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VIA ELECTRONIC DELIVERY
AND REGULAR MAIL

April 11, 2019

Karen Mason-Smith
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Mail Code SR-6J
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Chicago, IL 60604

Re: Screening Level Ecological Risk Assessment Addendum;
Gary Development Landfill Superfund Site

Dear Ms. Mason-Smith:

On behalf of the Gary Development Landfill Site PRP Group (Respondents), the Screening Level Ecological Risk Assessment (SLERA) Addendum is attached for United States Environmental Protection Agency (EPA) review and approval. The SLERA Addendum is being provided in accordance with EPA's letter dated March 15, 2019, in which EPA provided Conditional Approval of the Revised Final Remedial Investigation (RI) Report. Consistent with EPA's direction during resolution of EPA's comments on the RI Report, the SLERA was terminated after the screening level step, and additional refinement steps were to be provided in a separate SLERA Addendum, following EPA approval of the RI Report. A hard copy of the SLERA Addendum is being mailed.

It is the Respondents' understanding that EPA has no further comments on the Revised Final RI Report, and once the attached submittal, along with the Remedial Action Objectives Technical Memorandum and the Alternatives Screening Technical Memorandum (forthcoming, respectively) are submitted to EPA and approved, the RI portion of the project will be complete and fully approved by EPA and development of the Feasibility Study Report can be initiated.

If you have any questions regarding this submittal, please contact Mr. Bennie Underwood or me at (865) 691-5052.

Sincerely,
de maximis, inc.

Michael H. Samples
Alternate Project Coordinator

MHS/jr

cc: (via email)
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GDL Site Technical Committee

Screening Level Ecological Risk Assessment Addendum

Gary Development Landfill Superfund Site
Gary, Indiana

Prepared for:

THE U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 5

Prepared on behalf of:

THE GARY DEVELOPMENT LANDFILL NOTICE PARTIES GROUP

Prepared by:

PARSONS

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APRIL 2019

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LIST OF ABBREVIATIONS AND ACRONYMS

Acronym	Definition / Description
AUF	Area use factor
BEHP	Bis(2-ethylhexyl)phthalate
BSV	Background screening value
BTAG	Biological Technical Assistance Group
Calumet	Calumet Ecotoxicology Round Table Technical Team
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cm	Centimeter
COPEC	Constituent of potential ecological concern
COSR	Calumet Open Space Reserve
CSM	Conceptual site model
DDD	Dichlorodiphenyldichloroethane
EPC	Exposure point concentration
ERAGS	Ecological Risk Assessment Guidance for Superfund
ESB	Equilibrium sediment benchmark
GDL	Gary Landfill Development
HQ	Hazard quotient
HMW	High molecular weight
LANL	Los Alamos National Laboratory
LMW	Low molecular weight
LOAEL	Lowest observed adverse effects level
mg/kg	Milligram(s) per kilogram
mg/L	Milligram(s) per liter
NOAEL	No observed adverse effect level
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
ppm	Part(s) per million
RI	Remedial Investigation
RME	Reasonable maximum exposure
RSV	USEPA Region 4 Refinement Screening Value
SLERA	Screening Level Ecological Risk Assessment
SSL	Soil screening Level
SVOC	Semi-volatile organic compound
TRRP	Texas Risk Reduction Program
TRV	Toxicity reference value
UCL	Upper confidence limit
USEPA	United States Environmental Protection Agency
UTL	Upper tolerance limit
VOC	Volatile organic compound

1.0 INTRODUCTION AND BACKGROUND

Parsons has prepared this refined Screening Level Ecological Risk Assessment (SLERA) Addendum on behalf of Gary Development Landfill (GDL) located at 479 North Cline Avenue, Gary, Lake County, Indiana (the Site). An initial SLERA was previously prepared for the Site in January 2019 as part of an overall Remedial Investigation (RI) of the Site (Parsons 2019). The initial SLERA represents the first two steps in the ecological risk assessment process and is intended to allow a rapid determination as to whether a site poses no or negligible ecological risk, or to identify which constituents and exposure pathways require further evaluation. Specifically, in the initial SLERA, maximum detections of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) (particularly polycyclic aromatic hydrocarbons [PAHs]), polychlorinated biphenyls (PCBs) and selected metals in the sediment of the northern pond and southern wetland indicated potential risk to various receptors inhabiting these areas. Therefore, consistent with United States Environmental Protection Agency (USEPA) guidance, further evaluation and refinement of the ecological risk was recommended in the initial SLERA to better characterize the risk to ecological receptors under site-specific circumstances in these two habitats at the Site.

For this SLERA Addendum, a refinement of the identified constituents of potential ecological concern (COPECs) was conducted to accomplish two goals: (1) represent more realistic site-specific conditions and (2) identify those COPECs that significantly contribute to potentially unacceptable levels of ecological risk and eliminate from further consideration those chemicals that have minimal associated risk. The refined ecological risk assessment presented in this Addendum corresponds to Step 3A of the USEPA Ecological Risk Assessment Guidance for Superfund (ERAGS) (1997) and USEPA Region 4 Supplemental Guidance (2018). Specifically, within Step 3A, the refinement process addresses COPECs based on a weight-of-evidence approach considering the following criteria:

- Background concentrations
- Nutrients and dietary considerations
- Frequency, magnitude, and pattern of detected chemicals
- Mode of toxicity and potential for bioaccumulation
- Multiple contaminant effects
- Exposure considerations

Per the Risk Assessment Scoping Memorandum (Parsons 2017) and subsequent comments received on the draft RI report in 2018, some of the Step 3A refinement criteria were incorporated in the initial SLERA. These include background concentrations, nutrient and dietary considerations, and exposure considerations.

Since this Addendum is a follow-up to the initial SLERA, the Site background/history, setting, and a discussion of the conceptual site model (CSM) are not repeated herein.

2.0 DATA USED IN THE REFINED ECOLOGICAL RISK ASSESSMENT

Based on the results of the initial SLERA, the identified medium for further evaluation for both the northern pond and southern wetland is sediment. This section presents a brief summary of the analytical data selected for use in this SLERA Addendum. Sample analytical results were presented in the initial SLERA, and full data summary tables were presented in the main body of the RI report.

2.1 Northern Pond

Sediment samples were collected from 10 locations in the northern pond as shown in Figure 2-2 of the main RI report (Parsons 2019). (Figure 2.2 is also provided with this Addendum for reference.) The samples were collected in October and November 2016 and analyzed for metals, VOCs, SVOCs, PCBs and pesticides. Samples were collected at depths of 0-1 foot at each location and also at a depth of 1-2 feet at one location (SD30). Because aquatic receptors would typically only be exposed to the top 10-15 centimeters (cm), which is considered to be the biological active zone (Interstate Technology and Regulatory Council 2011) and is the sediment interval that is sampled for the determination of site-specific biota-sediment accumulation factors, only the samples collected from the upper 0-1 foot depth interval were considered for use in this Addendum.

2.2 Southern Wetland

Sediment samples were collected from 15 locations in the southern wetland (Figure 2-2). The samples were collected in September and October 2016 and analyzed for metals, VOCs, SVOCs, PCBs and pesticides. Samples were collected at depths of 0-1 foot and 1-2 feet, with two locations sampled at depths of 2-5 feet for PCBs only. Because ecological receptors would typically only be exposed to the surficial sediment due to the high-water table in the wetland and because the top 10-15 cm is the bioavailable zone, only the samples collected from the upper 0-1-foot depth interval were considered for use in this SLERA Addendum.

3.0 INDENTIFICATION OF COPECS

COPECs were identified in the initial SLERA by comparing the maximum detected chemical concentrations from all depths in the sediment to conservative screening levels in accordance with the 2017 Risk Assessment Memorandum and supplemental correspondence (Parsons 2017) and current USEPA guidance (2018). Following this screening evaluation, estimated intakes for key receptor species were calculated and compared to No Observed Adverse Effect Levels (NOAELs) and Lowest Observed Adverse Effect Levels (LOAELs) for chemicals that were identified during the screening process. In addition, a comparison was made to regional background concentrations for identified COPECs.

For this SLERA Addendum, these initial COPECs were further evaluated through comparison to background screening values (BSVs) and refined screening values (RSVs) to focus further assessment on the COPECs that are driving the potential risk. The results of this refinement of the screening process are summarized for each area in the following subsections and presented on Tables 3.1 (A and B) and 3.2.

3.1 Northern Pond Sediment COPECs

Following comparisons to BSVs and RSVs using 95% upper confidence levels (UCLs) on the mean for the 0-1-foot depth range, the following COPECs were identified in the northern pond sediments (Table 3.1A):

- 1,4-dichlorobenzene
- PAHs
- Bis(2-ethylhexyl)phthalate (BEHP)
- Butyl benzyl phthalate
- Di-n-butyl phthalate
- Phenol
- Total PCBs
- Copper

USEPA "Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures" (2003) were used for the PAHs. Per this guidance, the individual PAH concentrations were corrected for total organic carbon and then compared to ESBs and summed to determine potential effects on benthic organisms. The results of this comparison are presented on Table 3.2B. BSVs were obtained from the Calumet Ecotoxicology Area Protocol (Calumet Ecotoxicology Round Table Technical Team [Calumet] 2007), which in turn are from the "Chicago Area Background Contaminants in Wetland Sediments and Surface Waters: Supporting the Calumet Wetlands Ecotoxicological Assessment." (Piwoni et al. 2006). The RSVs are from USEPA Region 4 Ecological Risk Assessment Supplemental Guidance (2018).

3.2 Southern Wetland Sediment COPECs

Following comparisons to BSVs and RSVs using 95% upper confidence limits (UCLs) on the mean for the 0-1-foot depth range, the following COPECs were identified in the southern wetland sediments (Table 3.2):

- BEHP
- Dibenzofuran
- High molecular weight (HMW) PAHs
- Dichlorodiphenyldichloroethane (DDD)
- Total PCBs

- Arsenic
- Cadmium
- Chromium
- Copper
- Lead
- Manganese
- Selenium
- Silver
- Thallium
- Vanadium
- Zinc

BSVs for metals were obtained from the Calumet Area Ecotoxicology Protocol (Calumet 2007) and are derived from established soil background levels for metropolitan areas. For PAHs, 95% upper threshold limits established for the City of Chicago were used as background levels. RSVs were preferentially obtained from the Calumet Open Space Reserve (COSR) Benchmarks (Calumet 2007). These benchmarks are chemical concentrations that are derived from toxicity studies that identified LOAELs. If a COSR benchmark was unavailable, then the USEPA Region 4 soil screening benchmarks were used (2018).

4.0 EXPOSURE ASSESSMENT

The objective of the exposure assessment is to estimate the type and magnitude of potential exposures to COPECs at the Site. The exposure assessment includes identifying potentially complete exposure pathways as well as exposure quantification. The exposure assessment was accomplished in a three-step process involving characterization of the exposure setting, identification of exposure pathways, and quantification of exposure. Completion of these three steps involved developing a CSM (Section 3 of the initial SLERA), estimating exposure point concentrations (EPCs), determining exposure assumptions, and quantitatively estimating exposure. These last three elements of the exposure assessment are described in the following subsections.

4.1 Exposure Point Concentrations

EPCs are the concentrations of constituents in a given medium to which a receptor may be exposed at a specific location known as the "exposure point." For this SLERA Addendum, a 95% UCL concentration for the upper 0-1-foot depth interval was calculated for each COPEC identified in initial SLERA for the sediments of the northern pond and southern wetland using Version 5.1 of the ProUCL software in accordance with USEPA guidance (2002 and 2018).

EPC concentration summary tables for the sediment of the northern pond and the southern wetland are presented on Table 4.1. Printouts of the 95% UCL calculations are provided in Appendix A.

4.2 Exposure Pathways

Ecological exposure pathways evaluated in this SLERA Addendum remained consistent with those identified in the initial SLERA. Biota may be exposed directly or through the food web via consumption of contaminated organisms. Direct exposure pathways include dermal contact, absorption, inhalation, and ingestion. Because there is little toxicological data on dermal and inhalation exposure, these exposure routes are not addressed quantitatively.

Food web (indirect) exposure pathways for biota can occur when fauna consume contaminated biota. Examples of food web exposure include animals at higher trophic levels consuming plants or animals that bioaccumulate contaminants. Contamination of biota could result from exposure to one or more COPECs. Bioavailability is an important characteristic that influences the degree of chemical-receptor interaction. Bioavailable compounds are those that a receptor can take in from the environment, and bioavailability is a function of several physical and chemical environmental factors. These properties directly affect a contaminant's behavior relative to receptor exposure.

In accordance with USEPA guidance (2018), the models used in the SLERA Addendum to estimate concentrations in food items remained consistent with those utilized in the initial SLERA and are presented in Tables 4.2 through 4.5.

4.3 Exposure Assumptions

Reasonable maximum estimates (RMEs) were used in this SLERA Addendum to represent a conservative upper bound of potential exposures. RMEs were also used in the initial SLERA. The RME is designed to be an estimate of "high-end" exposure and is the maximum exposure reasonably expected to occur in a population. This approach is intended to account for both uncertainty in the chemical concentration and variability in the exposure parameters (such as food ingestion rates or body weight).

The values and assumptions used to estimate intake are presented for each key receptor on Table 4.6 and include values for body weight, typical diet composition, food and water ingestion rates, foraging territory size, and estimated soil/sediment intake percentages. The exposure assumptions selected receptor species and parameter values were developed in consultation with USEPA Region 5 during development of the 2017 Risk Assessment Approach Memorandum (Parsons 2017) and generally follow the values presented in the Wildlife Exposure Factors Handbook (USEPA 1993).

4.4 Estimated Intakes

In general, a total daily intake, expressed as milligrams of chemical per kilogram of body weight per day (mg/kg-day), was estimated by combining the EPC with the exposure factors specific to a key receptor. Ingestion of sediment was calculated by multiplying the EPC in sediment by the fraction of sediment ingested and the normalized food ingestion rate for each species. Food intakes were calculated by multiplying the estimated tissue concentration in the food item by the species-specific normalized food ingestion rate. Calculated intakes for each key receptor for only the preliminary COPECs identified in the initial SLERA for each receptor are provided in Tables 4.7 through 4.15 and are summarized in the following subsections.

4.4.1 American Robin

The American Robin is a representative avian omnivore, with a typical diet composition of 50% plants and 50% invertebrates. The robin was also assumed to migrate part of the year; thus, a temporal use factor of 0.75 was applied to the intake model to account for a robin being present on site nine months per year.

Table 4.7 presents the total estimated intake calculated for an American Robin.

