCL	218.5
		95% Standard Bootstrap UCL	204.5
Anderson-Darling Test Statistic	0.441	95% Bootstrap-t UCL	292.3
Anderson-Darling 5% Critical Value	0.747	95% Hall's Bootstrap UCL	312.1
Kolmogorov-Smirnov Test Statistic	0.24	95% Percentile Bootstrap UCL	210.5
Kolmogorov-Smirnov 5% Critical Value	0.273	95% BCA Bootstrap UCL	232.1
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	336.3
		97.5% Chebyshev(Mean, Sd) UCL	424.3
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	597.1
95% Approximate Gamma UCL (Use when n >= 40)	264.1		
95% Adjusted Gamma UCL (Use when n < 40)	299.8		
Potential UCL to Use		Use 95% Approximate Gamma UCL	264.1

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

SOUTHERN AU
95% UCL

Aluminum Southern AU subsurface 2000

General Statistics			
Number of Valid Observations	6	Number of Distinct Observations	5
Raw Statistics		**Log-transformed Statistics**	
Minimum	13000	Minimum of Log Data	9.473
Maximum	26900	Maximum of Log Data	10.2
Mean	16867	Mean of log Data	9.699
Geometric Mean	16306	SD of log Data	0.273
Median	14850		
SD	5244		
Std. Error of Mean	2141		
Coefficient of Variation	0.311		
Skewness	1.85		

It is suggested to collect at least 8 to 10 observations using these statistical methods!

If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.774	Shapiro Wilk Test Statistic	0.833
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	21181	95% H-UCL	22076
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	24974
95% Adjusted-CLT UCL (Chen-1995)	22116	97.5% Chebyshev (MVUE) UCL	28504
95% Modified-t UCL (Johnson-1978)	21450	99% Chebyshev (MVUE) UCL	35438
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	7.591	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	2222		
MLE of Mean	16867		
MLE of Standard Deviation	6122		
nu star	91.09		
Approximate Chi Square Value (.05)	70.08	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0122	95% CLT UCL	20388
Adjusted Chi Square Value	63.46	95% Jackknife UCL	21181
		95% Standard Bootstrap UCL	19978
Anderson-Darling Test Statistic	0.594	95% Bootstrap-t UCL	31005
Anderson-Darling 5% Critical Value	0.698	95% Hall's Bootstrap UCL	33506
Kolmogorov-Smirnov Test Statistic	0.255	95% Percentile Bootstrap UCL	20200
Kolmogorov-Smirnov 5% Critical Value	0.332	95% BCA Bootstrap UCL	21383
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	26198
		97.5% Chebyshev(Mean, Sd) UCL	30236
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	38168
95% Approximate Gamma UCL (Use when n >= 40)	21923		
95% Adjusted Gamma UCL (Use when n < 40)	24211		
Potential UCL to Use		Use 95% Approximate Gamma UCL	21923

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Arsenic Southern AU surface 2000

General Statistics

Number of Valid Observations	22	Number of Distinct Observations	20

Raw Statistics		Log-transformed Statistics	
Minimum	0.76	Minimum of Log Data	-0.274
Maximum	17.1	Maximum of Log Data	2.839
Mean	5.662	Mean of log Data	1.501
Geometric Mean	4.484	SD of log Data	0.715
Median	4.2		
SD	4.179		
Std. Error of Mean	0.891		
Coefficient of Variation	0.738		
Skewness	1.606		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.82	Shapiro Wilk Test Statistic	0.963
Shapiro Wilk Critical Value	0.911	Shapiro Wilk Critical Value	0.911
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	7.195	95% H-UCL	8.191
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	9.786
95% Adjusted-CLT UCL (Chen-1995)	7.453	97.5% Chebyshev (MVUE) UCL	11.55
95% Modified-t UCL (Johnson-1978)	7.246	99% Chebyshev (MVUE) UCL	15.01

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.014	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	2.811		
MLE of Mean	5.662		
MLE of Standard Deviation	3.99		
nu star	88.61		
Approximate Chi Square Value (.05)	67.91	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0386	95% CLT UCL	7.127
Adjusted Chi Square Value	66.55	95% Jackknife UCL	7.195
		95% Standard Bootstrap UCL	7.098
Anderson-Darling Test Statistic	0.535	95% Bootstrap-t UCL	7.817
Anderson-Darling 5% Critical Value	0.754	95% Hall's Bootstrap UCL	7.789
Kolmogorov-Smirnov Test Statistic	0.155	95% Percentile Bootstrap UCL	7.241
Kolmogorov-Smirnov 5% Critical Value	0.188	95% BCA Bootstrap UCL	7.689
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	9.545
		97.5% Chebyshev(Mean, Sd) UCL	11.23
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	14.53
95% Approximate Gamma UCL (Use when n >= 40)	7.388		
95% Adjusted Gamma UCL (Use when n < 40)	7.538		
Potential UCL to Use		Use 95% Approximate Gamma UCL	7.388

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Cobalt Southern AU surface 2000

General Statistics			
Number of Valid Observations	22	Number of Distinct Observations	22

Raw Statistics		Log-transformed Statistics	
Minimum	5.5	Minimum of Log Data	1.705
Maximum	121	Maximum of Log Data	4.796
Mean	42.52	Mean of log Data	3.465
Geometric Mean	31.96	SD of log Data	0.791
Median	32.45		
SD	33.73		
Std. Error of Mean	7.19		
Coefficient of Variation	0.793		
Skewness	1.369		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.831	Shapiro Wilk Test Statistic	0.975
Shapiro Wilk Critical Value	0.911	Shapiro Wilk Critical Value	0.911
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	54.9	95% H-UCL	65.16
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	77.28
95% Adjusted-CLT UCL (Chen-1995)	56.59	97.5% Chebyshev (MVUE) UCL	92.14
95% Modified-t UCL (Johnson-1978)	55.24	99% Chebyshev (MVUE) UCL	121.3
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.672	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	25.43		
MLE of Mean	42.52		
MLE of Standard Deviation	32.88		
nu star	73.58		
Approximate Chi Square Value (.05)	54.83	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0386	95% CLT UCL	54.35
Adjusted Chi Square Value	53.62	95% Jackknife UCL	54.9
		95% Standard Bootstrap UCL	54.1
Anderson-Darling Test Statistic	0.362	95% Bootstrap-t UCL	59.35
Anderson-Darling 5% Critical Value	0.757	95% Hall's Bootstrap UCL	57.35
Kolmogorov-Smirnov Test Statistic	0.107	95% Percentile Bootstrap UCL	55.4
Kolmogorov-Smirnov 5% Critical Value	0.188	95% BCA Bootstrap UCL	56.13
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	73.86
		97.5% Chebyshev(Mean, Sd) UCL	87.43
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	114.1
95% Approximate Gamma UCL (Use when n >= 40)	57.07		
95% Adjusted Gamma UCL (Use when n < 40)	58.35		
Potential UCL to Use		Use 95% Approximate Gamma UCL	57.07

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Cobalt Southern AU subsurface 2000

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		Log-transformed Statistics	
Minimum	15.3	Minimum of Log Data	2.728
Maximum	67.4	Maximum of Log Data	4.211
Mean	43.68	Mean of log Data	3.641
Geometric Mean	38.12	SD of log Data	0.603
Median	45.35		
SD	22.42		
Std. Error of Mean	9.155		
Coefficient of Variation	0.513		
Skewness	-0.152		

It is suggested to collect at least 8 to 10 observations using these statistical methods!

If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.853	Shapiro Wilk Test Statistic	0.868
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	62.13	95% H-UCL	100
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	91.57
95% Adjusted-CLT UCL (Chen-1995)	58.13	97.5% Chebyshev (MVUE) UCL	112.1
95% Modified-t UCL (Johnson-1978)	62.04	99% Chebyshev (MVUE) UCL	152.3

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.026	Data appear Normal at 5% Significance Level	
Theta Star	21.56		
MLE of Mean	43.68		
MLE of Standard Deviation	30.69		
nu star	24.31		
Approximate Chi Square Value (.05)	14.08	Nonparametric Statistics	
Adjusted Level of Significance	0.0122	95% CLT UCL	58.74
Adjusted Chi Square Value	11.38	95% Jackknife UCL	62.13
		95% Standard Bootstrap UCL	57.18
Anderson-Darling Test Statistic	0.513	95% Bootstrap-t UCL	62.47
Anderson-Darling 5% Critical Value	0.7	95% Hall's Bootstrap UCL	52.84
Kolmogorov-Smirnov Test Statistic	0.307	95% Percentile Bootstrap UCL	57.82
Kolmogorov-Smirnov 5% Critical Value	0.334	95% BCA Bootstrap UCL	57.12
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	83.59
		97.5% Chebyshev(Mean, Sd) UCL	100.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	134.8
95% Approximate Gamma UCL (Use when n >= 40)	75.4		
95% Adjusted Gamma UCL (Use when n < 40)	93.35		

Potential UCL to Use		Use 95% Student's-t UCL	62.13

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

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Iron Southern AU subsurface 2000

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		Log-transformed Statistics	
Minimum	24400	Minimum of Log Data	10.1
Maximum	45600	Maximum of Log Data	10.73
Mean	36200	Mean of log Data	10.47
Geometric Mean	35416	SD of log Data	0.233
Median	35100		
SD	8067		
Std. Error of Mean	3293		
Coefficient of Variation	0.223		
Skewness	-0.134		

It is suggested to collect at least 8 to 10 observations using these statistical methods!

If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.934	Shapiro Wilk Test Statistic	0.93
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	42836	95% H-UCL	45368
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	51234
95% Adjusted-CLT UCL (Chen-1995)	41424	97.5% Chebyshev (MVUE) UCL	57729
95% Modified-t UCL (Johnson-1978)	42806	99% Chebyshev (MVUE) UCL	70487

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	11.61	Data appear Normal at 5% Significance Level	
Theta Star	3117		
MLE of Mean	36200		
MLE of Standard Deviation	10622		
nu star	139.4		
Approximate Chi Square Value (.05)	113.1	Nonparametric Statistics	
Adjusted Level of Significance	0.0122	95% CLT UCL	41617
Adjusted Chi Square Value	104.5	95% Jackknife UCL	42836
		95% Standard Bootstrap UCL	41042
Anderson-Darling Test Statistic	0.29	95% Bootstrap-t UCL	44592
Anderson-Darling 5% Critical Value	0.697	95% Hall's Bootstrap UCL	45433
Kolmogorov-Smirnov Test Statistic	0.206	95% Percentile Bootstrap UCL	41350
Kolmogorov-Smirnov 5% Critical Value	0.332	95% BCA Bootstrap UCL	41050
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	50556
		97.5% Chebyshev(Mean, Sd) UCL	56767
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	68969
95% Approximate Gamma UCL (Use when n >= 40)	44611		
95% Adjusted Gamma UCL (Use when n < 40)	48262		

Potential UCL to Use	Use 95% Student's-t UCL 42836

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

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Vanadium Southern AU subsurface 2000

General Statistics			
Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		Log-transformed Statistics	
Minimum	30.5	Minimum of Log Data	3.418
Maximum	105	Maximum of Log Data	4.654
Mean	75.98	Mean of log Data	4.265
Geometric Mean	71.18	SD of log Data	0.436
Median	79.1		
SD	25.1		
Std. Error of Mean	10.25		
Coefficient of Variation	0.33		
Skewness	-1.268		

It is suggested to collect at least 8 to 10 observations using these statistical methods!

If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.902	Shapiro Wilk Test Statistic	0.783
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	96.63	95% H-UCL	127.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	136.6
95% Adjusted-CLT UCL (Chen-1995)	87.17	97.5% Chebyshev (MVUE) UCL	162.4
95% Modified-t UCL (Johnson-1978)	95.75	99% Chebyshev (MVUE) UCL	213
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.024	Data appear Normal at 5% Significance Level	
Theta Star	18.88		
MLE of Mean	75.98		
MLE of Standard Deviation	37.88		
nu star	48.28		
Approximate Chi Square Value (.05)	33.34	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0122	95% CLT UCL	92.84
Adjusted Chi Square Value	28.92	95% Jackknife UCL	96.63
		95% Standard Bootstrap UCL	91.17
Anderson-Darling Test Statistic	0.608	95% Bootstrap-t UCL	90.8
Anderson-Darling 5% Critical Value	0.698	95% Hall's Bootstrap UCL	88.65
Kolmogorov-Smirnov Test Statistic	0.328	95% Percentile Bootstrap UCL	90
Kolmogorov-Smirnov 5% Critical Value	0.333	95% BCA Bootstrap UCL	88.4
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	120.7
		97.5% Chebyshev(Mean, Sd) UCL	140
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	178
95% Approximate Gamma UCL (Use when n >= 40)	110.1		
95% Adjusted Gamma UCL (Use when n < 40)	126.9		
Potential UCL to Use		Use 95% Student's-t UCL	96.63

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	4801 Glenbrook Rd.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

4801 GR
95% UCL

Vanadium surface 4801 Glenbrook Rd 2000

General Statistics			
Number of Valid Observations	234	Number of Distinct Observations	178

Raw Statistics		Log-transformed Statistics	
Minimum	25.5	Minimum of Log Data	3.239
Maximum	132	Maximum of Log Data	4.883
Mean	63.02	Mean of log Data	4.099
Geometric Mean	60.27	SD of log Data	0.304
Median	61.6		
SD	18.72		
Std. Error of Mean	1.224		
Coefficient of Variation	0.297		
Skewness	0.635		

Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.0387	Lilliefors Test Statistic	0.0679
Lilliefors Critical Value	0.0579	Lilliefors Critical Value	0.0579
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	65.04	95% H-UCL	65.31
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	68.68
95% Adjusted-CLT UCL (Chen-1995)	65.08	97.5% Chebyshev (MVUE) UCL	71.1
95% Modified-t UCL (Johnson-1978)	65.05	99% Chebyshev (MVUE) UCL	75.84
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	11.24	Data appear Normal at 5% Significance Level	
Theta Star	5.608		
MLE of Mean	63.02		
MLE of Standard Deviation	18.8		
nu star	5259		
Approximate Chi Square Value (.05)	5091	Nonparametric Statistics	
Adjusted Level of Significance	0.049	95% CLT UCL	65.03
Adjusted Chi Square Value	5090	95% Jackknife UCL	65.04
		95% Standard Bootstrap UCL	65.05
Anderson-Darling Test Statistic	0.491	95% Bootstrap-t UCL	65.02
Anderson-Darling 5% Critical Value	0.752	95% Hall's Bootstrap UCL	65.09
Kolmogorov-Smirnov Test Statistic	0.0524	95% Percentile Bootstrap UCL	64.94
Kolmogorov-Smirnov 5% Critical Value	0.0596	95% BCA Bootstrap UCL	65.03
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	68.35
		97.5% Chebyshev(Mean, Sd) UCL	70.66
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	75.19
95% Approximate Gamma UCL (Use when n >= 40)	65.09		
95% Adjusted Gamma UCL (Use when n < 40)	65.1		
Potential UCL to Use		Use 95% Student's-t UCL	65.04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 1 Sedgwick Trench.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

STEP 3a
BACKGROUND TESTS
POI 1

Area of Concern Data: Aluminum POI 1 Sedgwick Trench 1999

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	11	23
Number of Distinct Observations	11	21
Minimum	16800	5940
Maximum	26900	16300
Mean	20700	11552
Median	20000	11500
SD	2764	3283
SE of Mean	833.4	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	32	7.973	1.694	0
Welch-Satterthwaite (Unequal Varian	23.2	8.482	1.714	0

Pooled SD 3129.855

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	7640000
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
22	10	1.41	0.586

Conclusion with Alpha = 0.05

* Two variances appear to be equal

POI 19
BACKGROUND TESTS

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 19.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 19 1999

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	12	23
Number of Distinct Observations	11	21
Minimum	11200	5940
Maximum	33800	16300
Mean	19183	11552
Median	19700	11500
SD	6832	3283
SE of Mean	1972	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	33	4.493	1.692	0
Welch-Satterthwaite (Unequal Varian	13.7	3.655	1.761	0.001

Pooled SD 4769.119

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	46681515
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
11	22	4.332	0.003

Conclusion with Alpha = 0.05

* Two variances are not equal

POI 38
BACKGROUND TESTS

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 38 Major Tolman's.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 38 Major Tolman's 1999

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	12	23
Number of Distinct Observations	12	21
Minimum	18300	5940
Maximum	30400	16300
Mean	23792	11552
Median	25300	11500
SD	3792	3283
SE of Mean	1095	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	33	9.932	1.692	0
Welch-Satterthwaite (Unequal Varian	19.8	9.481	1.725	0

Pooled SD 3460.693

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	14377197
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
11	22	1.334	0.542

Conclusion with Alpha = 0.05

* Two variances appear to be equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