4.4.2 Song Sparrow

The Song Sparrow is a representative avian invertivore, with a typical diet composition of 100% invertebrates. No additional adjustments were made to the intake model for the Song Sparrow since it is expected to be on site year-round and its foraging territory is smaller than the size of the southern wetland.

Table 4.8 presents the total estimated intake calculated for a Song Sparrow.

4.4.3 Bobwhite

The Bobwhite is a representative avian herbivore, with a typical diet composition of 100% plants. An area use factor (AUF) of 0.25 was applied to the intake model for a Bobwhite to reflect that its foraging territory is larger than the size of the southern wetland.

Table 4.9 presents the total estimated intake calculated for a Bobwhite.

4.4.4 American Kestrel

The American Kestrel is a representative avian carnivore, with a typical diet composition of 100% small prey. An AUF of 0.006 was applied to the intake model for the American Kestrel to reflect that the foraging territory is much larger than the size of the southern wetland.

Table 4.10 presents the total estimated intake calculated for an American Kestrel.

4.4.5 Osprey

The Osprey is a representative avian piscivore. An AUF of 0.002 was applied to the intake model for an Osprey to reflect that its foraging territory is much larger than the size of the northern pond.

Table 4.11 presents the total estimated intake calculated for an Osprey.

Fish have not been observed in the northern pond and are not expected. Therefore, the fish ingestion pathway is currently incomplete for piscivores. The northern pond has neither inlets nor outlets and no surface water connection with nearby water bodies. Although no COPECs were identified in the surface water of the northern pond, the relatively high hardness of the water of the northern pond and associated high dissolved cation concentrations of magnesium, potassium and sodium can increase the pH and put further stress on aquatic life. Additionally, the average dissolved oxygen content in the pond was 1.19 milligrams per liter (mg/L) and ranged from 0.04 to 3.61 mg/L, with only one location having a dissolved oxygen measurement over 3 mg/L. Dissolved oxygen concentrations below 3 mg/L stress most warmwater species of fish, and concentrations below 2 parts per million (ppm) are lethal to some species. Often fish that have been stressed by dissolved oxygen concentrations in the range of 2 or 3 ppm will also become susceptible to disease (Texas A&M 2017). Thus, although it was assumed that fish could inhabit the pond in future, the presence of a sustainable game fish population in the northern pond is unlikely due to the low dissolved oxygen content, high pH (8.7), and high hardness.

Additionally, although the northern pond was evaluated for its potential as wildlife habitat, it is believed that the northern pond does not meet the definition of waters of the state and is therefore not subject to typical water quality regulations or protection under state water laws. This is because the pond is isolated, has no surface water connections to surrounding water bodies, originated during quarry operations, and was subsequently used as a surface water retention pond to control landfill runoff (Indiana Code 13-11-2-265).

4.4.6 Deer Mouse

The Deer Mouse is a representative mammalian omnivore, with a typical diet composition of 50% plants and 50% invertebrates. No additional adjustments were made to the intake model for the Deer Mouse since it is expected to be on site year-round and its foraging territory is smaller than the size of the southern wetland.

Table 4.12 presents the total estimated intake calculated for a Deer Mouse.

4.4.7 Short-Tailed Shrew

The Short-tailed Shrew is a representative mammalian invertivore, with a typical diet composition of 100% invertebrates. No additional adjustments were made to the intake model for the Short-tailed Shrew since it is expected to be on site year-round and its foraging territory is smaller than the size of the southern wetland.

Table 4.13 presents the total estimated intake calculated for a Short-tailed Shrew.

4.4.8 Meadow Vole

The Meadow Vole is a representative mammalian herbivore, with a typical diet composition of 100% plants. No additional adjustments were made to the intake model for the Meadow Vole since it is expected to be on site year-round and its foraging territory is smaller than the size of the southern wetland.

Table 4.14 presents the total estimated intake calculated for a Meadow Vole.

4.4.9 Red Fox

The Red Fox is a representative mammalian carnivore, with a typical diet composition of 100% small prey. No additional adjustments were made to the intake model for the Red Fox since it is expected to be on site year-round.

Table 4.15 presents the total estimated intake calculated for a Red Fox.

4.4.10 Wetland Plants and Invertebrates

Tables 4.16 and 4.17 summarize the HQs calculated for plants and invertebrates, respectively. However, toxicity reference values (TRVs) are not intended to be directly protective of receptors with limited mobility or range (e.g., plants, soil invertebrates, and small rodents with a home range of less than 2.5 acres) because the habitat and foraging areas of wildlife that depend on them are frequently large enough to compensate for any localized losses in food or shelter (Texas Risk Reduction Program [TRRP] 2018). Thus, these tables are presented only as additional weight-of-evidence to assist in identifying COPECs that are driving ecological risk on an ecological community or population-level scale.

Wetland plants would be exposed to COPECs in the southern wetland sediments via uptake and direct contact. Wetland invertebrates would be exposed to COPECs in the sediments via uptake/direct contact, incidental ingestion and potential food chain transfer. Because intake calculations are not applicable for these receptors, the wetland sediment concentrations were

compared directly to sediment TRVs developed specifically for plants and invertebrates by the USEPA. Tables 4.16 and 4.17 present the results of this comparison.

4.4.11 Aquatic Life in the Northern Pond

Aquatic plants and invertebrates would be exposed to sediments in the northern pond via uptake/direct contact and potential food chain transfers. Because intake calculations are not applicable for these receptors, sediment concentrations were compared directly to sediment TRVs developed specifically for sediment effects on aquatic life. Table 4.18 presents the results of this comparison.

5.0 TOXICITY ASSESSMENT

Identified LOAELs for site COPECs did not change from those used in the initial SLERA and are presented in Tables 6.1 and 6.2 of the initial SLERA for mammals and birds, respectively. LOAELs were preferentially obtained from USEPA Ecological Soil Screening Levels (SSLs) (2005 and 2007). Supplemental LOAELs were obtained from the USEPA Biological Technical Assistance Group (BTAG) (2002 and 2009) and the Los Alamos National Laboratory (LANL) EcoRisk database, Release 4.1 (2017).

Because calculation of intakes is not applicable for terrestrial plants, invertebrates or aquatic life, sediment concentrations were compared directly to sediment TRVs developed specifically for these receptors as presented on Tables 4.16 through 4.18.

6.0 RISK CHARACTERIZATION

Comparisons were made between projected intakes of substances and the TRVs to characterize potential adverse effects. The equations for calculating hazard quotients (HQs) and summaries of these results by pathway and receptor for potential future receptors are presented below.

The potential for adverse ecological effects is evaluated by comparing an exposure level or intake over a specified time period with a TRV derived for a similar exposure period. This ratio is termed the HQ. In other words, HQ equals the intake divided by the corresponding reference value, or:

$$HQ = \text{Total Intake} / TRV$$

HQs greater than 1 will be generated any time intake for any COPEC exceeds its TRV. Tables 4.7 through 4.15 summarize the ecological hazards for estimated exposures by receptor when using the 95% UCL as the EPC and LOAEL as the TRV. For direct comparison of sediment concentrations, the HQ is the concentration in the sediment divided by the sediment TRV concentration. Tables 4.16 through 4.18 summarize the HQs calculated for plants, invertebrates, and aquatic life, respectively. However, as mentioned previously, the TRVs are not intended to be directly protective of receptors with limited mobility or range (e.g., plants, soil invertebrates, and small rodents with a home range of less than 2.5 acres) because the habitat and foraging areas of wildlife that depend on them are frequently large enough to compensate for any localized losses in food or shelter (TRRP 2018). Results are discussed for each medium in the following subsections.

6.1 Northern Pond

Potential adverse effects to key receptor species from COPECs detected in the northern pond sediment and food chain transfers for the northern pond when using LOAELs as the TRVs and 95% UCLs concentrations are as follows:

COPEC	Receptor HQ Based on NOAEL as the TRV	
	Osprey	Aquatic Life
1,4-dichlorobenzene		1.3
LMW PAHs		17
HMW PAHs		84
BEHP		2.3
Butyl benzyl phthalate		33
Di-n-butyl phthalate		1.7
Phenol		1.9
Total PCBs		5.6
Copper		1.1

Note: A blank indicates that the calculated HQ was 1 or less for the COPEC-receptor combination

6.2 Southern Wetlands

Potential adverse effects to key receptor species from exposure to COPECs detected in the southern wetland sediment and food chain transfers using LOAELs as the TRVs and 95% UCL concentrations are as follows:

COPEC	Receptor HQ Based on NOAEL as the TRV									
	Robin	Sparrow	Bob-white	Kestrel	Mouse	Shrew	Vole	Fox	Plants	Inverts
HMW PAHs					4.7	5.4			55	3.4
BEHP									53	
Dibenzofuran										4.5
DDD									11	10
Total PCBs	154	341			141	167				102
Arsenic									2.1	
Cadmium	1.4	3			1.6	1.8				
Chromium	9	13			3.1	4.1			65	
Copper									3.5	
Lead	3.4	4.7				1.4			9.9	
Manganese									6.4	
Selenium	1.4	1.5			2.1	1.5	1.3			
Silver										3.7
Thallium									7.2	72
Vanadium	1.3	1.2								4.8
Zinc	2.3	3			2.1	2.3			27	4.6

Note: A blank indicates that the calculated HQ was 1 or less for the COPEC-receptor combination

7.0 DISCUSSION OF RESULTS

The northern pond and southern wetland do not provide any unique habitat in the area, and the habitat is likely to be of lesser quality than other wetlands and water bodies in the area (refer to Appendix F of the RI report). In addition, Menzie et al. (1993) recommended the following guidelines for interpreting HQs:

- Adverse effects are not expected for HQ values less than 1.
- A low potential for adverse effects may be indicated by HQ values between 1 and 10.
- A significant potential for adverse effects on ecological receptors and communities may be indicated by HQ values greater than 10, particularly if they exceed a value of 100.

Thus, given the conservative assumptions and the low potential for adverse effects based on calculated HQs below 10, most COPECs can be eliminated as significant risk drivers, and the calculated HQs presented above likely overestimate the ecological risk to populations.

Additionally, the assumption that COPECs are 100% bioavailable likely overestimates the potential for adverse effects. The duration that has lapsed since the contaminant release affects bioavailability as the contaminant becomes sequestered or transformed within the environmental media. Sequestration, transformation, and bioavailability are influenced by medium characteristics such as pH, temperature, and organic carbon content.

For instance, metals occur naturally in soils primarily as amorphous oxides and hydroxides, and to a lesser extent as carbonates, phosphates, sulfates, and sulfides, which are relatively insoluble. The same is generally true for metal contaminated soils because metals quickly undergo precipitation and coprecipitation reactions forming relatively insoluble solid phases, and/or they are strongly complexed by soil minerals or organic matter. Therefore, many elements are not very bioavailable or toxic to animals even when element-rich soils are ingested. Toxicity testing, on the other hand, usually employs very soluble metals not commonly found in any appreciable amounts in soils relative to total metal concentrations. Antimony is a metal that typically exist as cationic species. As such, it can complex with inorganic soil constituents (e.g., carbonates, sulfates, hydroxides, sulfides) to form either precipitates or positively charged complexes. Both complexation and precipitation reactions are pH dependent. Therefore, although antimony can form complexes with a net negative charge, it either precipitates or exists as a cation under most environmentally relevant scenarios (pH = 4 to 8.5). Metals existing as cationic species have a greater propensity to associate with the soil and are less bioavailable (USEPA 2009).

In addition, the use of laboratory-derived or empirically estimated partitioning and transfer factors to predict COPEC concentrations in plants, invertebrates, and prey species likely overestimates potential risks. As discussed previously, the incorporation of COPECs into the food chain is influenced by the characteristics of the exposure medium, which likely differs from that used in the laboratory to derive partitioning and transfer factors.

The calculation of HQs also introduces uncertainty. The following limitations associated with HQs (Tannenbaum et al. 2003) are noted:

- HQs are not measures of risk.
- HQs are not population based.
- HQs are not linearly scaled.
- HQs are often produced that are unrealistically high and toxicologically impossible (i.e., estimated HQs greater than 1,000).
- Trace soil concentrations of inorganic chemicals (including concentrations well below background levels) can lead to HQ threshold exceedances.

Therefore, HQs greater than 1 do not necessarily mean that adverse ecological effects are occurring or may occur in the future.

7.1 Northern Pond

For this SLERA Addendum, the only receptor that showed a potential ecological risk (calculated HQ greater than 1) as a result of exposure to the northern pond sediment is aquatic life. No other key receptor had a calculated HQ greater than 1. For aquatic life, three COPECs had calculated HQs greater than 10: low molecular weight (LMW) PAHs, HMW PAHs, and butyl benzyl phthalate.

PAHs are prevalent throughout the Grand Calumet River watershed, and regional background levels have been established for the area. For sediment, the regional background concentrations for total LMW and HMW PAHs are unavailable; however, background levels have been determined for 16 individual PAHs. Background levels for HMW PAHs range from 0.691 mg/kg for dibenzo(a,h)anthracene to 9.07 mg/kg for fluoranthene (Calumet 2007). For LMW PAHs, background levels range from 0.1 mg/kg for acenaphthylene to 3.7 mg/kg for phenanthrene (Calumet 2007). Except for sediment sample locations SD26 and SD30, concentrations of PAHs are generally similar to these background levels. The concentration of PAHs at SD26 and SD30 are an order or more of magnitude greater than the concentrations detected at the other eight locations. In comparison to ESBs, only locations SD26 and SD30 have summed toxic units greater than one. Thus, elevated PAH concentrations appear to be limited in extent.

Butyl benzyl phthalate was detected in two of the 10 sediment samples from the northern pond. The highest concentration was detected at location SD28 at 16 mg/kg at SD28 in the 0-1 foot depth. Butyl benzyl phthalate was also detected at a concentration of 0.28 J mg/kg at location SD30. Butyl benzyl phthalate was not detected in the other sediment sample locations (detection limits ranged from 0.26 to 1.1 mg/kg), which is similar to the sediment RSV for butyl benzyl phthalate of 0.481 mg/kg and the Region 4 soil screening value of 0.59 mg/kg. Thus, elevated phthalate concentrations appear to be limited in extent to one location in the pond sediment.