POI 53
BACKGROUND TESTS

Area of Concern Data: Aluminum POI 53 Baker Valley 1999

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	8	23
Number of Distinct Observations	8	21
Minimum	11900	5940
Maximum	43900	16300
Mean	20125	11552
Median	15800	11500
SD	10559	3283
SE of Mean	3733	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	29	3.526	1.699	0.001
Welch-Satterthwaite (Unequal Varian	7.5	2.259	1.895	0.028

Pooled SD 5923.323

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	111500000
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
7	22	10.346	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI 53 Baker Valley 1999

Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	8	23
Number of Distinct Observations	8	23
Minimum	52.8	27.6
Maximum	243	85
Mean	97.69	55.43
Median	75.55	54.1
SD	63.24	14.98
SE of Mean	22.36	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

		t-Test	Critical	
Method	DF	Value	t (0.050)	P-Value
Pooled (Equal Variance)	29	3.056	1.699	0.002
Welch-Satterthwaite (Unequal Varian	7.3	1.872	1.895	0.051

Pooled SD 33.696

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

*** Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background**

Test of Equality of Variances

Variance of Site	3999
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
7	22	17.831	0

Conclusion with Alpha = 0.05

* Two variances are not equal

POI AU
BACKGROUND TESTS

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI AU 1995

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	10	23
Number of Distinct Observations	10	21
Minimum	8679	5940
Maximum	56138	16300
Mean	29026	11552
Median	25978	11500
SD	17191	3283
SE of Mean	5436	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	31	4.772	1.696	0
Welch-Satterthwaite (Unequal Varian	9.3	3.189	1.833	0.005

Pooled SD 9666.823

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	295500000
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
9	22	27.425	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI AU 1999

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	10	23
Number of Distinct Observations	10	21
Minimum	9120	5940
Maximum	57700	16300
Mean	29272	11552
Median	27250	11500
SD	16068	3283
SE of Mean	5081	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	31	5.147	1.696	0
Welch-Satterthwaite (Unequal Varian	9.3	3.456	1.833	0.003

Pooled SD 9088.820

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	258200000
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
9	22	23.96	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Antimony POI AU 1999

Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Observations	10	23
Number of Distinct Observations	10	19
Minimum	6.9	0.36
Maximum	40.4	7.4
Mean	21.46	2.943
Median	17.7	1.2
SD	12.16	2.567
SE of Mean	3.846	0.535

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	31	7.084	1.696	0
Welch-Satterthwaite (Unequal Varian	9.4	4.768	1.833	0

Pooled SD 6.901

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	147.9
Variance of Background	6.587

Numerator DF	Denominator DF	F-Test Value	P-Value
9	22	22.458	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Arsenic POI AU 1999

Background Data: ArsenicBG

Raw Statistics

	Site	Background
Number of Valid Observations	10	23
Number of Distinct Observations	10	19
Minimum	1.7	2.1
Maximum	11.4	8.2
Mean	6.45	4.683
Median	6.6	4.6
SD	3.736	1.555
SE of Mean	1.181	0.324

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

		t-Test	Critical	
Method	DF	Value	t (0.050)	P-Value
Pooled (Equal Variance)	31	1.943	1.696	0.031
Welch-Satterthwaite (Unequal Varian	10.4	1.443	1.812	0.089

Pooled SD 2.402

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

*** Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background**

Test of Equality of Variances

Variance of Site	13.96
Variance of Background	2.418

Numerator DF	Denominator DF	F-Test Value	P-Value
9	22	5.772	0.001

Conclusion with Alpha = 0.05

* Two variances are not equal

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Cobalt POI AU 1995

Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Data	10	23
Number of Non-Detect Data	1	0
Number of Detect Data	9	23
Minimum Non-Detect	1.59	N/A
Maximum Non-Detect	1.59	N/A
Percent Non detects	10.00%	0.00%
Minimum Detected	3.15	2.5
Maximum Detected	193.1	20
Mean of Detected Data	52.98	10.17
Median of Detected Data	37.24	8.5
SD of Detected Data	61.3	5.323

Wilcoxon-Mann-Whitney Site vs Background Test

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	223
WMW Test U-Stat	2.057
WMW Critical Value (0.050)	1.645
P-Value	0.0199

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

P-Value < alpha (0.05)

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Manganese POI AU 1999

Background Data: ManganeseBG

Raw Statistics

	Site	Background
Number of Valid Observations	10	23
Number of Distinct Observations	10	23
Minimum	23.9	163
Maximum	1760	1000
Mean	680.9	453
Median	512	368
SD	597.6	229.3
SE of Mean	189	47.81

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	31	1.603	1.696	0.06
Welch-Satterthwaite (Unequal Varian	10.2	1.169	1.812	0.134

Pooled SD 375.520

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	357184
Variance of Background	52583

Numerator DF	Denominator DF	F-Test Value	P-Value
9	22	6.793	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Mercury POI AU 1995

Background Data: MercuryBG

Raw Statistics

	Site	Background
Number of Valid Data	10	23
Number of Non-Detect Data	4	0
Number of Detect Data	6	23
Minimum Non-Detect	0.09	N/A
Maximum Non-Detect	0.11	N/A
Percent Non detects	40.00%	0.00%
Minimum Detected	0.1	0.0065
Maximum Detected	9.74	0.29
Mean of Detected Data	1.89	0.0865
Median of Detected Data	0.405	0.065
SD of Detected Data	3.851	0.0679

Wilcoxon-Mann-Whitney Site vs Background Test

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	213.5
WMW Test U-Stat	1.684
WMW Critical Value (0.050)	1.645
P-Value	0.046

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

P-Value < alpha (0.05)

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI AU 1995

Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	10	23
Number of Distinct Observations	10	23
Minimum	17.07	27.6
Maximum	488	85
Mean	133	55.43
Median	64.6	54.1
SD	147.5	14.98
SE of Mean	46.65	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	31	2.544	1.696	0.008
Welch-Satterthwaite (Unequal Varian	9.1	1.659	1.833	0.066

Pooled SD 80.477

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

*** Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background**

Test of Equality of Variances

Variance of Site	21760
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
9	22	97.022	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium POI AU 1999

Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	10	23
Number of Distinct Observations	10	23
Minimum	28	27.6
Maximum	627	85
Mean	151.8	55.43
Median	78.3	54.1
SD	180.1	14.98
SE of Mean	56.96	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	31	2.599	1.696	0.007
Welch-Satterthwaite (Unequal Varian	9.1	1.689	1.833	0.063

Pooled SD 97.869

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

*** Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background**

Test of Equality of Variances

Variance of Site	32443
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
9	22	144.658	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

SOUTHERN AU BACKGROUND TESTS

Area of Concern Data: Aluminum Southern AU subsurface 2000

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	6	23
Number of Distinct Observations	5	21
Minimum	13000	5940
Maximum	26900	16300
Mean	16867	11552
Median	14850	11500
SD	5244	3283
SE of Mean	2141	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	27	3.113	1.703	0.002
Welch-Satterthwaite (Unequal Varian	6.1	2.365	1.943	0.028

Pooled SD 3724.618

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	27498667
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
5	22	2.552	0.115

Conclusion with Alpha = 0.05

* Two variances appear to be equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Arsenic Southern AU surface 2000

Background Data: ArsenicBG

Raw Statistics

	Site	Background
Number of Valid Observations	22	23
Number of Distinct Observations	20	19
Minimum	0.76	2.1
Maximum	17.1	8.2
Mean	5.662	4.683
Median	4.2	4.6
SD	4.179	1.555
SE of Mean	0.891	0.324

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	43	1.051	1.681	0.15
Welch-Satterthwaite (Unequal Varian	26.5	1.033	1.706	0.156

Pooled SD 3.125

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	17.46
Variance of Background	2.418

Numerator DF	Denominator DF	F-Test Value	P-Value
21	22	7.222	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Cobalt Southern AU subsurface 2000

Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Observations	6	23
Number of Distinct Observations	6	23
Minimum	15.3	2.5
Maximum	67.4	20
Mean	43.68	10.17
Median	45.35	8.5
SD	22.42	5.323
SE of Mean	9.155	1.11

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	27	6.782	1.703	0
Welch-Satterthwaite (Unequal Varian	5.1	3.634	2.015	0.007

Pooled SD 10.780

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	502.8
Variance of Background	28.34

Numerator DF	Denominator DF	F-Test Value	P-Value
5	22	17.745	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Cobalt Southern AU surface 2000

Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Observations	22	23
Number of Distinct Observations	22	23
Minimum	5.5	2.5
Maximum	121	20
Mean	42.52	10.17
Median	32.45	8.5
SD	33.73	5.323
SE of Mean	7.19	1.11

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	43	4.544	1.681	0
Welch-Satterthwaite (Unequal Varian	22	4.447	1.717	0

Pooled SD 23.874

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	1137
Variance of Background	28.34

Numerator DF	Denominator DF	F-Test Value	P-Value
21	22	40.138	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Iron Southern AU subsurface 2000

Background Data: IronBG

Raw Statistics

	Site	Background
Number of Valid Observations	6	23
Number of Distinct Observations	6	22
Minimum	24400	14000
Maximum	45600	36200
Mean	36200	24643
Median	35100	23100
SD	8067	6635
SE of Mean	3293	1383

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	27	3.642	1.703	0.001
Welch-Satterthwaite (Unequal Varian	6.9	3.235	1.895	0.007

Pooled SD 6922.472

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	65080000
Variance of Background	44020751

Numerator DF	Denominator DF	F-Test Value	P-Value
5	22	1.478	0.474

Conclusion with Alpha = 0.05

* Two variances appear to be equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium Southern AU subsurface 2000

Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	6	23
Number of Distinct Observations	6	23
Minimum	30.5	27.6
Maximum	105	85
Mean	75.98	55.43
Median	79.1	54.1
SD	25.1	14.98
SE of Mean	10.25	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	27	2.592	1.703	0.008
Welch-Satterthwaite (Unequal Varian	6	1.919	1.943	0.052

Pooled SD 17.304

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	630.1
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
5	22	2.81	0.083

Conclusion with Alpha = 0.05

* Two variances appear to be equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	4801 Glenbrook Rd.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

4801 GR BACKGROUND TESTS

Area of Concern Data: Vanadium surface 4801 Glenbrook Rd 2000

Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	234	23
Number of Distinct Observations	178	23
Minimum	25.5	27.6
Maximum	132	85
Mean	63.02	55.43
Median	61.6	54.1
SD	18.72	14.98
SE of Mean	1.224	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	255	1.884	1.651	0.03
Welch-Satterthwaite (Unequal Varian	29.2	2.263	1.699	0.016

Pooled SD 18.430

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

*** Welch-Satterthwaite Test: Reject H0, Conclude Site > Background**

Test of Equality of Variances

Variance of Site	350.6
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
233	22	1.563	0.215

Conclusion with Alpha = 0.05

* Two variances appear to be equal

STEP 3b:

95% UCL RESULTS
BACKGROUND TEST RESULTS

(BY POI OR AREA OF INVESTIGATION)

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	POI 1 Sedgwick Trench.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

STEP 3b
POI 1
95% UCLS

Aluminum POI 1 Sedgwick Trench 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	12
Raw Statistics		**Log-transformed Statistics**	
Minimum	4007	Minimum of Log Data	8.296
Maximum	26900	Maximum of Log Data	10.2
Mean	18132	Mean of log Data	9.679
Geometric Mean	15974	SD of log Data	0.625
Median	19800		
SD	6758		
Std. Error of Mean	1874		
Coefficient of Variation	0.373		
Skewness	-1.495		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.79	Shapiro Wilk Test Statistic	0.627
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	21472	95% H-UCL	29234
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	34061
95% Adjusted-CLT UCL (Chen-1995)	20384	97.5% Chebyshev (MVUE) UCL	40540
95% Modified-t UCL (Johnson-1978)	21343	99% Chebyshev (MVUE) UCL	53268
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.21	Data do not follow a Discernable Distribution (0.05)	
Theta Star	5649		
MLE of Mean	18132		
MLE of Standard Deviation	10121		
nu star	83.45		
Approximate Chi Square Value (.05)	63.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	21215
Adjusted Chi Square Value	60.91	95% Jackknife UCL	21472
		95% Standard Bootstrap UCL	21085
Anderson-Darling Test Statistic	2.018	95% Bootstrap-t UCL	20771
Anderson-Darling 5% Critical Value	0.737	95% Hall's Bootstrap UCL	20415
Kolmogorov-Smirnov Test Statistic	0.352	95% Percentile Bootstrap UCL	20977
Kolmogorov-Smirnov 5% Critical Value	0.238	95% BCA Bootstrap UCL	20424
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	26301
		97.5% Chebyshev(Mean, Sd) UCL	29836
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	36780
95% Approximate Gamma UCL (Use when n >= 40)	23867		
95% Adjusted Gamma UCL (Use when n < 40)	24841		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	26301

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	POI 19.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 19
95% UCLs

Aluminum POI 19 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	12
Raw Statistics		**Log-transformed Statistics**	
Minimum	11200	Minimum of Log Data	9.324
Maximum	33900	Maximum of Log Data	10.43
Mean	18824	Mean of log Data	9.787
Geometric Mean	17810	SD of log Data	0.343
Median	18600		
SD	6693		
Std. Error of Mean	1856		
Coefficient of Variation	0.356		
Skewness	0.859		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.907	Shapiro Wilk Test Statistic	0.938
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22133	95% H-UCL	22917
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	26711
95% Adjusted-CLT UCL (Chen-1995)	22350	97.5% Chebyshev (MVUE) UCL	30134
95% Modified-t UCL (Johnson-1978)	22206	99% Chebyshev (MVUE) UCL	36856
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	7.118	Data appear Normal at 5% Significance Level	
Theta Star	2645		
MLE of Mean	18824		
MLE of Standard Deviation	7056		
nu star	185.1		
Approximate Chi Square Value (.05)	154.6	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	21877
Adjusted Chi Square Value	150.6	95% Jackknife UCL	22133
		95% Standard Bootstrap UCL	21713
Anderson-Darling Test Statistic	0.418	95% Bootstrap-t UCL	22865
Anderson-Darling 5% Critical Value	0.734	95% Hall's Bootstrap UCL	22801
Kolmogorov-Smirnov Test Statistic	0.207	95% Percentile Bootstrap UCL	21869
Kolmogorov-Smirnov 5% Critical Value	0.237	95% BCA Bootstrap UCL	22462
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	26915
		97.5% Chebyshev(Mean, Sd) UCL	30416
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	37293
95% Approximate Gamma UCL (Use when n >= 40)	22534		
95% Adjusted Gamma UCL (Use when n < 40)	23128		
Potential UCL to Use		Use 95% Student's-t UCL	22133

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	POI 24.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 24
95% UCLs

Aluminum POI 24 1999

General Statistics

Number of Valid Observations	11	Number of Distinct Observations	4

Raw Statistics		Log-transformed Statistics	
Minimum	12914	Minimum of Log Data	9.466
Maximum	21500	Maximum of Log Data	9.976
Mean	14228	Mean of log Data	9.549
Geometric Mean	14024	SD of log Data	0.17
Median	12914		
SD	2794		
Std. Error of Mean	842.5		
Coefficient of Variation	0.196		
Skewness	2.267		

It is necessary to have 4 or more Distinct Values to compute bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10-15 or more observations for accurate and meaningful bootstrap results.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.563	Shapiro Wilk Test Statistic	0.577
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	15755	95% H-UCL	15703
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	17390
95% Adjusted-CLT UCL (Chen-1995)	16229	97.5% Chebyshev (MVUE) UCL	18766
95% Modified-t UCL (Johnson-1978)	15851	99% Chebyshev (MVUE) UCL	21470
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	25.34	Data do not follow a Discernable Distribution (0.05)	
Theta Star	561.5		
MLE of Mean	14228		
MLE of Standard Deviation	2827		
nu star	557.4		
Approximate Chi Square Value (.05)	503.7	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	15614
Adjusted Chi Square Value	495.3	95% Jackknife UCL	15755
		95% Standard Bootstrap UCL	15475
Anderson-Darling Test Statistic	2.325	95% Bootstrap-t UCL	20627
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	21492
Kolmogorov-Smirnov Test Statistic	0.421	95% Percentile Bootstrap UCL	15681
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	16108
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	17901
		97.5% Chebyshev(Mean, Sd) UCL	19490
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	22611
95% Approximate Gamma UCL (Use when n >= 40)	15747		
95% Adjusted Gamma UCL (Use when n < 40)	16012		
Potential UCL to Use		Use 95% Student's-t UCL	15755
		or 95% Modified-t UCL	15851

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Antimony POI 24 1999

General Statistics			
Number of Valid Observations	11	Number of Distinct Observations	4

Raw Statistics		Log-transformed Statistics	
Minimum	0.251	Minimum of Log Data	-1.381
Maximum	14.9	Maximum of Log Data	2.701
Mean	3.128	Mean of log Data	-0.372
Geometric Mean	0.689	SD of log Data	1.74
Median	0.251		
SD	5.292		
Std. Error of Mean	1.595		
Coefficient of Variation	1.692		
Skewness	1.649		

It is necessary to have 4 or more Distinct Values to compute bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10-15 or more observations for accurate and meaningful bootstrap results.

Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.622	Shapiro Wilk Test Statistic	0.604
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	6.02	95% H-UCL	38.54
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	8.294
95% Adjusted-CLT UCL (Chen-1995)	6.6	97.5% Chebyshev (MVUE) UCL	10.84
95% Modified-t UCL (Johnson-1978)	6.152	99% Chebyshev (MVUE) UCL	15.85
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.373	Data do not follow a Discernable Distribution (0.05)	
Theta Star	8.378		
MLE of Mean	3.128		
MLE of Standard Deviation	5.119		
nu star	8.214		
Approximate Chi Square Value (.05)	2.86	Nonparametric Statistics	
Adjusted Level of Significance	0.0278	95% CLT UCL	5.752
Adjusted Chi Square Value	2.37	95% Jackknife UCL	6.02
		95% Standard Bootstrap UCL	5.544
Anderson-Darling Test Statistic	2.222	95% Bootstrap-t UCL	6.971
Anderson-Darling 5% Critical Value	0.795	95% Hall's Bootstrap UCL	5.063
Kolmogorov-Smirnov Test Statistic	0.465	95% Percentile Bootstrap UCL	5.901
Kolmogorov-Smirnov 5% Critical Value	0.271	95% BCA Bootstrap UCL	5.901
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	10.08
		97.5% Chebyshev(Mean, Sd) UCL	13.09
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	19
95% Approximate Gamma UCL (Use when n >= 40)	8.986		
95% Adjusted Gamma UCL (Use when n < 40)	10.84		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	19

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.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	POI 38 Major Tolman's.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 38
95% UCLs

Aluminum POI 38 Major Tolman's 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	13
Raw Statistics		**Log-transformed Statistics**	
Minimum	4007	Minimum of Log Data	8.296
Maximum	30400	Maximum of Log Data	10.32
Mean	22270	Mean of log Data	9.929
Geometric Mean	20517	SD of log Data	0.515
Median	24700		
SD	6580		
Std. Error of Mean	1825		
Coefficient of Variation	0.295		
Skewness	-1.855		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.812	Shapiro Wilk Test Statistic	0.59
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	25522	95% H-UCL	32149
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	37979
95% Adjusted-CLT UCL (Chen-1995)	24268	97.5% Chebyshev (MVUE) UCL	44390
95% Modified-t UCL (Johnson-1978)	25366	99% Chebyshev (MVUE) UCL	56983
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.867	Data do not follow a Discernable Distribution (0.05)	
Theta Star	4575		
MLE of Mean	22270		
MLE of Standard Deviation	10094		
nu star	126.6		
Approximate Chi Square Value (.05)	101.6	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	25271
Adjusted Chi Square Value	98.38	95% Jackknife UCL	25522
		95% Standard Bootstrap UCL	25196
Anderson-Darling Test Statistic	1.633	95% Bootstrap-t UCL	24799
Anderson-Darling 5% Critical Value	0.735	95% Hall's Bootstrap UCL	24573
Kolmogorov-Smirnov Test Statistic	0.29	95% Percentile Bootstrap UCL	24762
Kolmogorov-Smirnov 5% Critical Value	0.237	95% BCA Bootstrap UCL	24431
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	30224
		97.5% Chebyshev(Mean, Sd) UCL	33666
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	40427
95% Approximate Gamma UCL (Use when n >= 40)	27747		
95% Adjusted Gamma UCL (Use when n < 40)	28646		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	30224

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI 53
95% UCLs

Aluminum POI 53 Baker Valley 1999

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	9

Raw Statistics		**Log-transformed Statistics**	
Minimum	11900	Minimum of Log Data	9.384
Maximum	43900	Maximum of Log Data	10.69
Mean	21526	Mean of log Data	9.897
Geometric Mean	19880	SD of log Data	0.407
Median	17150		
SD	9769		
Std. Error of Mean	3089		
Coefficient of Variation	0.454		
Skewness	1.436		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.834	Shapiro Wilk Test Statistic	0.915
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	27189	95% H-UCL	28706
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	33567
95% Adjusted-CLT UCL (Chen-1995)	28106	97.5% Chebyshev (MVUE) UCL	38828
95% Modified-t UCL (Johnson-1978)	27423	99% Chebyshev (MVUE) UCL	49163
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.578	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	4702		
MLE of Mean	21526		
MLE of Standard Deviation	10060		
nu star	91.57		
Approximate Chi Square Value (.05)	70.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	26608
Adjusted Chi Square Value	67.3	95% Jackknife UCL	27189
		95% Standard Bootstrap UCL	26459
Anderson-Darling Test Statistic	0.544	95% Bootstrap-t UCL	29623
Anderson-Darling 5% Critical Value	0.728	95% Hall's Bootstrap UCL	29432
Kolmogorov-Smirnov Test Statistic	0.22	95% Percentile Bootstrap UCL	26576
Kolmogorov-Smirnov 5% Critical Value	0.267	95% BCA Bootstrap UCL	27910
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	34992
		97.5% Chebyshev(Mean, Sd) UCL	40819
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	52265
95% Approximate Gamma UCL (Use when n >= 40)	27958		
95% Adjusted Gamma UCL (Use when n < 40)	29290		
Potential UCL to Use		**Use 95% Approximate Gamma UCL 27958**	

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

POI AU
95% UCLs

Aluminum POI AU 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	11

Raw Statistics		Log-transformed Statistics	
Minimum	9120	Minimum of Log Data	9.118
Maximum	57700	Maximum of Log Data	10.96
Mean	28778	Mean of log Data	10.15
Geometric Mean	25503	SD of log Data	0.535
Median	27131		
SD	13947		
Std. Error of Mean	3868		
Coefficient of Variation	0.485		
Skewness	0.563		

Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.954	Shapiro Wilk Test Statistic	0.957
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	35672	95% H-UCL	41013
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	48395
95% Adjusted-CLT UCL (Chen-1995)	35786	97.5% Chebyshev (MVUE) UCL	56760
95% Modified-t UCL (Johnson-1978)	35773	99% Chebyshev (MVUE) UCL	73192
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	3.358	Data appear Normal at 5% Significance Level	
Theta Star	8571		
MLE of Mean	28778		
MLE of Standard Deviation	15705		
nu star	87.3		
Approximate Chi Square Value (.05)	66.76	Nonparametric Statistics	
Adjusted Level of Significance	0.0301	95% CLT UCL	35141
Adjusted Chi Square Value	64.21	95% Jackknife UCL	35672
		95% Standard Bootstrap UCL	34958
Anderson-Darling Test Statistic	0.246	95% Bootstrap-t UCL	36391
Anderson-Darling 5% Critical Value	0.737	95% Hall's Bootstrap UCL	36522
Kolmogorov-Smirnov Test Statistic	0.144	95% Percentile Bootstrap UCL	35140
Kolmogorov-Smirnov 5% Critical Value	0.238	95% BCA Bootstrap UCL	35579
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	45639
		97.5% Chebyshev(Mean, Sd) UCL	52935
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	67267
95% Approximate Gamma UCL (Use when n >= 40)	37632		
95% Adjusted Gamma UCL (Use when n < 40)	39129		
Potential UCL to Use		Use 95% Student's-t UCL	35672

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Aluminum POI AU 1995

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	11

Raw Statistics		Log-transformed Statistics	
Minimum	8679	Minimum of Log Data	9.069
Maximum	56138	Maximum of Log Data	10.94
Mean	28485	Mean of log Data	10.12
Geometric Mean	24862	SD of log Data	0.57
Median	27131		
SD	14331		
Std. Error of Mean	3830		
Coefficient of Variation	0.503		
Skewness	0.423		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.949	Shapiro Wilk Test Statistic	0.939
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	35268	95% H-UCL	40921
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	48691
95% Adjusted-CLT UCL (Chen-1995)	35247	97.5% Chebyshev (MVUE) UCL	57271
95% Modified-t UCL (Johnson-1978)	35340	99% Chebyshev (MVUE) UCL	74126
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.061	Data appear Normal at 5% Significance Level	
Theta Star	9307		
MLE of Mean	28485		
MLE of Standard Deviation	16282		
nu star	85.7		
Approximate Chi Square Value (.05)	65.36	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	34785
Adjusted Chi Square Value	63.01	95% Jackknife UCL	35268
		95% Standard Bootstrap UCL	34348
Anderson-Darling Test Statistic	0.312	95% Bootstrap-t UCL	36126
Anderson-Darling 5% Critical Value	0.741	95% Hall's Bootstrap UCL	35704
Kolmogorov-Smirnov Test Statistic	0.174	95% Percentile Bootstrap UCL	34741
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	34803
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	45180
		97.5% Chebyshev(Mean, Sd) UCL	52404
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	66595
95% Approximate Gamma UCL (Use when n >= 40)	37348		
95% Adjusted Gamma UCL (Use when n < 40)	38743		
Potential UCL to Use		**Use 95% Student's-t UCL**	**35268**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Antimony POI AU 1999