7.2 Southern Wetland

Total PCBs had the highest calculated HQs (range of 102–341) for five of the 10 receptor species. When looking at the individual results for the southern wetland, four PCB aroclors were detected in the southern wetland sediment (PCB-1242, PCB-1248, PCB-1254, and

PCB-1260). PCB-1248 and PCB-1254 were the most commonly detected aroclors, with PCB-1248 and PCB-1254 being detected at seven locations each in the 0-1 foot depth. Locations SD-16, SD-17 and SD-21 have the highest concentrations of PCBs (at least one congener with a detection over 10 mg/kg). SD-16 is the farthest upstream location that was sampled and has the highest total PCB concentration (132 mg/kg). PCBs have been widely detected throughout the river watershed, and concentrations of PCBs in river sediment directly upstream of the Site are comparable to or higher than concentrations detected in the sediment adjacent to the Site or in the wetland. Thus, their origin in the wetland sediment could be from deposition of river sediment onto the wetland. However, as discussed in the RI Report, the landfill was not definitively ruled out as a potential source.

PAH concentrations in the wetland sediment show a similar pattern to PCB's, with the highest concentrations of PAHs at locations SD-16, SD-17, SD-18 and SD-21. The highest concentrations of PAHs appear on the upstream end of the southern wetland and closest to the river shore. However, the only calculated HQ over 10 is for HMW PAHs for wetland plants, and the only receptors that show a potential adverse effect due to detected concentrations of HMW PAHs in the southern wetland are all receptors with very limited home ranges (mouse, shrew and invertebrates). Because the TRVs are not intended to be directly protective of receptors with limited mobility or range (e.g., plants, soil invertebrates, and small rodents with a home range of less than 2.5 acres), the potential for adverse effects to populations of wetland plants, invertebrates and small mammals due to the concentration of PAHs in the southern wetland sediment is expected to be minimal.

BEHP was identified as a COPEC for terrestrial plants in wetlands. BEHP was detected in eight of 15 samples from the southern wetland, with a 95% UCL of 1.06 mg/kg; however, many of the detection limits for BEHP were elevated (i.e., detection limits ranged from 0.22 to 8.4 mg/kg). Additionally, the Region 4 SSL (0.02 mg/kg) was used as the comparison value for terrestrial plants. Because the wetland sediment is regularly saturated, the Region 4 RSV for sediments for BEHP was also considered as an alternative screening value for evaluating exposure of plants. The Region 4 RSV for BEHP is 2 mg/kg, two orders of magnitude higher than the Region 4 initial screening level for soil. No other receptor species had calculated HQs above 1 due to exposure to BEHP in the wetland sediment, and the average concentration of BEHP in the sediments is 25% to 50% lower than the Region 4 sediment RSV. Therefore, adverse effects to populations of wetland plants due to the concentration of BEHP in the sediments are expected to be minimal.

DDD was detected at one location (SD17) in the wetland sediments at depths of 0-1 and 1-2 feet that may have an adverse effect on wetlands plants or invertebrates. The detections ranged from 0.22 to 0.28 mg/kg, with the higher detection in the 1-2 foot depth. The Region 4 SSL for DDD for invertebrates is 0.001 mg/kg; however, the Region 4 RSV for sediment is 0.028 mg/kg for DDD and 0.572 mg/kg for total DDD/DDE/DDT[1]. Because DDE and DDT were not detected in the wetland sediment and because DDD was only detected at one of 15

[1] DDE - dichlorodiphenyldichloroethylene; DDT - dichlorodiphenyltrichloroethane

locations, wetland plants and invertebrates are unlikely to show adverse effects due to direct contact with DDD.

Total chromium concentrations in the southern wetland sediments ranged from 23 to 1,500 mg/kg, with a mean concentration of 330 mg/kg in the upper 1 foot. Calculated HQs were greater than 10 for the sparrow and terrestrial plants. The Calumet area background Upper Tolerance Limit (UTL) is 68.9 mg/kg for chromium in sediment, and the sediment benchmark is 111 mg/kg (Calumet 2007). The metropolitan soil background concentration for total chromium is 16.2 mg/kg, and the soil benchmark for total chromium is 131 mg/kg (Calumet 2007). For comparison, the Region 4 RSV is 110 mg/kg for total chromium. Using a benchmark of 110 mg/kg of total chromium for comparison for the shallow wetland sediment, chromium was detected at greater than this benchmark in four locations (SD14, SD16, SD17, and SD18) at concentrations ranging from 540 to 1500 mg/kg. These four locations are nearest to the river, furthest upstream, in the far eastern portion of the wetlands.

Thallium had calculated HQs greater than 10 only for terrestrial plants, and terrestrial invertebrates were the only other receptor that had a calculated HQ greater than one. Thallium was detected in two locations, SD17 and SD16, at concentrations of 1.1 J[2] and 3.6 J mg/kg, respectively, in the 0-1 foot depth, with a mean concentration of 1.65 mg/kg. The Calumet area background UTL is 1.1 mg/kg for thallium in sediments (Calumet 2007). The metropolitan soil background concentration for thallium is 0.32 mg/kg, and the soil threshold for thallium is 1.3 mg/kg (Calumet 2007). Using a threshold value of 1.3 mg/kg of thallium for comparison for the shallow wetland sediment, thallium was detected at concentrations greater than this benchmark in only one location (SD16). This location is closest to the river, furthest upstream, in the far eastern portion of the wetlands. Because thallium was only detected at one of 15 locations above the soil threshold value, wetland plants and invertebrate populations are unlikely to show adverse effects due to direct contact with the thallium.

Zinc concentrations in the southern wetland sediment ranged from 100 to 9600 mg/kg with a mean concentration of 1354 mg/kg in the upper 1 foot. The Calumet area background UTL is 761 mg/kg for zinc in sediments, and the sediment benchmark is 459 mg/kg (Calumet 2007). The metropolitan soil background concentration for zinc is 95 mg/kg, and the soil threshold for zinc is 250 mg/kg (Calumet 2007). For comparison, the Region 4 RSV is also 459 mg/kg for zinc. Using a benchmark of 459 mg/kg of zinc for comparison for the shallow wetland sediment, zinc was detected at greater than this benchmark in four locations (SD14, SD16, SD17 and SD18) at concentrations ranging from 1200 to 9600 mg/kg. These four locations are all closest to the river, furthest upstream, in the far eastern portion of the wetlands.

HQs were less than 10 for the other COPECs for all the other receptor species evaluated, and no higher trophic level receptors (such as carnivorous birds or mammals) had HQs greater than 1, indicating that population-level effects are not likely. In addition, based on the ecological evaluation and wetland delineation conducted in 2016 (Appendix F of the RI report), there was no evidence that COPEC concentrations are at levels where wetland plants could not support

[2] J is a laboratory qualifier indicating an estimated concentration.

upper trophic level receptors in terms of habitat, shelter, and forage because there were no observations of bare ground or other effects on the vegetation. Most of the locations with concentrations of COPECs that show a potential adverse effect on ecological receptors are collocated along the upstream portion of the Site, closest to the river shore, and are generally limited to four locations (SD14, SD16, SD17, and SD18).

8.0 SUMMARY AND CONCLUSIONS

In accordance with USEPA guidance, the purpose of this SLERA Addendum is to quantitatively characterize and refine the potential ecological risk associated with future exposures to COPECs in sediments of the northern pond and southern wetland under a future presumptive remedy scenario of capping/containment. The exposure pathways evaluated in this refined SLERA Addendum were focused on the COPECs identified in the initial SLERA (Parsons 2019). These initial COPECs were identified by comparing maximum detected concentrations of constituents to established ecological screening levels. COPECs were eliminated from further consideration in the initial SLERA if they were not detected in a medium or the maximum detected concentration was below its screening level.

In accordance with USEPA guidance, those initial COPECs were refined in this SLERA Addendum using the 95% UCL on the mean as the EPC and including site-specific information such as the size of the areas and the frequency, magnitude and distribution of the detections.

Based on the estimated intakes and calculated hazard quotients, the COPECs that may have a potential adverse effect on ecological receptors inhabiting the northern pond and southern wetland appear to be collocated and limited in extent. Most of the hazards to key ecological receptors were associated with PCBs and chromium in the southern wetland sediment and with PAHs in the northern pond sediment. The following table summarizes the key receptors and COPECs that are driving potential unacceptable ecological risk (HQs > 10) in the sediment of the southern wetland and northern pond.

Key Receptor	Wetland Sediment	Northern Pond Sediment
Invertivorous Birds (Song Sparrow)	Total PCBs Chromium	--
Omnivorous Birds (American Robin)	Total PCBs	--
Invertivorous Mammals (Short-tail Shrew)	Total PCBs	--
Omnivorous Mammals (Deer Mouse)	Total PCBs	--
Terrestrial Plants	HMW PAHs BEHP DDD Chromium Zinc	--
Terrestrial Invertebrates	DDD Total PCBs Thallium	--
Aquatic Life	--	LMW PAHs HMW PAHs Butyl benzyl phthalate

– = No COCs identified for the receptor in this medium or no exposure by the receptor to this medium.

Based on the results of this SLERA Addendum that was conducted to determine the risks to ecological receptors associated with exposure to constituents detected in sediment of the northern pond and southern wetland, key findings are as follows:

- Most of the identified hazards under the presumptive remedy for the southern wetland are associated with food chain transfers (>80%). However, when considering the attractiveness and size of the southern wetland in relation to other nearby habitats and waterbodies, the risk to wetland species is expected to be minimal.
- The elevated COPEC concentrations are generally collocated and isolated to a few locations (i.e., SD26, SD27, SD28, and SD30 in the sediments in the northern pond and SD14, SD16, SD17, and SD18 in the southern wetland sediment). Given the total size of each area, the limited extent of the elevated detections, and conservative uptake models used to predict intake, population and/or community level effects are unlikely.
- Due to the lack of protected species or critical habitat at the Site and no evidence of community level effects to species inhabiting the Site, ecological risks are expected to be minimal under the presumed remedy of a cap/containment.

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FIGURES

PARSONS

10 South Riverside Plaza, Suite 400
Chicago, Illinois 60606-3724

Figure 2-2
Sediment Sample Location Map
Gary Development Landfill Superfund Site
Gary, Indiana

C. Oneal	2/2/2018	
Revision: 2/2/2018		Parsons Project No. 449595
File Name: Sediment_samples.mxd		

D:\GIS\GaryLandfill\AGO\2017\Sediment_samples.mxd

TABLES

Table 3.1A

Refinement of Constituents of Potential Ecological Concern in the Northern Pond Sediment
Refined Ecological Risk Assessment

Gary Development Landfill

CAS Number	Constituent	Freq. of Detection	Maximum Detected Conc.	Background Screening Value (BSV)	Freq. Exceeding BSV	Refinement Screening Value (RSV)	RSV Source	Freq. Exceeding RSV	Refinement Hazard Quotient (HQ)	95% UCL Conc.	95% UCL HQ	COPC (Y/N) Basis
	Volatiles, mg/kg											
106-46-7	1,4-DICHLOROBENZENE	1/10	0.61	NA	NA	0.468	Region 4	1/10	1.3	0.61	1.3	**Yes**
	Semi-Volatiles, mg/kg											
83-32-9	ACENAPHTHENE	6/10	0.86	0.12	NA	4.91	Region 4	0/10	0.2	0.404	0.1	No
208-96-8	ACENAPHTHYLENE	6/10	0.24	0.1	NA	4.52	Region 4	0/10	0.1	0.089	0.0	No
120-12-7	ANTHRACENE	8/10	2.7	1.06	NA	5.94	Region 4	0/10	0.5	2.7	0.5	No
56-55-3	BENZO(A)ANTHRACENE	10/10	7.7	2.91	NA	8.41	Region 4	0/10	0.9	7.7	0.9	No
50-32-8	BENZO(A)PYRENE	10/10	7.8	2.99	NA	9.65	Region 4	0/10	0.8	7.8	0.8	No
205-99-2	BENZO(B)FLUORANTHENE	10/10	11	2.69	NA	9.79	Region 4	1/11	1.1	11	1.1	**Yes**
191-24-2	BENZO(G,H,I)PERYLENE	9/10	4.2	2.2	NA	10.9	Region 4	0/10	0.4	4.2	0.4	No
207-08-9	BENZO(K)FLUORANTHENE	8/10	3.9	2.7	NA	9.81	Region 4	0/10	0.4	3.9	0.4	No
218-01-9	CHRYSENE	10/10	7.5	3.76	NA	8.44	Region 4	0/10	0.9	7.5	0.9	No
53-70-3	DIBENZ(A,H)ANTHRACENE	4/10	1.3	0.691	NA	11.2	Region 4	0/10	0.1	0.446	0.04	No
206-44-0	FLUORANTHENE	10/10	20	9.07	NA	7.07	Region 4	1/10	3	20	2.8	**Yes**
86-73-7	FLUORENE	9/10	1.5	0.429	NA	5.38	Region 4	0/10	0.3	1.5	0.3	No
193-39-5	INDENO(1,2,3-C,D)PYRENE	7/10	3.9	3.48	NA	11.2	Region 4	0/10	0.3	3.9	0.3	No
117-81-7	NAPHTHALENE	10/10	1.4	0.2	NA	3.85	Region 4	0/10	0.4	0.671	0.2	No
85-01-8	PHENANTHRENE	10/10	11	3.7	NA	5.96	Region 4	1/10	2	11	1.8	**Yes**
129-00-0	PYRENE	10/10	14	7.77	NA	6.97	Region 4	2/10	2	14	2.0	**Yes**
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	4/10	15	NA	NA	2.6	Region 4	2/10	6	6.08	2.3	**Yes**
85-68-7	BUTYL BENZYL PHTHALATE	2/10	16	NA	NA	0.481	Region 4	1/10	33	16	33.3	**Yes**
86-74-8	CARBAZOLE	2/10	1.6	NA	NA	4.561	Region 4	0/10	0.4	1.6	0.4	No
132-64-9	DIBENZOFURAN	3/10	0.73	NA	NA	2.313	Region 4	0/10	0.3	0.48	0.2	No
84-74-2	DI-N-BUTYL PHTHALATE	1/10	0.55	NA	NA	0.319	Region 4	1/10	1.7	0.55	1.7	**Yes**
108-95-2	PHENOL	1/10	0.39	NA	NA	0.21	Region 4	1/10	1.9	0.39	1.9	**Yes**
	PCBs, mg/kg											
12674-11-2	PCB-1016 (AROCLOR 1016)	0/10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11104-28-2	PCB-1221 (AROCLOR 1221)	0/10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11141-16-5	PCB-1232 (AROCLOR 1232)	0/10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
53469-21-9	PCB-1242 (AROCLOR 1242)	0/10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12672-29-6	PCB-1248 (AROCLOR 1248)	4/10	1.9	NA	NA	NA	NA	NA	NA	0.882	NA	NA
11097-69-1	PCB-1254 (AROCLOR 1254)	1/10	0.53	NA	NA	NA	NA	NA	NA	0.53	NA	NA
11096-82-5	PCB-1260 (AROCLOR 1260)	0/10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
-	Total PCBs	5/10	6.4	0.134	5/10	0.676	Region 4	1/10	9	3.76	6	**Yes**
	Inorganics, mg/kg											
7440-39-3	BARIUM	10/10	2400	213	6/10	60	Region 4	10/10	40	1.27	0.02	No
7440-47-3	CHROMIUM	10/10	130	69.9	1/10	111	Region 4	1/10	1.2	77.11	0.7	No
7440-50-8	COPPER	10/10	320	99.9	4/10	149	Region 4	2/10	2.1	165.4	1.1	**Yes**
7439-92-1	LEAD	10/10	140	538	0/10	128	Region 4	1/10	1.1	83.55	0.7	No
7440-02-0	NICKEL	10/10	75	49.2	1/10	48.6	Region 4	1/10	1.5	43.23	0.9	No
7782-49-2	SELENIUM	9/10	3.5	5.03	1/10	2.9	Region 4	3/10	1.2	2.64	0.9	No
7440-66-6	ZINC	10/10	640	761	0/10	459	Region 4	1/10	1.4	401.3	0.9	No

Table 3.1A

Refinement of Constituents of Potential Ecological Concern in the Northern Pond Sediment
Refined Ecological Risk Assessment

Gary Development Landfill

CAS Number	Constituent	Freq. of Detection	Maximum Detected Conc.	Background Screening Value (BSV)	Freq. Exceeding BSV	Refinement Screening Value (RSV)	RSV Source	Freq. Exceeding RSV	Refinement Hazard Quotient (HQ)	95% UCL Conc.	95% UCL HQ	COPC (Y/N) Basis

Notes:

BSV from Calumet Area Ecotoxicology Protocol, 2007.