General Statistics			
Number of Valid Observations	13	Number of Distinct Observations	11

Raw Statistics		Log-transformed Statistics	
Minimum	1.458	Minimum of Log Data	0.377
Maximum	40.4	Maximum of Log Data	3.699
Mean	16.84	Mean of log Data	2.32
Geometric Mean	10.18	SD of log Data	1.232
Median	14.1		
SD	13.71		
Std. Error of Mean	3.802		
Coefficient of Variation	0.814		
Skewness	0.52		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.906	Shapiro Wilk Test Statistic	0.857
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	23.62	95% H-UCL	69.45
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	52.37
95% Adjusted-CLT UCL (Chen-1995)	23.68	97.5% Chebyshev (MVUE) UCL	66.43
95% Modified-t UCL (Johnson-1978)	23.71	99% Chebyshev (MVUE) UCL	94.05
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.921	Data appear Normal at 5% Significance Level	
Theta Star	18.29		
MLE of Mean	16.84		
MLE of Standard Deviation	17.55		
nu star	23.94		
Approximate Chi Square Value (.05)	13.8	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	23.1
Adjusted Chi Square Value	12.72	95% Jackknife UCL	23.62
		95% Standard Bootstrap UCL	22.72
Anderson-Darling Test Statistic	0.444	95% Bootstrap-t UCL	24.33
Anderson-Darling 5% Critical Value	0.756	95% Hall's Bootstrap UCL	23.07
Kolmogorov-Smirnov Test Statistic	0.166	95% Percentile Bootstrap UCL	22.94
Kolmogorov-Smirnov 5% Critical Value	0.242	95% BCA Bootstrap UCL	23.17
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	33.42
		97.5% Chebyshev(Mean, Sd) UCL	40.59
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	54.67
95% Approximate Gamma UCL (Use when n >= 40)	29.21		
95% Adjusted Gamma UCL (Use when n < 40)	31.71		
Potential UCL to Use		**Use 95% Student's-t UCL**	**23.62**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Cobalt POI AU 1995

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	11

Raw Statistics		Log-transformed Statistics	
Minimum	1.59	Minimum of Log Data	0.464
Maximum	193.1	Maximum of Log Data	5.263
Mean	39.1	Mean of log Data	3.002
Geometric Mean	20.12	SD of log Data	1.26
Median	18.02		
SD	51.97		
Std. Error of Mean	13.89		
Coefficient of Variation	1.329		
Skewness	2.431		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.664	Shapiro Wilk Test Statistic	0.948
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	63.7	95% H-UCL	138.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	107.2
95% Adjusted-CLT UCL (Chen-1995)	71.59	97.5% Chebyshev (MVUE) UCL	135.9
95% Modified-t UCL (Johnson-1978)	65.2	99% Chebyshev (MVUE) UCL	192.4
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.741	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	52.78		
MLE of Mean	39.1		
MLE of Standard Deviation	45.43		
nu star	20.74		
Approximate Chi Square Value (.05)	11.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	61.95
Adjusted Chi Square Value	10.49	95% Jackknife UCL	63.7
		95% Standard Bootstrap UCL	61.12
Anderson-Darling Test Statistic	0.597	95% Bootstrap-t UCL	107.3
Anderson-Darling 5% Critical Value	0.765	95% Hall's Bootstrap UCL	171.9
Kolmogorov-Smirnov Test Statistic	0.233	95% Percentile Bootstrap UCL	64.28
Kolmogorov-Smirnov 5% Critical Value	0.236	95% BCA Bootstrap UCL	72.32
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	99.65
		97.5% Chebyshev(Mean, Sd) UCL	125.8
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	177.3
95% Approximate Gamma UCL (Use when n >= 40)	71.14		
95% Adjusted Gamma UCL (Use when n < 40)	77.31		
Potential UCL to Use		**Use 95% Approximate Gamma UCL 71.14**	

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Mercury POI AU 1995

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	9

Raw Statistics		Log-transformed Statistics	
Minimum	0.0241	Minimum of Log Data	-3.727
Maximum	9.74	Maximum of Log Data	2.276
Mean	0.846	Mean of log Data	-2.043
Geometric Mean	0.13	SD of log Data	1.642
Median	0.105		
SD	2.566		
Std. Error of Mean	0.686		
Coefficient of Variation	3.032		
Skewness	3.711		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.348	Shapiro Wilk Test Statistic	0.848
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2.061	95% H-UCL	3.031
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.313
95% Adjusted-CLT UCL (Chen-1995)	2.701	97.5% Chebyshev (MVUE) UCL	1.702
95% Modified-t UCL (Johnson-1978)	2.174	99% Chebyshev (MVUE) UCL	2.465
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.328	Data do not follow a Discernable Distribution (0.05)	
Theta Star	2.577		
MLE of Mean	0.846		
MLE of Standard Deviation	1.477		
nu star	9.192		
Approximate Chi Square Value (.05)	3.443	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	1.974
Adjusted Chi Square Value	2.992	95% Jackknife UCL	2.061
		95% Standard Bootstrap UCL	1.953
Anderson-Darling Test Statistic	2.085	95% Bootstrap-t UCL	15.2
Anderson-Darling 5% Critical Value	0.821	95% Hall's Bootstrap UCL	11.27
Kolmogorov-Smirnov Test Statistic	0.322	95% Percentile Bootstrap UCL	2.213
Kolmogorov-Smirnov 5% Critical Value	0.246	95% BCA Bootstrap UCL	2.891
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	3.835
		97.5% Chebyshev(Mean, Sd) UCL	5.129
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	7.67
95% Approximate Gamma UCL (Use when n >= 40)	2.259		
95% Adjusted Gamma UCL (Use when n < 40)	2.6		

Potential UCL to Use	Use 99% Chebyshev (Mean, Sd) UCL 7.67

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	General UCL Statistics for Full Data Sets
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

SOUTHERN AU (2000)
95% UCLs

Aluminum Southern AU subsurface 2000

General Statistics

Number of Valid Observations	7	Number of Distinct Observations	6

Raw Statistics		Log-transformed Statistics	
Minimum	13000	Minimum of Log Data	9.473
Maximum	26900	Maximum of Log Data	10.2
Mean	16979	Mean of log Data	9.711
Geometric Mean	16492	SD of log Data	0.251
Median	16000		
SD	4796		
Std. Error of Mean	1813		
Coefficient of Variation	0.282		
Skewness	1.783		

It is suggested to collect at least 8 to 10 observations using these statistical methods!

If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.797	Shapiro Wilk Test Statistic	0.861
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	20502	95% H-UCL	21078
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23948
95% Adjusted-CLT UCL (Chen-1995)	21266	97.5% Chebyshev (MVUE) UCL	26980
95% Modified-t UCL (Johnson-1978)	20705	99% Chebyshev (MVUE) UCL	32936
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	10.01	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	1696		
MLE of Mean	16979		
MLE of Standard Deviation	5367		
nu star	140.1		
Approximate Chi Square Value (.05)	113.8	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	19961
Adjusted Chi Square Value	106.6	95% Jackknife UCL	20502
		95% Standard Bootstrap UCL	19700
Anderson-Darling Test Statistic	0.541	95% Bootstrap-t UCL	23652
Anderson-Darling 5% Critical Value	0.707	95% Hall's Bootstrap UCL	31649
Kolmogorov-Smirnov Test Statistic	0.239	95% Percentile Bootstrap UCL	19957
Kolmogorov-Smirnov 5% Critical Value	0.312	95% BCA Bootstrap UCL	20614
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	24881
		97.5% Chebyshev(Mean, Sd) UCL	28300
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	35016
95% Approximate Gamma UCL (Use when n >= 40)	20912		
95% Adjusted Gamma UCL (Use when n < 40)	22319		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**20912**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Cobalt Southern AU surface 2000

General Statistics			
Number of Valid Observations	31	Number of Distinct Observations	23

Raw Statistics		Log-transformed Statistics	
Minimum	5.5	Minimum of Log Data	1.705
Maximum	121	Maximum of Log Data	4.796
Mean	32.34	Mean of log Data	3.042
Geometric Mean	20.94	SD of log Data	0.943
Median	19.1		
SD	32.53		
Std. Error of Mean	5.842		
Coefficient of Variation	1.006		
Skewness	1.673		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.765	Shapiro Wilk Test Statistic	0.912
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	42.26	95% H-UCL	49.05
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	58.94
95% Adjusted-CLT UCL (Chen-1995)	43.83	97.5% Chebyshev (MVUE) UCL	70.59
95% Modified-t UCL (Johnson-1978)	42.55	99% Chebyshev (MVUE) UCL	93.46
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.188	Data do not follow a Discernable Distribution (0.05)	
Theta Star	27.21		
MLE of Mean	32.34		
MLE of Standard Deviation	29.67		
nu star	73.69		
Approximate Chi Square Value (.05)	54.92	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0413	95% CLT UCL	41.95
Adjusted Chi Square Value	54.02	95% Jackknife UCL	42.26
		95% Standard Bootstrap UCL	41.96
Anderson-Darling Test Statistic	1.051	95% Bootstrap-t UCL	45.17
Anderson-Darling 5% Critical Value	0.769	95% Hall's Bootstrap UCL	43.92
Kolmogorov-Smirnov Test Statistic	0.17	95% Percentile Bootstrap UCL	42.06
Kolmogorov-Smirnov 5% Critical Value	0.161	95% BCA Bootstrap UCL	44.7
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	57.81
		97.5% Chebyshev(Mean, Sd) UCL	68.82
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	90.47
95% Approximate Gamma UCL (Use when n >= 40)	43.39		
95% Adjusted Gamma UCL (Use when n < 40)	44.12		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	57.81

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Cobalt Southern AU subsurface 2000

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	7.452	Minimum of Log Data	2.008
Maximum	67.4	Maximum of Log Data	4.211
Mean	38.51	Mean of log Data	3.408
Geometric Mean	30.19	SD of log Data	0.827
Median	29.5		
SD	24.63		
Std. Error of Mean	9.309		
Coefficient of Variation	0.64		
Skewness	0.0655		

It is suggested to collect at least 8 to 10 observations using these statistical methods!

If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.875	Shapiro Wilk Test Statistic	0.894
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	56.6	95% H-UCL	126.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	95.03
95% Adjusted-CLT UCL (Chen-1995)	54.07	97.5% Chebyshev (MVUE) UCL	118.8
95% Modified-t UCL (Johnson-1978)	56.63	99% Chebyshev (MVUE) UCL	165.5
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.357	Data appear Normal at 5% Significance Level	
Theta Star	28.38		
MLE of Mean	38.51		
MLE of Standard Deviation	33.06		
nu star	18.99		
Approximate Chi Square Value (.05)	10.11	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	53.82
Adjusted Chi Square Value	8.23	95% Jackknife UCL	56.6
		95% Standard Bootstrap UCL	52.64
Anderson-Darling Test Statistic	0.404	95% Bootstrap-t UCL	56.74
Anderson-Darling 5% Critical Value	0.714	95% Hall's Bootstrap UCL	50.08
Kolmogorov-Smirnov Test Statistic	0.261	95% Percentile Bootstrap UCL	52.14
Kolmogorov-Smirnov 5% Critical Value	0.315	95% BCA Bootstrap UCL	54.23
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	79.08
		97.5% Chebyshev(Mean, Sd) UCL	96.64
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	131.1
95% Approximate Gamma UCL (Use when n >= 40)	72.32		
95% Adjusted Gamma UCL (Use when n < 40)	88.86		
Potential UCL to Use		Use 95% Student's-t UCL	56.6

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

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Iron Southern AU subsurface 2000

General Statistics			
Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	24400	Minimum of Log Data	10.1
Maximum	45600	Maximum of Log Data	10.73
Mean	35363	Mean of log Data	10.45
Geometric Mean	34642	SD of log Data	0.22
Median	33900		
SD	7690		
Std. Error of Mean	2907		
Coefficient of Variation	0.217		
Skewness	0.236		

It is suggested to collect at least 8 to 10 observations using these statistical methods!

If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.935	Shapiro Wilk Test Statistic	0.948
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	41011	95% H-UCL	42604
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	48234
95% Adjusted-CLT UCL (Chen-1995)	40420	97.5% Chebyshev (MVUE) UCL	53800
95% Modified-t UCL (Johnson-1978)	41054	99% Chebyshev (MVUE) UCL	64734
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	14.06	Data appear Normal at 5% Significance Level	
Theta Star	2515		
MLE of Mean	35363		
MLE of Standard Deviation	9430		
nu star	196.9		
Approximate Chi Square Value (.05)	165.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0158	95% CLT UCL	40144
Adjusted Chi Square Value	156.7	95% Jackknife UCL	41011
		95% Standard Bootstrap UCL	39775
Anderson-Darling Test Statistic	0.271	95% Bootstrap-t UCL	42710
Anderson-Darling 5% Critical Value	0.707	95% Hall's Bootstrap UCL	44607
Kolmogorov-Smirnov Test Statistic	0.188	95% Percentile Bootstrap UCL	39863
Kolmogorov-Smirnov 5% Critical Value	0.311	95% BCA Bootstrap UCL	40214
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	48033
		97.5% Chebyshev(Mean, Sd) UCL	53515
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	64284
95% Approximate Gamma UCL (Use when n >= 40)	42089		
95% Adjusted Gamma UCL (Use when n < 40)	44434		
Potential UCL to Use		**Use 95% Student's-t UCL**	**41011**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Vanadium Southern AU subsurface 2000

General Statistics

Number of Valid Observations	7	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	30.5	Minimum of Log Data	3.418
Maximum	105	Maximum of Log Data	4.654
Mean	72.99	Mean of log Data	4.228
Geometric Mean	68.61	SD of log Data	0.409
Median	76.2		
SD	24.25		
Std. Error of Mean	9.165		
Coefficient of Variation	0.332		
Skewness	-0.723		

It is suggested to collect at least 8 to 10 observations using these statistical methods!

If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.964	Shapiro Wilk Test Statistic	0.873
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	90.8	95% H-UCL	109.5
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	123.5
95% Adjusted-CLT UCL (Chen-1995)	85.39	97.5% Chebyshev (MVUE) UCL	145.1
95% Modified-t UCL (Johnson-1978)	90.38	99% Chebyshev (MVUE) UCL	187.5

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	4.808	Data appear Normal at 5% Significance Level	
Theta Star	15.18		
MLE of Mean	72.99		
MLE of Standard Deviation	33.29		
nu star	67.31		
Approximate Chi Square Value (.05)	49.43	Nonparametric Statistics	
Adjusted Level of Significance	0.0158	95% CLT UCL	88.06
Adjusted Chi Square Value	44.84	95% Jackknife UCL	90.8
		95% Standard Bootstrap UCL	87.09
Anderson-Darling Test Statistic	0.387	95% Bootstrap-t UCL	88.77
Anderson-Darling 5% Critical Value	0.709	95% Hall's Bootstrap UCL	86.49
Kolmogorov-Smirnov Test Statistic	0.251	95% Percentile Bootstrap UCL	86.11
Kolmogorov-Smirnov 5% Critical Value	0.312	95% BCA Bootstrap UCL	84.79
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	112.9
		97.5% Chebyshev(Mean, Sd) UCL	130.2
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	164.2
95% Approximate Gamma UCL (Use when n >= 40)	99.39		
95% Adjusted Gamma UCL (Use when n < 40)	109.6		

Potential UCL to Use	Use 95% Student's-t UCL 90.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 1 Sedgwick Trench.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

STEP 3b
POI 1
BACKGROUND TESTS

Area of Concern Data: Aluminum POI 1 Sedgwick Trench 1999

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	12	21
Minimum	4007	5940
Maximum	26900	16300
Mean	18132	11552
Median	19800	11500
SD	6758	3283
SE of Mean	1874	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	3.946	1.691	0
Welch-Satterthwaite (Unequal Varian	15.3	3.298	1.753	0.002

Pooled SD 4805.214

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	45665912
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	4.238	0.003

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 19.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