RSV USEPA Region 4 Ecological Risk Assessment Supplemental Guidance, 2018

Table 3.1B

Calculation of ESBs for PAHs in Northern Pond Sediment
Refined Ecological Risk Assessment

Gary Development Landfill

(TOC=3.7%; f_{OC}=0.037)			SD22			SD23			SD24		
PAH	COC, $_{PAHi, FCVi}$ ($\mu g/g_{OC}$)	COC, $_{PAHi, Maxi}$ ($\mu g/g_{OC}$)	Conc. ($\mu g/g$ dry wt.)	COC ($\mu g/g_{OC}$)	$ESBTU_{FCVi}$	Conc. ($\mu g/g$ dry wt.)	COC ($\mu g/g_{OC}$)	$ESBTU_{FCVi}$	Conc. ($\mu g/g$ dry wt.)	COC ($\mu g/g_{OC}$)	$ESBTU_{FCVi}$
ACENAPHTHENE	491	33400	0.1	2.70	0.0055	0.076	2.05	0.0042	0.056	1.51	0.0031
ACENAPHTHYLENE	452	24000	0.029	0.78	0.0017	0.105	2.84	0.0063	0.08	2.16	0.0048
ANTHRACENE	594	1300	0.1	2.70	0.0046	0.045	1.22	0.0020	0.04	1.08	0.0018
BENZO(A)ANTHRACENE	841	4153	0.12	3.24	0.0039	0.11	2.97	0.0035	0.093	2.51	0.0030
BENZO(A)PYRENE	965	3840	0.14	3.78	0.0039	0.12	3.24	0.0034	0.046	1.24	0.0013
BENZO(B)FLUORANTHENE	979	2169	0.27	7.30	0.0075	0.22	5.95	0.0061	0.15	4.05	0.0041
BENZO(G,H,I)PERYLENE	1095	648	0.86	23.24	0.0212	0.1	2.70	0.0025	0.07	1.89	0.0017
BENZO(K)FLUORANTHENE	981	1220	0.96	25.95	0.0264	0.11	2.97	0.0030	0.059	1.59	0.0016
CHRYSENE	844	826	0.2	5.41	0.0064	0.2	5.41	0.0064	0.42	11.35	0.0134
DIBENZ(A,H)ANTHRACENE	1123	2389	0.1	2.70	0.0024	0.11	2.97	0.0026	0.08	2.16	0.0019
FLUORANTHENE	707	23870	0.28	7.57	0.0107	0.34	9.19	0.0130	0.25	6.76	0.0096
FLUORENE	538	26000	0.055	1.49	0.0028	0.089	2.41	0.0045	0.069	1.86	0.0035
INDENO(1,2,3-C,D)PYRENE	1115	-	0.079	2.14	0.0019	0.11	2.97	0.0027	0.08	2.16	0.0019
NAPHTHALENE	385	61700	0.073	1.97	0.0051	0.58	15.68	0.0407	0.34	9.19	0.0239
PHENANTHRENE	596	34300	0.19	5.14	0.0086	0.25	6.76	0.0113	0.21	5.68	0.0095
PYRENE	697	9090	0.27	7.30	0.0105	0.35	9.46	0.0136	0.24	6.49	0.0093
SUM TOTAL $ESBTU_{FCV,13}$ =					0.1231			0.1258			0.0945
SUM WITH ALL PAH MULTIPLIER (2.75 FOR 50% CONFIDENCE LEVEL)					0.34			0.35			0.26

Table 3.1B

Calculation of ESBs for PAHs in Northern Pond Sediment
Refined Ecological Risk Assessment

Gary Development Landfill

(TOC=3.7%; f_{OC}=0.037)			SD25			SD26			SD27		
PAH	COC, $_{PAHi, FCVi}$ ($\mu g/g_{OC}$)	COC, $_{PAHi, Maxi}$ ($\mu g/g_{OC}$)	Conc. ($\mu g/g$ dry wt.)	COC ($\mu g/g_{OC}$)	$ESBTU_{FCVi}$	Conc. ($\mu g/g$ dry wt.)	COC ($\mu g/g_{OC}$)	$ESBTU_{FCVi}$	Conc. ($\mu g/g$ dry wt.)	COC ($\mu g/g_{OC}$)	$ESBTU_{FCVi}$
ACENAPHTHENE	491	33400	0.026	0.70	0.0014	0.57	15.41	0.0314	0.0315	0.85	0.0017
ACENAPHTHYLENE	452	24000	0.026	0.70	0.0016	0.021	0.57	0.0013	0.0315	0.85	0.0019
ANTHRACENE	594	1300	0.0088	0.24	0.0004	1.3	35.14	0.0592	0.0315	0.85	0.0014
BENZO(A)ANTHRACENE	841	4153	0.024	0.65	0.0008	2.3	62.16	0.0739	0.037	1.00	0.0012
BENZO(A)PYRENE	965	3840	0.026	0.70	0.0007	2.5	67.57	0.0700	0.045	1.22	0.0013
BENZO(B)FLUORANTHENE	979	2169	0.051	1.38	0.0014	3.9	105.41	0.1077	0.066	1.78	0.0018
BENZO(G,H,I)PERYLENE	1095	648	0.018	0.49	0.0004	1.4	37.84	0.0346	0.027	0.73	0.0007
BENZO(K)FLUORANTHENE	981	1220	0.026	0.70	0.0007	1.4	37.84	0.0386	0.026	0.70	0.0007
CHRYSENE	844	826	0.045	1.22	0.0014	2.5	67.57	0.0801	0.049	1.32	0.0016
DIBENZ(A,H)ANTHRACENE	1123	2389	0.026	0.70	0.0006	0.31	8.38	0.0075	0.015	0.41	0.0004
FLUORANTHENE	707	23870	0.045	1.22	0.0017	4.2	113.51	0.1606	0.096	2.59	0.0037
FLUORENE	538	26000	0.011	0.30	0.0006	0.63	17.03	0.0316	0.0315	0.85	0.0016
INDENO(1,2,3-C,D)PYRENE	1115	-	0.023	0.62	0.0006	1.4	37.84	0.0339	0.032	0.86	0.0008
NAPHTHALENE	385	61700	0.015	0.41	0.0011	0.27	7.30	0.0190	0.014	0.38	0.0010
PHENANTHRENE	596	34300	0.049	1.32	0.0022	4	108.11	0.1814	0.049	1.32	0.0022
PYRENE	697	9090	0.083	2.24	0.0032	9.3	251.35	0.3606	0.075	2.03	0.0029
SUM TOTAL $ESBTU_{FCV,13}$ =					0.0188			**1.2911**			0.0248
SUM WITH ALL PAH MULTIPLIER (2.75 FOR 50% CONFIDENCE LEVEL)					0.05			**3.55**			0.07

Table 3.1B

Calculation of ESBs for PAHs in Northern Pond Sediment
Refined Ecological Risk Assessment

Gary Development Landfill

(TOC=3.7%; f_{OC}=0.037)			SD28			SD29			SD30		
PAH	COC, $_{PAHi, FCVi}$ ($\mu g/g_{OC}$)	COC, $_{PAHi, Maxi}$ ($\mu g/g_{OC}$)	Conc. ($\mu g/g$ dry wt.)	COC ($\mu g/g_{OC}$)	$ESBTU_{FCVi}$	Conc. ($\mu g/g$ dry wt.)	COC ($\mu g/g_{OC}$)	$ESBTU_{FCVi}$	Conc. ($\mu g/g$ dry wt.)	COC ($\mu g/g_{OC}$)	$ESBTU_{FCVi}$
ACENAPHTHENE	491	33400	0.46	12.43	0.0253	0.043	1.16	0.0024	0.86	23.24	0.0473
ACENAPHTHYLENE	452	24000	0.021	0.57	0.0013	0.071	1.92	0.0042	0.24	6.49	0.0144
ANTHRACENE	594	1300	0.057	1.54	0.0026	0.058	1.57	0.0026	2.7	72.97	0.1229
BENZO(A)ANTHRACENE	841	4153	0.16	4.32	0.0051	0.11	2.97	0.0035	7.7	208.11	0.2475
BENZO(A)PYRENE	965	3840	0.28	7.57	0.0078	0.14	3.78	0.0039	7.8	210.81	0.2185
BENZO(B)FLUORANTHENE	979	2169	0.5	13.51	0.0138	0.22	5.95	0.0061	11	297.30	0.3037
BENZO(G,H,I)PERYLENE	1095	648	0.32	8.65	0.0079	0.07	1.89	0.0017	4.2	113.51	0.1037
BENZO(K)FLUORANTHENE	981	1220	0.15	4.05	0.0041	0.083	2.24	0.0023	3.9	105.41	0.1074
CHRYSENE	844	826	0.35	9.46	0.0112	0.16	4.32	0.0051	7.5	202.70	0.2402
DIBENZ(A,H)ANTHRACENE	1123	2389	0.08	2.16	0.0019	0.07	1.89	0.0017	1.3	35.14	0.0313
FLUORANTHENE	707	23870	0.27	7.30	0.0103	0.31	8.38	0.0119	20	540.54	0.7646
FLUORENE	538	26000	0.21	5.68	0.0105	0.075	2.03	0.0038	1.5	40.54	0.0754
INDENO(1,2,3-C,D)PYRENE	1115	-	0.23	6.22	0.0056	0.07	1.89	0.0017	3.9	105.41	0.0945
NAPHTHALENE	385	61700	1.4	37.84	0.0983	0.5	13.51	0.0351	0.86	23.24	0.0604
PHENANTHRENE	596	34300	0.25	6.76	0.0113	0.3	8.11	0.0136	11	297.30	0.4988
PYRENE	697	9090	1.1	29.73	0.0427	0.33	8.92	0.0128	14	378.38	0.5429
SUM TOTAL $ESBTU_{FCV,13}$ =					0.2598			0.1124			**3.4732**
SUM WITH ALL PAH MULTIPLIER (2.75 FOR 50% CONFIDENCE LEVEL)					0.71			0.31			**9.55**

Table 3.1B

Calculation of ESBs for PAHs in Northern Pond Sediment
Refined Ecological Risk Assessment

Gary Development Landfill

(TOC=3.7%; f_{OC}=0.037)			SD31		
PAH	$COC_{PAHi, FCVi}$ ($\mu g/g_{OC}$)	$COC_{PAHi, Maxi}$ ($\mu g/g_{OC}$)	Conc. ($\mu g/g$ dry wt.)	COC ($\mu g/g_{OC}$)	$ESBTU_{FCVi}$
ACENAPHTHENE	491	33400	0.095	2.57	0.0052
ACENAPHTHYLENE	452	24000	0.031	0.84	0.0019
ANTHRACENE	594	1300	0.052	1.41	0.0024
BENZO(A)ANTHRACENE	841	4153	0.15	4.05	0.0048
BENZO(A)PYRENE	965	3840	0.2	5.41	0.0056
BENZO(B)FLUORANTHENE	979	2169	0.35	9.46	0.0097
BENZO(G,H,I)PERYLENE	1095	648	0.11	2.97	0.0027
BENZO(K)FLUORANTHENE	981	1220	0.11	2.97	0.0030
CHRYSENE	844	826	0.21	5.68	0.0067
DIBENZ(A,H)ANTHRACENE	1123	2389	0.19	5.14	0.0046
FLUORANTHENE	707	23870	0.31	8.38	0.0119
FLUORENE	538	26000	0.06	1.62	0.0030
INDENO(1,2,3-C,D)PYRENE	1115	-	0.077	2.08	0.0019
NAPHTHALENE	385	61700	0.078	2.11	0.0055
PHENANTHRENE	596	34300	0.2	5.41	0.0091
PYRENE	697	9090	0.34	9.19	0.0132
SUM TOTAL $ESBTU_{FCV,13}$ =					0.0910
SUM WITH ALL PAH MULTIPLIER (2.75 FOR 50% CONFIDENCE LEVEL)					0.25

Table 3.1B

Calculation of ESBs for PAHs in Northern Pond Sediment
Refined Ecological Risk Assessment

Gary Development Landfill

Notes:
From: USEPA, 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures
Percent TOC (3.7%) is the median value detected in background sediments from Calumet Area Ecotoxicology Protocol, 2007.
Estimated ESTBU value exceeds 1 indicating potential for adverse effects from PAHs.