POI 19
BACKGROUND TESTS

Area of Concern Data: Aluminum POI 19 1999

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	12	21
Minimum	11200	5940
Maximum	33900	16300
Mean	18824	11552
Median	18600	11500
SD	6693	3283
SE of Mean	1856	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	4.391	1.691	0
Welch-Satterthwaite (Unequal Varian	15.3	3.676	1.753	0.001

Pooled SD 4772.925

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	44789658
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	4.156	0.004

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 24.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

POI 24
BACKGROUND TESTS

Area of Concern Data: Aluminum POI 24 1999

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	11	23
Number of Distinct Observations	4	21
Minimum	12914	5940
Maximum	21500	16300
Mean	14228	11552
Median	12914	11500
SD	2794	3283
SE of Mean	842.5	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	32	2.326	1.694	0.013
Welch-Satterthwaite (Unequal Varian	23	2.465	1.714	0.011

Pooled SD 3138.265

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	7808678
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
22	10	1.38	0.612

Conclusion with Alpha = 0.05

* Two variances appear to be equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 24.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Antimony POI 24 1999

Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Observations	11	23
Number of Distinct Observations	4	19
Minimum	0.251	0.36
Maximum	14.9	7.4
Mean	3.128	2.943
Median	0.251	1.2
SD	5.292	2.567
SE of Mean	1.595	0.535

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	32	0.138	1.694	0.445
Welch-Satterthwaite (Unequal Varian	12.3	0.11	1.782	0.457

Pooled SD 3.644

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	28
Variance of Background	6.587

Numerator DF	Denominator DF	F-Test Value	P-Value
10	22	4.251	0.004

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 38 Major Tolman's.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

POI 38
BACKGROUND TESTS

Area of Concern Data: Aluminum POI 38 Major Tolman's 1999

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	13	21
Minimum	4007	5940
Maximum	30400	16300
Mean	22270	11552
Median	24700	11500
SD	6580	3283
SE of Mean	1825	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	6.548	1.691	0
Welch-Satterthwaite (Unequal Varian	15.4	5.499	1.753	0

Pooled SD 4717.165

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	43290345
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	4.017	0.005

Conclusion with Alpha = 0.05

* Two variances are not equal

POI 53
BACKGROUND TESTS

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI 53 Baker Valley.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI 53 Baker Valley 1999

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	10	23
Number of Distinct Observations	9	21
Minimum	11900	5940
Maximum	43900	16300
Mean	21526	11552
Median	17150	11500
SD	9769	3283
SE of Mean	3089	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	31	4.428	1.696	0
Welch-Satterthwaite (Unequal Varian	9.9	3.152	1.812	0.005

Pooled SD 5946.066

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	95439451
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
9	22	8.857	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

POI AU
BACKGROUND TESTS

Area of Concern Data: Aluminum POI AU 1995

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	14	23
Number of Distinct Observations	11	21
Minimum	8679	5940
Maximum	56138	16300
Mean	28485	11552
Median	27131	11500
SD	14331	3283
SE of Mean	3830	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	35	5.481	1.69	0
Welch-Satterthwaite (Unequal Varian	13.8	4.352	1.761	0

Pooled SD 9113.769

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	205400000
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
13	22	19.06	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Aluminum POI AU 1999

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	11	21
Minimum	9120	5940
Maximum	57700	16300
Mean	28778	11552
Median	27131	11500
SD	13947	3283
SE of Mean	3868	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	5.708	1.691	0
Welch-Satterthwaite (Unequal Varian	12.8	4.385	1.771	0

Pooled SD 8696.487

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	194500000
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	18.052	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Antimony POI AU 1999

Background Data: AntimonyBG

Raw Statistics

	Site	Background
Number of Valid Observations	13	23
Number of Distinct Observations	11	19
Minimum	1.458	0.36
Maximum	40.4	7.4
Mean	16.84	2.943
Median	14.1	1.2
SD	13.71	2.567
SE of Mean	3.802	0.535

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	4.769	1.691	0
Welch-Satterthwaite (Unequal Varian	12.5	3.621	1.782	0.002

Pooled SD 8.401

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	187.9
Variance of Background	6.587

Numerator DF	Denominator DF	F-Test Value	P-Value
12	22	28.524	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Cobalt POI AU 1995

Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Observations	14	23
Number of Distinct Observations	11	23
Minimum	1.59	2.5
Maximum	193.1	20
Mean	39.1	10.17
Median	18.02	8.5
SD	51.97	5.323
SE of Mean	13.89	1.11

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	35	2.671	1.69	0.006
Welch-Satterthwaite (Unequal Varian	13.2	2.076	1.771	0.029

Pooled SD 31.955

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	2701
Variance of Background	28.34

Numerator DF	Denominator DF	F-Test Value	P-Value
13	22	95.323	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	POI AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Mercury POI AU 1995

Background Data: MercuryBG

Raw Statistics

	Site	Background
Number of Valid Observations	14	23
Number of Distinct Observations	9	21
Minimum	0.0241	0.0065
Maximum	9.74	0.29
Mean	0.846	0.0865
Median	0.105	0.065
SD	2.566	0.0679
SE of Mean	0.686	0.0142

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	35	1.432	1.69	0.08
Welch-Satterthwaite (Unequal Varian	13	1.107	1.771	0.144

Pooled SD 1.565

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	6.584
Variance of Background	0.00461

Numerator DF	Denominator DF	F-Test Value	P-Value
13	22	1428.314	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

SOUTHERN AU (2000)
BACKGROUND TESTS

Area of Concern Data: Aluminum Southern AU subsurface 2000

Background Data: AluminumBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	6	21
Minimum	13000	5940
Maximum	26900	16300
Mean	16979	11552
Median	16000	11500
SD	4796	3283
SE of Mean	1813	684.5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	3.435	1.701	0.001
Welch-Satterthwaite (Unequal Varian	7.8	2.801	1.86	0.012

Pooled SD 3660.089

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	23003868
Variance of Background	10775991

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	2.135	0.18

Conclusion with Alpha = 0.05

* Two variances appear to be equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Cobalt Southern AU surface 2000

Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Observations	31	23
Number of Distinct Observations	23	23
Minimum	5.5	2.5
Maximum	121	20
Mean	32.34	10.17
Median	19.1	8.5
SD	32.53	5.323
SE of Mean	5.842	1.11

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	52	3.229	1.675	0.001
Welch-Satterthwaite (Unequal Varian	32.1	3.728	1.694	0

Pooled SD 24.948

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	1058
Variance of Background	28.34

Numerator DF	Denominator DF	F-Test Value	P-Value
30	22	37.338	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Cobalt Southern AU subsurface 2000

Background Data: CobaltBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	23
Minimum	7.452	2.5
Maximum	67.4	20
Mean	38.51	10.17
Median	29.5	8.5
SD	24.63	5.323
SE of Mean	9.309	1.11

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	5.32	1.701	0
Welch-Satterthwaite (Unequal Varian	6.2	3.023	1.943	0.011

Pooled SD 12.339

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	606.6
Variance of Background	28.34

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	21.406	0

Conclusion with Alpha = 0.05

* Two variances are not equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Iron Southern AU subsurface 2000

Background Data: IronBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	22
Minimum	24400	14000
Maximum	45600	36200
Mean	35363	24643
Median	33900	23100
SD	7690	6635
SE of Mean	2907	1383

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	3.612	1.701	0.001
Welch-Satterthwaite (Unequal Varian	8.9	3.33	1.833	0.004

Pooled SD 6874.683

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	59143177
Variance of Background	44020751

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	1.344	0.561

Conclusion with Alpha = 0.05

* Two variances appear to be equal

	t-Test Site vs Background Comparison for Full Data Sets without NDs
User Selected Options	
From File	Southern AU.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Vanadium Southern AU subsurface 2000

Background Data: VanadiumBG

Raw Statistics

	Site	Background
Number of Valid Observations	7	23
Number of Distinct Observations	7	23
Minimum	30.5	27.6
Maximum	105	85
Mean	72.99	55.43
Median	76.2	54.1
SD	24.25	14.98
SE of Mean	9.165	3.123

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	28	2.34	1.701	0.013
Welch-Satterthwaite (Unequal Varian	7.4	1.814	1.895	0.055

Pooled SD 17.385

Conclusion with Alpha = 0.050

*** Student t (Pooled) Test: Reject H0, Conclude Site > Background**

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	588
Variance of Background	224.3

Numerator DF	Denominator DF	F-Test Value	P-Value
6	22	2.622	0.09

Conclusion with Alpha = 0.05

* Two variances appear to be equal