Table 3.2

Refinement of Constituents of Potential Ecological Concern in the Southern Wetland Sediment
Refined Ecological Risk Assessment

Gary Development Landfill

CAS Number	Constituent	Freq. of Detection	Maximum Detected Conc.	Background Screening Value (BSV)	Freq. Exceeding BSV	Refinement Screening Value (RSV)	RSV Source	Freq. Exceeding RSV	Refinement Hazard Quotient (HQ)	95% UCL Conc.	95% UCL HQ	COPC (Y/N) Basis
	Volatiles, mg/kg											
67-64-1	ACETONE	8/15	0.93	NA	NA	1.2	Region 4	0/15	0.78	0.26	0.22	No
71-43-2	BENZENE	4/15	0.04	NA	NA	0.12	Region 4	0/15	0.33	0.016	0.13	No
	Semi-Volatiles, mg/kg											
-	LMW PAHs	15/15	9.99	NA	NA	29	Region 4	0/15	0.34	5.12	0.18	No
-	HMW PAHs	15/15	60.7	NA	NA	1.1	Region 4	12/15	55	60.74	55	**Yes**
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	8/15	2.2 J+	NA	NA	0.02	Region 4	8/15	110	1.06	53	**Yes**
132-64-9	DIBENZOFURAN	3/15	2.7	NA	NA	0.15	Region 4	1/15	18	0.68	4.5	**Yes**
	Pesticides, mg/kg											
60-57-1	DIELDRIN	2/15	0.12 J	NA	NA	0.54	Calumet, 2007	0/15	0.2	0.54	1	No
72-54-8	P,P'-DDD	1/15	0.22	NA	NA	0.04	Calumet, 2007	1/15	6	0.22	6	**Yes**
	PCBs, mg/kg											
12674-11-2	PCB-1016 (AROCLOR 1016)	0/13	NA	NA	NA	NA	NA	NA	NA	NA	NA	No
11104-28-2	PCB-1221 (AROCLOR 1221)	0/13	NA	NA	NA	NA	NA	NA	NA	NA	NA	No
11141-16-5	PCB-1232 (AROCLOR 1232)	0/13	NA	NA	NA	NA	NA	NA	NA	NA	NA	No
53469-21-9	PCB-1242 (AROCLOR 1242)	1/13	150	NA	NA	0.041	Region 4	1/13	3659	NA	NA	**Yes**
12672-29-6	PCB-1248 (AROCLOR 1248)	7/13	48	NA	NA	0.0072	Region 4	7/13	6667	NA	NA	**Yes**
11097-69-1	PCB-1254 (AROCLOR 1254)	7/13	26	NA	NA	0.014	Region 4	7/13	1857	NA	NA	**Yes**
11096-82-5	PCB-1260 (AROCLOR 1260)	2/13	0.05	NA	NA	0.88	Region 4	0/13	0.1	NA	NA	No
-	Total PCBs	11/13	132	NA	NA	13	Region 4	11/13	10	33.7	3	**Yes**
	Inorganics, mg/kg											
7440-36-0	ANTIMONY	12/15	13	4	4/15	65	Calumet, 2007	0/15	0.2	8.1	0.1	No
7440-38-2	ARSENIC	15/15	71	13	4/15	31	Calumet, 2007	3/15	2.3	37.31	1.2	**Yes**
7440-39-3	BARIUM	15/15	400	110	8/15	585	Calumet, 2007	0/15	0.7	171.8	0.3	No
7440-41-7	BERYLLIUM	15/15	2.8	0.59	13/15	48	Calumet, 2007	0/15	0.06	1.37	0.03	No
7440-43-9	CADMIUM	15/15	13	0.6	8/15	3.37	Calumet, 2007	4/15	4	6.21	1.8	**Yes**
7440-47-3	CHROMIUM	15/15	1500	16.2	15/15	131	Calumet, 2007	4/15	11	1500	11	**Yes**
7440-50-8	COPPER	15/15	640	19.6	15/15	190	Calumet, 2007	4/15	3	246.5	1.3	**Yes**
7439-92-1	LEAD	15/15	2300	36	13/15	430	Calumet, 2007	4/15	5	1182	3	**Yes**
7439-96-5	MANGANESE	15/15	4200	636	6/15	500	Calumet, 2007	9/15	8	1417	3	**Yes**
7440-02-0	NICKEL	15/15	140	18	15/15	210	Calumet, 2007	0/15	0.7	95.4	0.5	No
7782-49-2	SELENIUM	13/15	9.3	0.48	12/15	1	Calumet, 2007	8/15	9	4.62	5	**Yes**
7440-22-4	SILVER	10/15	18	0.55	4/15	2	Calumet, 2007	3/15	9	15.43	8	**Yes**
7440-28-0	THALLIUM	2/15	3.6 J	0.32	2/15	1.3	Calumet, 2007	1/15	3	3.6	3	**Yes**
7440-62-2	VANADIUM	15/15	69	25.2	8/15	43	Calumet, 2007	3/15	2	37.7	0.9	**Yes**
7440-66-6	ZINC	15/15	9600	95	15/15	250	Calumet, 2007	8/15	38	4256	17	**Yes**
7439-97-6	MERCURY	15/15	2.7	0.06	11/15	1.3	Calumet, 2007	1/15	2	1.14	0.9	No
57-12-5	CYANIDE	10/15	3.4	0.51	5/15	9	Calumet, 2007	0/15	0	2.03	0.2	No

References:

Calumet Area Ecotoxicology Protocol, 2007 (soil background for BSV and soil threshold for RSV).

USEPA Region 4 Ecological Risk Assessment Supplemental Guidance, 2018

TABLE 4.1

COPEC EXPOSURE POINT CONCENTRATIONS BY MEDIA
REFINED ECOLOGICAL RISK ASSESSMENT
95% UCL Concentrations

Gary Development Landfill

Compound	No Pond Sediment (mg/kg)	So Wetlands Sed Conc. (mg/kg)
1,4-Dichlorobenzene	0.61	
Total LMW PAHs	9.78	
Total HMW PAHs	81.3	60.74
Bis(2-ethylhexyl)phthalate	6.08	1.06
Butyl benzyl phthalate	16	
Dibenzofuran		0.68
Di-N-Butyl Phthalate	0.55	
Phenol	0.39	
DDD		0.22
Total PCBs	3.75	33.7
Arsenic		37.31
Cadmium		6.21
Chromium		1500
Copper	165.4	246.5
Lead		1182
Manganese		1417
Selenium		4.62
Silver		15.43
Thallium		3.6
Vanadium		37.7
Zinc		4256

A blank indicates that the compound was not identified as a COPEC for that medium.
95% UCLs calculated per ProUCL version 5.1 as presented in Attachment A.

Table 4.2

DETERMINATION OF PLANT TISSUE CONCENTRATIONS - SOUTHERN WETLANDS - 95% UCLs
REFINED ECOLOGICAL RISK ASESSMENT

Gary Development Landfill

COPEC	Exposure Point Concentration[1] (mg/kg)	Soil to Plant Uptake Equation[2]	Reference	Concentration in Plant (mg/kg)
Bis(2-ethylhexyl)phthalate	1.06	Cp = 0.0015 * Cs	RAIS, 2017	1.59E-03
Dibenzofuran	0.68	Cp = 0.157 * Cs	RAIS, 2017	1.07E-01
Total HMW PAHs	60.74	ln(Cp) = 0.9469 * ln(Cs) - 1.7026	Eco SSLs, 2007	8.90E+00
DDD	0.22	ln(Cp) = 0.7524 * ln(Cs) - 2.5119	Eco SSLs, 2007	2.60E-02
Total PCBs (high risk)	33.7	Cp = 0.00293 * Cs	RAIS, 2017	5.42E-02
Arsenic	37.31	Cp = 0.03752 *Cs	Eco SSLs, 2007	1.40E+00
Cadmium	6.21	ln(Cp) = 0.546 * ln(Cs) - 0.475	Eco SSLs, 2007	1.69E+00
Chromium	1500	Cp = 0.041 * Cs	Eco SSLs, 2007	6.15E+01
Copper	246.5	ln(Cp) = 0.394 * ln(Cs) + 0.668	Eco SSLs, 2007	9.43E+00
Lead	1182	ln(Cp) = 0.561 * ln(Cs) - 1.328	Eco SSLs, 2007	1.40E+01
Manganese	1417	Cp = 0.079 * Cs	Eco SSLs, 2007	1.12E+02
Selenium	4.62	ln(Cp) = 1.104 * ln(Cs) - 0.677	Eco SSLs, 2007	2.75E+00
Silver	15.43	Cp = 0.014 * Cs	Eco SSLs, 2007	2.16E-01
Thallium	3.6	Cp = 0.004 * Cs	Bechtel-Jacobs, 1998a	1.44E-02
Vanadium	37.7	Cp = 0.00485 * Cs	Eco SSLs, 2007	1.83E-01
Zinc	4256	ln(Cp) = 0.554 * ln(Cs) + 1.575	Eco SSLs, 2007	4.95E+02

(1) EPCs are the 95% UCL concentrations concentrations as provided in Table 4.1.

(2) Where:

Cp = concentration in the plant (mg/kg dry weight)

Cs = concentration in sediment (mg/kg)

References:

EcoSSLs, 2007 - USEPA, 2007. Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs), Attachment 4-1, Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55. Revised April 2007.

RAIS, 2017 - Risk Assessment Information System (RAIS), 2017. Database maintained by Oak Rdige National Laboratory, available at https://rais.ornl.gov/

Bechtel-Jacobs, 1998a - Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants. Prepared for the U.S. Department of Energy, Office of Environmental Management. BJC/OR-133.

Table 4.3

DETERMINATION OF INVERTEBRATE TISSUE CONCENTRATIONS - SOUTHERN WETLANDS - 95% UCLs
REFINED ECOLOGICAL RISK ASSESSMENT

Gary Development Landfill

COPEC	Exposure Point Concentration[1] (mg/kg)	Soil to Invertebrate Uptake Equation[2]	Reference	Concentration in Invertebrate (mg/kg)
Bis(2-ethylhexyl)phthalate	1.06	Ci = (Cs / %TOC) * BSAF * % Lipid	USEPA, 2009a	1.94E+00
Dibenzofuran	0.68	Not expected to bioaccumulate	USEPA, 2000	1.07E-01
Total HMW PAHs	60.74	Ci = 2.6 * Cs	EcoSSLs, 2007	1.58E+02
DDD	0.22	Ci = 11.2 * Cs	EcoSSLs, 2007	2.46E+00
Total PCBs (high risk)	33.7	Ci = 64.122 * Cs	EcoSSLs, 2007	2.16E+03
Arsenic	37.31	ln(Ci) = 0.706 * ln(Cs) - 1.421	EcoSSLs, 2007	3.11E+00
Cadmium	6.21	ln(Ci) = 0.795 * ln(Cs) + 2.114	EcoSSLs, 2007	3.54E+01
Chromium	1500	Ci = 0.306 * Cs	EcoSSLs, 2007	4.59E+02
Copper	246.5	Ci = 0.515 * Cs	EcoSSLs, 2007	1.27E+02
Lead	1182	ln(Ci) = 0.807 * ln(Cs) - 0.218	EcoSSLs, 2007	2.43E+02
Manganese	1417	ln(Ci) = 0.682 * ln(Cs) - 0.809	EcoSSLs, 2007	6.28E+01
Selenium	4.62	ln(Ci) = 0.733 * ln(Cs) - 0.075	EcoSSLs, 2007	2.85E+00
Silver	15.43	Ci = 2.045 * Cs	EcoSSLs, 2007	3.16E+01
Thallium	3.6	Ci = Cs	Default Assumption	3.60E+00
Vanadium	37.7	Ci = 0.042 * Cs	EcoSSLs, 2007	1.58E+00
Zinc	4256	ln(Ci) = 0.328 * ln(Cs) + 4.449	EcoSSLs, 2007	1.33E+03

(1) EPCs are the 95% UCL concentrations concentrations as provided in Table 4.1.

(2) Where:

Ci = concentration in the invertebrate (mg/kg dry weight)

Cs = concentration in sediment (mg/kg)

Percent total organic carbon (TOC) for bis(2-ethylhexyl)phthalate is 3.7 from Calumet Ecotoxicology Roundtable Technical Team, 2007. Calumet Area Ecotoxicology Protocol. 2007.

Biota sediment accumulation factor for bis(2-ethylhexyl)phthalate is 1.367 from the Biota Sediment Accumulation Factor Database, 2018, available at: https://bsaf.el.erdc.dren.mil/. The average reported BSAF for three fish species was utilized.

Percent lipid for bis(2-ethylhexyl)phthalate is 4.9 and is based on the average reported pecent lipid for the three fish species in the BSAF database, 2018.

References:

EcoSSLs, 2007 - USEPA, 2007. Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs), Attachment 4-1, Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55. Revised April 2007.

Bechtel-Jacobs, 1998b - Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation. BJC/OR-112.

USEPA, 2000 - Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, February 2000.

USEPA, 2009a - Estimation of Biota Sediment Accumulation Factor (BSAF) From Paired Observations of Chemical Concentrations in Biota and Sediment. February, 2009.

Table 4.4

DETERMINATION OF SMALL PREY TISSUE CONCENTRATIONS - SOUTHERN WETLANDS - 95% UCLs
REFINED ECOLOGICAL RISK ASSESSMENT

Gary Development Landfill

COPEC	Exposure Point Concentration ($mg/kg_{sediment}$)	Concentration in Diet (mg/kg)	Log Kow	Transfer Factor ($kg_{sediment}/kg_{tissue}$)	Reference	Dry Weight to Wet Weight Conversion Factor[1]	Concentration in Tissue[2] (mg/kg_{tissue})
Bis(2-ethylhexyl)phthalate	1.06	1.94E+00	7.6	1.00E+00	Travis & Arms, 1988	1	1.06E+00
Dibenzofuran	0.68	1.07E-01	4.12	3.31E-04	Travis & Arms, 1988	1	2.25E-04
Total HMW PAHs	60.74	1.58E+02	-	Cm = 0	Eco SSLs, 2007	1	0.00E+00
DDD	0.22	2.46E+00	6.02	Cm = 4.83 * Cd	Eco SSLs, 2007	1	1.19E+01
Total PCBs (high risk)	33.7	2.16E+03	7.1	3.16E-01	Travis & Arms, 1988	1	1.07E+01
Arsenic	37.31	3.11E+00	NA	ln(Cm) = 0.8188 * ln(Cs) - 4.8471	Eco SSLs, 2007	1	1.52E-01
Cadmium	6.21	3.54E+01	NA	ln(Cm) = 0.4723 * ln(Cs) - 1.2571	Eco SSLs, 2007	1	8.76E+00
Chromium	1500	4.59E+02	NA	ln(Cm) = 0.7338 * ln(Cs) - 1.4599	Eco SSLs, 2007	1	4.97E+01
Copper	246.5	1.27E+02	NA	ln(Cm) = 0.1444 * ln(Cs) + 2.042	Eco SSLs, 2007	1	1.14E+02
Lead	1182	2.43E+02	NA	ln(Cm) = 0.4422 * ln(Cs) + 0.0761	Eco SSLs, 2007	1	2.46E+01
Manganese	1417	6.28E+01	NA	Cm = 0.0205 * Cs	Eco SSLs, 2007	1	2.90E+01
Selenium	4.62	2.85E+00	NA	ln(Cm) = 0.3764 * ln(Cs) - 0.4158	Eco SSLs, 2007	1	1.17E+00
Silver	15.43	3.16E+01	NA	Cm = 0.004 * Cs	Eco SSLs, 2007	1	6.17E-02
Thallium	3.6	3.60E+00	NA	Cm = 0.001 * 50 * Cd	Default assumption	1	1.80E-01
Vanadium	37.7	1.58E+00	NA	Cm = 0.0123 * Cs	Eco SSLs, 2007	1	4.64E-01
Zinc	4256	1.33E+03	NA	ln(Cm) = 0.0706 * ln(Cs) + 4.3632	Eco SSLs, 2007	1	1.42E+02

(1) EPCs are 95% UCL concentrations concentrations as provided in Table 4.1.

(2) Where:

Cm = concentration in the mammal (mg/kg dry weight)

Cs = concentration in sediment (mg/kg)

Cd = Concentration in the diet (mg/kg) (assumed to be 100% invertebrates; from Table 2.2).

For organics, concentration in tissue = sediment concentration x sediment-to-animal transfer factor x conversion factor (default of 1 assumed)

Transfer factor based on equation from Travis & Arms, 1988:

Log Bb = -7.6 + Log kow Where: Bb = BAF, kow = Octanol to water partition coefficient for the organic COPEC

References:

EcoSSLs, 2007 - USEPA, 2007. Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs), Attachment 4-1, Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55. Revised April 2007.

Baes, C. F., III, R. D. Sharp, A. L. Sjoreen, and R. W. Shor, 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture. Oak Ridge National Laboratory, ORNL-5786

Travis and Arms, 1988. Bioconcentration of Organics in Beef, Milk, and Vegetation. Environmental Science and Technology. 22(3):271-274.

TABLE 4.5

ESTIMATED FISH TISSUE CONCENTRATIONS IN THE NORTHERN POND - 95% UCLs
REFINED ECOLOGICAL RISK ASSESSMENT

Gary Development Landfill

COPECs in Sediment[1]	Exposure Point Concentration (mg/kg)	% TOC[2]	BSAF[3] (unitless)	% Lipid[4]	Fish Conc.[5] (mg/kg)
1,4-Dichlorobenzene	0.61	3.7	4.394	3.73	2.70E+00
Total LMW PAHs[6]	9.78	3.7	0.91	3.73	8.97E+00
Total HMW PAHs[6]	81.3	3.7	0.27	3.73	2.21E+01
Total PCBs	3.75	3.7	8.69	3.73	3.29E+01

(1) Selected COPECs based on being potentially site-related and bioaccumulative. 95% UCL concentrations in the 0 - 1 foot depth used as the Exposure Point Concentrations.

(2) Percent TOC is the median value detected in background sediments from Calumet Area Ecotoxicology Protocol, 2007.

(3) Data from USACE BSAF database,2018, https://bsaf.el.erdc.dren.mil/

(4) Percent lipid (wet weight) based on mean value for common carp from USACE BSAF database, 2018.

(5) Fish conc. = (Exposure Point Conc./% TOC) * BSAF * % Lipid

(6) Total LMW PAHs and Total HMW PAHs based on the maximum detected concentrations in the 0 - 1 foot depth at location SD30. BSAF for LMW PAHs based on average for freshwater molluscs and lake trout for all listed LMW PAHs. BASF for HMW PAHs based on average for HMW PAHS for freshwater molluscs and lake trout for all listed HMW PAHs.

Table 4.6
Intake Parameters for the Key Ecological Receptor Species
Refined Ecological Risk Assessment
Gary Development Landfill
Gary, Indiana

Receptor Species	Body Weight (kg)	Typical Diet Composition	Food Ingestion Rate (FIR)* (kg/kg dry wt-day)	Water Ingestion Rate (WIR) (kg/kg dry wt-day)	Soil/Sediment Intake (% of diet)	Foraging Territory (acres)
Bird Species						
American Robin	0.077	50% plants 50% invertebrates	0.24	0.14	10.4%	0.37
Song Sparrow	0.02	100% invertebrates	0.2	0.21	6.1%	0.5
Bobwhite	0.18	100% plants	0.024	0.11	10.4%	8.9
American Kestrel	0.12	100% small prey	0.096	0.12	2.55%	380
Osprey	1.9	100% fish	0.21	0.053	0	2243
Mammal Species						
Deer Mouse	0.02	50% plants 50% invertebrates	0.17	0.19	2%	0.13
Short-tailed Shrew	0.018	100% invertebrates	0.1	0.223	13%	0.25
Meadow Vole	0.037	100% plants	0.105	0.21	2%	0.05
Red Fox	4.5	100% small prey	0.08	0.086	2.80%	240

*FIR - Adjusted for percent moisture in food (USEPA, 1993).

TABLE 4.7

Estimated Exposure Intake and Hazard Quotient Calculations for the American Robin
Refined Ecological Risk Assessment

Gary Development Landfill

Compound	Sediment Conc. (mg/kg)	Est. Intake via Sediment (mg/kg-day)	Wetland Invert Food Conc. (mg/kg)	Est. Intake via Food (mg/kg-day)	Wetland Plant Food Conc. (mg/kg)	Est. Intake via Food (mg/kg-day)	Temporal Use Factor (unitless)	Total Estimated Intake (mg/kg-day)	Ecological LOAEL TRV (mg/kg-day)	Calculated HQ (unitless)
Total HMW PAHs	6.07E+01	1.52E+00	1.58E+02	1.90E+01	8.90E+00	1.07E+00	7.50E-01	1.62E+01	2.00E+02	8.08E-02
Total PCBs	3.37E+01	8.41E-01	2.16E+03	2.59E+02	5.42E-02	6.51E-03	7.50E-01	1.95E+02	1.27E+00	**1.54E+02**
Cadmium	6.21E+00	1.55E-01	3.54E+01	4.24E+00	1.69E+00	2.02E-01	7.50E-01	3.45E+00	2.39E+00	**1.44E+00**
Chromium	1.50E+03	3.74E+01	4.59E+02	5.51E+01	6.15E+01	7.38E+00	7.50E-01	7.49E+01	8.32E+00	**9.01E+00**
Copper	2.47E+02	6.15E+00	1.27E+02	1.52E+01	9.43E+00	1.13E+00	7.50E-01	1.69E+01	2.80E+01	6.03E-01
Lead	1.18E+03	2.95E+01	2.43E+02	2.91E+01	1.40E+01	1.68E+00	7.50E-01	4.52E+01	1.33E+01	**3.40E+00**
Selenium	4.62E+00	1.15E-01	2.85E+00	3.42E-01	2.75E+00	3.30E-01	7.50E-01	5.91E-01	4.25E-01	**1.39E+00**
Vanadium	3.77E+01	9.41E-01	1.58E+00	1.90E-01	1.83E-01	2.19E-02	7.50E-01	8.65E-01	6.70E-01	**1.29E+00**
Zinc	4.26E+03	1.06E+02	1.33E+03	1.59E+02	4.95E+02	5.94E+01	7.50E-01	2.44E+02	1.05E+02	**2.32E+00**

Sediment concentrations from Table 4.1; plant concentrations from Table 4.2; invertebrate concentrations from Table 4.3.
Temporal use factor based on migratory behavior assuming on-site 9 months per year.

TABLE 4.8

Estimated Exposure Intake and Hazard Quotient Calculations for the Song Sparrow
Refined Ecological Risk Assessment

Gary Development Landfill

Compound	Sediment Conc. (mg/kg)	Est. Intake via Sediment (mg/kg-day)	Wetland Invert Food Conc. (mg/kg)	Est. Intake via Food (mg/kg-day)	Total Estimated Intake (mg/kg-day)	Ecological LOAEL TRV (mg/kg-day)	Calculated HQ (unitless)
Total HMW PAHs	6.07E+01	7.41E-01	1.58E+02	3.16E+01	3.23E+01	2.00E+02	1.62E-01
Total PCBs	3.37E+01	4.11E-01	2.16E+03	4.32E+02	4.33E+02	1.27E+00	**3.41E+02**
Cadmium	6.21E+00	7.58E-02	3.54E+01	7.07E+00	7.15E+00	2.39E+00	**2.99E+00**
Chromium	1.50E+03	1.83E+01	4.59E+02	9.18E+01	1.10E+02	8.32E+00	**1.32E+01**
Copper	2.47E+02	3.01E+00	1.27E+02	2.54E+01	2.84E+01	2.80E+01	1.01E+00
Lead	1.18E+03	1.44E+01	2.43E+02	4.85E+01	6.29E+01	1.33E+01	**4.73E+00**
Selenium	4.62E+00	5.64E-02	2.85E+00	5.70E-01	6.26E-01	4.25E-01	**1.47E+00**
Vanadium	3.77E+01	4.60E-01	1.58E+00	3.17E-01	7.77E-01	6.70E-01	**1.16E+00**
Zinc	4.26E+03	5.19E+01	1.33E+03	2.65E+02	3.17E+02	1.05E+02	**3.02E+00**

Sediment concentrations from Table 4.1; invertebrate concentrations from Table 4.3.

TABLE 4.9

Estimated Exposure Intake and Hazard Quotient Calculations for the Bobwhite
Refined Ecological Risk Assessment

Gary Development Landfill

Compound	Sediment Conc. (mg/kg)	Est. Intake via Sediment (mg/kg-day)	Wetland Plant Food Conc. (mg/kg)	Est. Intake via Food (mg/kg-day)	Area Use Factor (unitless)	Total Estimated Intake (mg/kg-day)	Ecological LOAEL TRV (mg/kg-day)	Calculated HQ (unitless)
Total PCBs	3.37E+01	4.11E-01	5.42E-02	1.30E-03	2.50E-01	1.03E-01	1.27E+00	8.12E-02
Chromium	1.50E+03	1.83E+01	6.15E+01	1.48E+00	2.50E-01	4.94E+00	8.32E+00	5.94E-01
Lead	1.18E+03	1.44E+01	1.40E+01	3.37E-01	2.50E-01	3.69E+00	1.33E+01	2.77E-01
Vanadium	3.77E+01	4.60E-01	1.83E-01	4.39E-03	2.50E-01	1.16E-01	6.70E-01	1.73E-01
Zinc	4.26E+03	5.19E+01	4.95E+02	1.19E+01	2.50E-01	1.59E+01	1.05E+02	1.52E-01

Sediment concentrations from Table 4.1; plant concentrations from Table 4.2.
Area use factor based on a foraging territory of 8.9 acres and site area of 2.2 acres (2.2 / 8.9 = 0.25).

TABLE 4.10

Estimated Exposure Intake and Hazard Quotient Calculations for the American Kestrel
Refined Ecological Risk Assessment

Gary Development Landfill

Compound	Sediment Conc. (mg/kg)	Est. Intake via Sediment (mg/kg-day)	Small Prey Food Conc. (mg/kg)	Est. Intake via Food (mg/kg-day)	Area Use Factor (unitless)	Total Estimated Intake (mg/kg-day)	Ecological LOAEL TRV (mg/kg-day)	Calculated HQ (unitless)
DDD	2.20E-01	5.39E-04	1.19E+01	1.14E+00	6.00E-03	6.86E-03	8.20E-01	8.36E-03
Total PCBs	3.37E+01	8.25E-02	1.07E+01	1.02E+00	6.00E-03	6.63E-03	1.27E+00	5.22E-03
Chromium	1.50E+03	3.67E+00	4.97E+01	4.77E+00	6.00E-03	5.07E-02	8.32E+00	6.09E-03

Sediment concentrations from Table 4.1; small prey concentrations from Table 4.4.
Area use factor based on a foraging territory of 380 acres and site area of 2.2 acres (2.2 / 380 = 0.006).

TABLE 4.11

Estimated Exposure Intake and Hazard Quotient Calculations for the Osprey
Refined Ecological Risk Assessment

Gary Development Landfill

Compound	No. Pond Fish Conc. (mg/kg)	Est. Intake via Food (mg/kg-day)	Area Use Factor (unitless)	Total Estimated Intake (mg/kg-day)	Ecological LOAEL TRV (mg/kg-day)	Calculated HQ (unitless)
Total PCBs	2.98E+01	6.26E+00	2.00E-03	1.25E-02	1.27E+00	9.86E-03

Fish tissue concentrations from Table 4.5
Area use factor based on a foraging territory of 2243 acres and site area of 4.8 acres (4.8 / 2243 = 0.002).

TABLE 4.12

Estimated Exposure Intake and Hazard Quotient Calculations for the Deer Mouse
Refined Ecological Risk Assessment

Gary Development Landfill

Compound	Sediment Conc. (mg/kg)	Est. Intake via Sediment (mg/kg-day)	Wetland Invert Food Conc. (mg/kg)	Est. Intake via Food (mg/kg-day)	Wetland Plant Food Conc. (mg/kg)	Est. Intake via Food (mg/kg-day)	Total Estimated Intake (mg/kg-day)	Ecological LOAEL TRV (mg/kg-day)	Calculated HQ (unitless)
Total HMW PAHs	6.07E+01	2.07E-01	1.58E+02	1.34E+01	8.90E+00	7.56E-01	1.44E+01	3.07E+00	**4.69E+00**
Total PCBs	3.37E+01	1.15E-01	2.16E+03	1.84E+02	5.42E-02	4.61E-03	1.84E+02	1.30E+00	**1.41E+02**
Cadmium	6.21E+00	2.11E-02	3.54E+01	3.01E+00	1.69E+00	1.43E-01	3.17E+00	2.01E+00	**1.58E+00**
Chromium	1.50E+03	5.10E+00	4.59E+02	3.90E+01	6.15E+01	5.23E+00	4.93E+01	1.61E+01	**3.06E+00**
Lead	1.18E+03	4.02E+00	2.43E+02	2.06E+01	1.40E+01	1.19E+00	2.58E+01	2.87E+01	9.00E-01
Manganese	1.42E+03	4.82E+00	6.28E+01	5.34E+00	1.12E+02	9.52E+00	1.97E+01	7.10E+01	2.77E-01
Selenium	4.62E+00	1.57E-02	2.85E+00	2.42E-01	2.75E+00	2.34E-01	4.92E-01	2.37E-01	**2.08E+00**
Zinc	4.26E+03	1.45E+01	1.33E+03	1.13E+02	4.95E+02	4.21E+01	1.69E+02	8.23E+01	**2.06E+00**

Sediment concentrations from Table 4.1; plant concentrations from Table 4.2; invertebrate concentrations from Table 4.3.

TABLE 4.13

Estimated Exposure Intake and Hazard Quotient Calculations for the Short-Tail Shrew
Refined Ecological Risk Assessment

Gary Development Landfill

Compound	Sediment Conc. (mg/kg)	Est. Intake via Sediment (mg/kg-day)	Wetland Invert Food Conc. (mg/kg)	Est. Intake via Food (mg/kg-day)	Total Estimated Intake (mg/kg-day)	Ecological LOAEL TRV (mg/kg-day)	Calculated HQ (unitless)
Total HMW PAHs	6.07E+01	7.90E-01	1.58E+02	1.58E+01	1.66E+01	3.07E+00	**5.40E+00**
Total PCBs	3.37E+01	4.38E-01	2.16E+03	2.16E+02	2.17E+02	1.30E+00	**1.67E+02**
Cadmium	6.21E+00	8.07E-02	3.54E+01	3.54E+00	3.62E+00	2.01E+00	**1.80E+00**
Chromium	1.50E+03	1.95E+01	4.59E+02	4.59E+01	6.54E+01	1.61E+01	**4.06E+00**
Copper	2.47E+02	3.20E+00	1.27E+02	1.27E+01	1.59E+01	3.12E+01	5.10E-01
Lead	1.18E+03	1.54E+01	2.43E+02	2.43E+01	3.96E+01	2.87E+01	**1.38E+00**
Manganese	1.42E+03	1.84E+01	6.28E+01	6.28E+00	2.47E+01	7.10E+01	3.48E-01
Selenium	4.62E+00	6.01E-02	2.85E+00	2.85E-01	3.45E-01	2.37E-01	**1.46E+00**
Zinc	4.26E+03	5.53E+01	1.33E+03	1.33E+02	1.88E+02	8.23E+01	**2.28E+00**

Sediment concentrations from Table 4.1; invertebrate concentrations from Table 4.3.

TABLE 4.14

Estimated Exposure Intake and Hazard Quotient Calculations for the Meadow Vole
Refined Ecological Risk Assessment

Gary Development Landfill

Compound	Sediment Conc. (mg/kg)	Est. Intake via Sediment (mg/kg-day)	Wetland Plant Food Conc. (mg/kg)	Est. Intake via Food (mg/kg-day)	Total Estimated Intake (mg/kg-day)	Ecological LOAEL TRV (mg/kg-day)	Calculated HQ (unitless)
Total HMW PAHs	6.07E+01	1.28E-01	8.90E+00	9.34E-01	1.06E+00	3.07E+00	3.46E-01
Manganese	1.42E+03	2.98E+00	1.12E+02	1.18E+01	1.47E+01	7.10E+01	2.07E-01
Selenium	4.62E+00	9.70E-03	2.75E+00	2.89E-01	2.99E-01	2.37E-01	**1.26E+00**
Zinc	4.26E+03	8.94E+00	4.95E+02	5.20E+01	6.09E+01	8.23E+01	7.40E-01

Sediment concentrations from Table 4.1; plant concentrations from Table 4.2.

TABLE 4.15

Estimated Exposure Intake and Hazard Quotient Calculations for the Red Fox
Refined Ecological Risk Assessment

Gary Development Landfill

Compound	Sediment Conc. (mg/kg)	Est. Intake via Sediment (mg/kg-day)	Small Prey Food Conc. (mg/kg)	Est. Intake via Food (mg/kg-day)	Total Estimated Intake (mg/kg-day)	Ecological LOAEL TRV (mg/kg-day)	Calculated HQ (unitless)
Total HMW PAHs	6.07E+01	1.36E-01	0.00E+00	0.00E+00	1.36E-01	3.07E+00	4.43E-02
DDD	2.20E-01	4.93E-04	1.19E+01	9.52E-01	9.53E-01	9.80E-01	9.72E-01
Total PCBs	3.37E+01	7.55E-02	1.07E+01	8.53E-01	9.28E-01	1.30E+00	7.14E-01

Sediment concentrations from Table 4.1; small prey concentrations from Table 4.4.

TABLE 4.16

Direct Sediment Comparison for Toxicity to Wetland Plants
Refined Ecological Risk Assessment

Gary Development Landfill

Compound	So Wetlands 95% UCL Sed Conc. (mg/kg)	Regional Background (mg/kg)	Wetland Plant LOAEL (mg/kg)	Reference	Calculated LOAEL HQ (unitless)
High Molecular Weight PAHs	60.74	-	1.1	Region 4 SL, 2018	**55**
Bis(2-ethylhexyl)phthalate	1.06	-	0.02	Region 4 SL, 2018	**53**
Dibenzofuran	0.68	-	61	LANL, 2017	0.01
DDD	0.22	-	0.021	Region 4 SL, 2018	**10**
Total PCBs	27.64	-	40	Region 4 Plants, 2018	0.7
Arsenic	37.31	13	91	LANL, 2017	0.4
Cadmium	6.21	0.6	32	Region 4 Plants, 2018	0.2
Chromium	1500	16.2	-		
Copper	246.5	19.6	490	LANL, 2017	0.5
Lead	1182	36	570	LANL, 2017	**2.1**
Manganese	1417	636	1100	LANL, 2017	**1.3**
Thallium	3.6	0.32	0.5	LANL, 2017	**7.2**
Vanadium	37.7	25.2	80	LANL, 2017	0.5
Zinc	4256	95	810	LANL, 2017	**5.3**

Regional background from Illinois TACO, 2007 for Metropolitan Areas.
Region 4 Plants, 2018 is specific to plant exposures.
Region 4 SL, 2018 is generic for all soils.
LANL, 2017 - Los Alamos National Laboratory EcoRisk database.

TABLE 4.17

Direct Sediment Comparison for Toxicity to Wetland Invertebrates
Refined Ecological Risk Assessment

Gary Development Landfill

Compound	So Wetlands 95% UCL Sed Conc. (mg/kg)	Regional Background (mg/kg)	Wetland Invert. LOAEL (mg/kg)	Reference	Calculated HQ (unitless)
High Molecular Weight PAHs	60.74	-	18	Region 4 Inv., 2018	**3.4**
Dibenzofuran	0.68	-	0.15	Region 4 Inv., 2018	**4.5**
DDD	0.22	-	0.021	Region 4 Inv., 2018	**10**
Total PCBs	33.7	-	0.33	Region 4 Inv., 2018	**102**
Arsenic	37.31	13	68	LANL, 2017	0.5
Chromium	1500	16.2	-		
Copper	246.5	19.6	530	LANL, 2017	0.5
Lead	1182	36	8400	LANL, 2017	0.1
Manganese	1417	636	4500	LANL, 2017	0.3
Silver	15.43	0.55	4.2	Region 4 SL, 2018	**3.7**
Thallium	3.6	0.32	0.05	Region 4 SL, 2018	**72**
Vanadium	37.7	25.2	7.8	Region 4 SL, 2018	**4.8**
Zinc	4256	95	930	LANL, 2017	**4.6**

Regional background from Illinois TACO, 2007 for Metropolitan Areas.

Region 4 Inv., 2018 is specific to invertebrate exposures.

Region 4 SL, 2018 is generic for all soils.

LANL, 2017 - Los Alamos National Laboratory EcoRisk database; based on earthworm exposure.

TABLE 4.18

Direct Sediment Comparison for Toxicity to Northern Pond Aquatic Life
Refined Ecological Risk Assessment

Gary Development Landfill

Compound	No. Pond 95% UCL Sed Conc. (mg/kg)	Regional Background (mg/kg)	Sediment RSV (mg/kg)	Reference	Calculated HQ (unitless)
1,4-Dichlorobenzene	0.61	-	0.468	Region 4, 2018	**1.3**
Low Molecular Weight PAHs	9.78	-	0.584	Region 4, 2018	**17**
High Molecular Weight PAHs	81.3	-	0.9675	Region 4, 2018	**84**
Bis(2-ethylhexyl)phthalate	6.08	-	2.6	Region 4, 2018	**2.3**
Butyl Benzyl Phthalate	16	-	0.481	Region 4, 2018	**33**
Di-N-Butyl Phthalate	0.55	-	0.319	Region 4, 2018	**1.7**
Phenol	0.39	-	0.21	Region 4, 2018	**1.9**
Total PCBs	3.76	0.134	0.676	Region 4, 2018	**5.6**
Copper	165.4	99.9	149	Region 4, 2018	**1.1**

Regional background from Calumet Area Ecotoxicology Protocol, 2007, Appendix A, Table A-2.
Sediment RSV from USEPA Region 4, 2018.

APPENDIX A

95% UCL Printouts

Northern Pond 95% UCLs

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/20/2019 3:00:22 PM
From File	ProUCL Setup No Pond Sed-eco-rev2.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,4-DCB

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Number of Detects	1	Number of Non-Detects	9
Number of Distinct Detects	1	Number of Distinct Non-Detects	9

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

s suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BT

The data set for variable 1,4-DCB was not processed!

Acenaphthene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Number of Detects	6	Number of Non-Detects	4
Number of Distinct Detects	6	Number of Distinct Non-Detects	4
Minimum Detect	43	Minimum Non-Detect	52
Maximum Detect	860	Maximum Non-Detect	200
Variance Detects	115231	Percent Non-Detects	40%
Mean Detects	344.2	SD Detects	339.5
Median Detects	268	CV Detects	0.986
Skewness Detects	0.612	Kurtosis Detects	-1.301
Mean of Logged Detects	5.225	SD of Logged Detects	1.327

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.858	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.285	Lilliefors GOF Test
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

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

KM Mean	226.1	KM Standard Error of Mean	97.12
KM SD	280.3	95% KM (BCA) UCL	385.8
95% KM (t) UCL	404.2	95% KM (Percentile Bootstrap) UCL	387.5
95% KM (z) UCL	385.9	95% KM Bootstrap t UCL	495.2
90% KM Chebyshev UCL	517.5	95% KM Chebyshev UCL	649.5
97.5% KM Chebyshev UCL	832.7	99% KM Chebyshev UCL	1193

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.531	Anderson-Darling GOF Test

54				5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level					
55				K-S Test Statistic	0.289	Kolmogorov-Smirnov GOF					
56				5% K-S Critical Value	0.341	Detected data appear Gamma Distributed at 5% Significance Level					
57				Detected data appear Gamma Distributed at 5% Significance Level							
58											
59				Gamma Statistics on Detected Data Only							
60				k hat (MLE)	0.944	k star (bias corrected MLE)	0.583				
61				Theta hat (MLE)	364.7	Theta star (bias corrected MLE)	590.4				
62				nu hat (MLE)	11.32	nu star (bias corrected)	6.995				
63				Mean (detects)	344.2						
64											
65				Gamma ROS Statistics using Imputed Non-Detects							
66				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
67				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
68				For such situations, GROS method may yield incorrect values of UCLs and BTVs							
69				This is especially true when the sample size is small.							
70				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
71				Minimum	0.01	Mean	209.9				
72				Maximum	860	Median	49.5				
73				SD	306.8	CV	1.462				
74				k hat (MLE)	0.273	k star (bias corrected MLE)	0.258				
75				Theta hat (MLE)	769.4	Theta star (bias corrected MLE)	814.7				
76				nu hat (MLE)	5.456	nu star (bias corrected)	5.152				
77				Adjusted Level of Significance (β)	0.0267						
78				Approximate Chi Square Value (5.15, α)	1.223	Adjusted Chi Square Value (5.15, β)	0.926				
79				95% Gamma Approximate UCL (use when n>=50)	884	95% Gamma Adjusted UCL (use when n<50)	1168				
80											
81				Estimates of Gamma Parameters using KM Estimates							
82				Mean (KM)	226.1	SD (KM)	280.3				
83				Variance (KM)	78552	SE of Mean (KM)	97.12				
84				k hat (KM)	0.651	k star (KM)	0.522				
85				nu hat (KM)	13.02	nu star (KM)	10.45				
86				theta hat (KM)	347.3	theta star (KM)	432.9				
87				80% gamma percentile (KM)	372	90% gamma percentile (KM)	606.3				
88				95% gamma percentile (KM)	855.2	99% gamma percentile (KM)	1465				
89											
90				Gamma Kaplan-Meier (KM) Statistics							
91				Approximate Chi Square Value (10.45, α)	4.224	Adjusted Chi Square Value (10.45, β)	3.562				
92				95% Gamma Approximate KM-UCL (use when n>=50)	559.4	95% Gamma Adjusted KM-UCL (use when n<50)	663.3				
93											
94				Lognormal GOF Test on Detected Observations Only							
95				Shapiro Wilk Test Statistic	0.85	Shapiro Wilk GOF Test					
96				5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level					
97				Lilliefors Test Statistic	0.253	Lilliefors GOF Test					
98				5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level					
99				Detected Data appear Lognormal at 5% Significance Level							
100											
101				Lognormal ROS Statistics Using Imputed Non-Detects							
102				Mean in Original Scale	224.5	Mean in Log Scale	4.642				
103				SD in Original Scale	296.5	SD in Log Scale	1.26				
104				95% t UCL (assumes normality of ROS data)	396.4	95% Percentile Bootstrap UCL	372.1				
105				95% BCA Bootstrap UCL	410.1	95% Bootstrap t UCL	526.1				
106				95% H-UCL (Log ROS)	1066						

107											
108	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										
109				KM Mean (logged)	4.685			KM Geo Mean	108.3		
110				KM SD (logged)	1.154			95% Critical H Value (KM-Log)	3.427		
111				KM Standard Error of Mean (logged)	0.402			95% H-UCL (KM -Log)	788		
112				KM SD (logged)	1.154			95% Critical H Value (KM-Log)	3.427		
113				KM Standard Error of Mean (logged)	0.402						
114											
115	DL/2 Statistics										
116				DL/2 Normal				DL/2 Log-Transformed			
117				Mean in Original Scale	231.8			Mean in Log Scale	4.722		
118				SD in Original Scale	292.6			SD in Log Scale	1.253		
119				95% t UCL (Assumes normality)	401.4			95% H-Stat UCL	1129		
120	DL/2 is not a recommended method, provided for comparisons and historical reasons										
121											
122	Nonparametric Distribution Free UCL Statistics										
123	Detected Data appear Normal Distributed at 5% Significance Level										
124											
125	Suggested UCL to Use										
126				95% KM (t) UCL	404.2						
127											
128	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
129	Recommendations are based upon data size, data distribution, and skewness.										
130	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
131	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
132											
133	Acenaphthylene										
134											
135	General Statistics										
136				Total Number of Observations	10			Number of Distinct Observations	9		
137				Number of Detects	6			Number of Non-Detects	4		
138				Number of Distinct Detects	5			Number of Distinct Non-Detects	4		
139				Minimum Detect	21			Minimum Non-Detect	52		
140				Maximum Detect	240			Maximum Non-Detect	210		
141				Variance Detects	7379			Percent Non-Detects	40%		
142				Mean Detects	68.83			SD Detects	85.9		
143				Median Detects	30			CV Detects	1.248		
144				Skewness Detects	2.214			Kurtosis Detects	4.977		
145				Mean of Logged Detects	3.772			SD of Logged Detects	0.948		
146											
147	Normal GOF Test on Detects Only										
148				Shapiro Wilk Test Statistic	0.652			Shapiro Wilk GOF Test			
149				5% Shapiro Wilk Critical Value	0.788			Detected Data Not Normal at 5% Significance Level			
150				Lilliefors Test Statistic	0.337			Lilliefors GOF Test			
151				5% Lilliefors Critical Value	0.325			Detected Data Not Normal at 5% Significance Level			
152	Detected Data Not Normal at 5% Significance Level										
153											
154	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
155				KM Mean	52.8			KM Standard Error of Mean	22.5		
156				KM SD	64.33			95% KM (BCA) UCL	95.94		
157				95% KM (t) UCL	94.04			95% KM (Percentile Bootstrap) UCL	91.37		
158				95% KM (z) UCL	89.81			95% KM Bootstrap t UCL	353.2		
159				90% KM Chebyshev UCL	120.3			95% KM Chebyshev UCL	150.9		

160				97.5% KM Chebyshev UCL	193.3				99% KM Chebyshev UCL		276.7
161											
162					Gamma GOF Tests on Detected Observations Only						
163				A-D Test Statistic	0.763	Anderson-Darling GOF Test					
164				5% A-D Critical Value	0.712	Detected Data Not Gamma Distributed at 5% Significance Level					
165				K-S Test Statistic	0.345	Kolmogorov-Smirnov GOF					
166				5% K-S Critical Value	0.339	Detected Data Not Gamma Distributed at 5% Significance Level					
167					Detected Data Not Gamma Distributed at 5% Significance Level						
168											
169					Gamma Statistics on Detected Data Only						
170				k hat (MLE)	1.228	k star (bias corrected MLE)	0.725				
171				Theta hat (MLE)	56.04	Theta star (bias corrected MLE)	94.91				
172				nu hat (MLE)	14.74	nu star (bias corrected)	8.703				
173				Mean (detects)	68.83						
174											
175					Gamma ROS Statistics using Imputed Non-Detects						
176					GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs						
177					GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)						
178					For such situations, GROS method may yield incorrect values of UCLs and BTVs						
179					This is especially true when the sample size is small.						
180					For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates						
181				Minimum	19.74	Mean	50.96				
182				Maximum	240	Median	28.55				
183				SD	68.12	CV	1.337				
184				k hat (MLE)	1.391	k star (bias corrected MLE)	1.04				
185				Theta hat (MLE)	36.64	Theta star (bias corrected MLE)	48.99				
186				nu hat (MLE)	27.81	nu star (bias corrected)	20.8				
187				Adjusted Level of Significance (β)	0.0267						
188				Approximate Chi Square Value (20.80, α)	11.45	Adjusted Chi Square Value (20.80, β)	10.26				
189				95% Gamma Approximate UCL (use when n>=50)	92.62	95% Gamma Adjusted UCL (use when n<50)	103.3				
190											
191					Estimates of Gamma Parameters using KM Estimates						
192				Mean (KM)	52.8	SD (KM)	64.33				
193				Variance (KM)	4138	SE of Mean (KM)	22.5				
194				k hat (KM)	0.674	k star (KM)	0.538				
195				nu hat (KM)	13.47	nu star (KM)	10.77				
196				theta hat (KM)	78.37	theta star (KM)	98.09				
197				80% gamma percentile (KM)	86.93	90% gamma percentile (KM)	140.6				
198				95% gamma percentile (KM)	197.6	99% gamma percentile (KM)	336.5				
199											
200					Gamma Kaplan-Meier (KM) Statistics						
201				Approximate Chi Square Value (10.77, α)	4.426	Adjusted Chi Square Value (10.77, β)	3.745				
202				95% Gamma Approximate KM-UCL (use when n>=50)	128.4	95% Gamma Adjusted KM-UCL (use when n<50)	151.8				
203											
204					Lognormal GOF Test on Detected Observations Only						
205				Shapiro Wilk Test Statistic	0.815	Shapiro Wilk GOF Test					
206				5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level					
207				Lilliefors Test Statistic	0.306	Lilliefors GOF Test					
208				5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level					
209					Detected Data appear Lognormal at 5% Significance Level						
210											
211					Lognormal ROS Statistics Using Imputed Non-Detects						
212				Mean in Original Scale	53.13	Mean in Log Scale	3.617				

213				SD in Original Scale	67.18				SD in Log Scale		0.736
214			95% t UCL (assumes normality of ROS data)		92.07				95% Percentile Bootstrap UCL		92.02
215				95% BCA Bootstrap UCL	111.4				95% Bootstrap t UCL		483
216				95% H-UCL (Log ROS)	92.32						
217											
218				Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution							
219				KM Mean (logged)	3.582				KM Geo Mean		35.95
220				KM SD (logged)	0.738				95% Critical H Value (KM-Log)		2.598
221				KM Standard Error of Mean (logged)	0.269				95% H-UCL (KM -Log)		89.43
222				KM SD (logged)	0.738				95% Critical H Value (KM-Log)		2.598
223				KM Standard Error of Mean (logged)	0.269						
224											
225				DL/2 Statistics							
226				DL/2 Normal					DL/2 Log-Transformed		
227				Mean in Original Scale	65.55				Mean in Log Scale		3.838
228				SD in Original Scale	67.86				SD in Log Scale		0.815
229				95% t UCL (Assumes normality)	104.9				95% H-Stat UCL		136
230				DL/2 is not a recommended method, provided for comparisons and historical reasons							
231											
232				Nonparametric Distribution Free UCL Statistics							
233				Detected Data appear Lognormal Distributed at 5% Significance Level							
234											
235				Suggested UCL to Use							
236				KM H-UCL	89.43						
237											
238				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
239				Recommendations are based upon data size, data distribution, and skewness.							
240				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
241				However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
242											
243	Anthracene										
244											
245				General Statistics							
246				Total Number of Observations	10				Number of Distinct Observations		10
247				Number of Detects	8				Number of Non-Detects		2
248				Number of Distinct Detects	8				Number of Distinct Non-Detects		2
249				Minimum Detect	8.8				Minimum Non-Detect		63
250				Maximum Detect	2700				Maximum Non-Detect		200
251				Variance Detects	960531				Percent Non-Detects		20%
252				Mean Detects	532.6				SD Detects		980.1
253				Median Detects	54.5				CV Detects		1.84
254				Skewness Detects	2.009				Kurtosis Detects		3.558
255				Mean of Logged Detects	4.6				SD of Logged Detects		1.922
256											
257				Normal GOF Test on Detects Only							
258				Shapiro Wilk Test Statistic	0.613				Shapiro Wilk GOF Test		
259				5% Shapiro Wilk Critical Value	0.818				Detected Data Not Normal at 5% Significance Level		
260				Lilliefors Test Statistic	0.436				Lilliefors GOF Test		
261				5% Lilliefors Critical Value	0.283				Detected Data Not Normal at 5% Significance Level		
262				Detected Data Not Normal at 5% Significance Level							
263											
264				Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs							
265				KM Mean	434.8				KM Standard Error of Mean		285

266				KM SD	843			95% KM (BCA) UCL		960.6	
267				95% KM (t) UCL	957.2			95% KM (Percentile Bootstrap) UCL		949.1	
268				95% KM (z) UCL	903.6			95% KM Bootstrap t UCL		19026	
269				90% KM Chebyshev UCL	1290			95% KM Chebyshev UCL		1677	
270				97.5% KM Chebyshev UCL	2215			99% KM Chebyshev UCL		3271	
271											
272				Gamma GOF Tests on Detected Observations Only							
273				A-D Test Statistic	1.154		Anderson-Darling GOF Test				
274				5% A-D Critical Value	0.781		Detected Data Not Gamma Distributed at 5% Significance Level				
275				K-S Test Statistic	0.428		Kolmogorov-Smirnov GOF				
276				5% K-S Critical Value	0.313		Detected Data Not Gamma Distributed at 5% Significance Level				
277				Detected Data Not Gamma Distributed at 5% Significance Level							
278											
279				Gamma Statistics on Detected Data Only							
280				k hat (MLE)	0.393			k star (bias corrected MLE)		0.329	
281				Theta hat (MLE)	1355			Theta star (bias corrected MLE)		1618	
282				nu hat (MLE)	6.291			nu star (bias corrected)		5.265	
283				Mean (detects)	532.6						
284											
285				Gamma ROS Statistics using Imputed Non-Detects							
286				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
287				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
288				For such situations, GROS method may yield incorrect values of UCLs and BTVs							
289				This is especially true when the sample size is small.							
290				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
291				Minimum	0.01			Mean		426.1	
292				Maximum	2700			Median		48.5	
293				SD	893			CV		2.096	
294				k hat (MLE)	0.22			k star (bias corrected MLE)		0.221	
295				Theta hat (MLE)	1937			Theta star (bias corrected MLE)		1931	
296				nu hat (MLE)	4.399			nu star (bias corrected)		4.413	
297				Adjusted Level of Significance (β)	0.0267						
298				Approximate Chi Square Value (4.41, α)	0.891			Adjusted Chi Square Value (4.41, β)		0.654	
299				95% Gamma Approximate UCL (use when n>=50)	2110			95% Gamma Adjusted UCL (use when n<50)		2877	
300											
301				Estimates of Gamma Parameters using KM Estimates							
302				Mean (KM)	434.8			SD (KM)		843	
303				Variance (KM)	710708			SE of Mean (KM)		285	
304				k hat (KM)	0.266			k star (KM)		0.253	
305				nu hat (KM)	5.319			nu star (KM)		5.057	
306				theta hat (KM)	1635			theta star (KM)		1720	
307				80% gamma percentile (KM)	634			90% gamma percentile (KM)		1304	
308				95% gamma percentile (KM)	2097			99% gamma percentile (KM)		4206	
309											
310				Gamma Kaplan-Meier (KM) Statistics							
311				Approximate Chi Square Value (5.06, α)	1.179			Adjusted Chi Square Value (5.06, β)		0.889	
312				95% Gamma Approximate KM-UCL (use when n>=50)	1865			95% Gamma Adjusted KM-UCL (use when n<50)		2474	
313											
314				Lognormal GOF Test on Detected Observations Only							
315				Shapiro Wilk Test Statistic	0.824		Shapiro Wilk GOF Test				
316				5% Shapiro Wilk Critical Value	0.818		Detected Data appear Lognormal at 5% Significance Level				
317				Lilliefors Test Statistic	0.36		Lilliefors GOF Test				
318				5% Lilliefors Critical Value	0.283		Detected Data Not Lognormal at 5% Significance Level				

	A	B	C	D	E	F	G	H	I	J	K	L
319	Detected Data appear Approximate Lognormal at 5% Significance Level											
320												
321	Lognormal ROS Statistics Using Imputed Non-Detects											
322					Mean in Original Scale	436				Mean in Log Scale	4.461	
323					SD in Original Scale	888				SD in Log Scale	1.72	
324				95% t UCL (assumes normality of ROS data)		950.8				95% Percentile Bootstrap UCL	963.6	
325					95% BCA Bootstrap UCL	1111				95% Bootstrap t UCL	24676	
326					95% H-UCL (Log ROS)	5709						
327												
328	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
329					KM Mean (logged)	4.404				KM Geo Mean	81.76	
330					KM SD (logged)	1.681				95% Critical H Value (KM-Log)	4.631	
331					KM Standard Error of Mean (logged)	0.58				95% H-UCL (KM -Log)	4505	
332					KM SD (logged)	1.681				95% Critical H Value (KM-Log)	4.631	
333					KM Standard Error of Mean (logged)	0.58						
334												
335	DL/2 Statistics											
336					DL/2 Normal					DL/2 Log-Transformed		
337					Mean in Original Scale	439.2				Mean in Log Scale	4.485	
338					SD in Original Scale	886.6				SD in Log Scale	1.734	
339					95% t UCL (Assumes normality)	953.2				95% H-Stat UCL	6231	
340	DL/2 is not a recommended method, provided for comparisons and historical reasons											
341												
342	Nonparametric Distribution Free UCL Statistics											
343	Detected Data appear Approximate Lognormal Distributed at 5% Significance Level											
344												
345	Suggested UCL to Use											
346					97.5% KM (Chebyshev) UCL	2215				99% KM (Chebyshev) UCL	3271	
347	Warning: Recommended UCL exceeds the maximum observation											
348												
349	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
350	Recommendations are based upon data size, data distribution, and skewness.											
351	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
352	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
353												
354												
355	BaA											
356												
357	General Statistics											
358					Total Number of Observations	10				Number of Distinct Observations	9	
359										Number of Missing Observations	0	
360					Minimum	24				Mean	1080	
361					Maximum	7700				Median	115	
362					SD	2427				Std. Error of Mean	767.4	
363					Coefficient of Variation	2.246				Skewness	2.763	
364												
365	Normal GOF Test											
366					Shapiro Wilk Test Statistic	0.504				Shapiro Wilk GOF Test		
367					5% Shapiro Wilk Critical Value	0.842				Data Not Normal at 5% Significance Level		
368					Lilliefors Test Statistic	0.448				Lilliefors GOF Test		
369					5% Lilliefors Critical Value	0.262				Data Not Normal at 5% Significance Level		
370	Data Not Normal at 5% Significance Level											
371												

	A	B	C	D	E	F	G	H	I	J	K	L
372	Assuming Normal Distribution											
373	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
374	95% Student's-t UCL					2487	95% Adjusted-CLT UCL (Chen-1995)					3059
375							95% Modified-t UCL (Johnson-1978)					2599
376												
377	Gamma GOF Test											
378	A-D Test Statistic					1.529	Anderson-Darling Gamma GOF Test					
379	5% A-D Critical Value					0.799	Data Not Gamma Distributed at 5% Significance Level					
380	K-S Test Statistic					0.427	Kolmogorov-Smirnov Gamma GOF Test					
381	5% K-S Critical Value					0.285	Data Not Gamma Distributed at 5% Significance Level					
382	Data Not Gamma Distributed at 5% Significance Level											
383												
384	Gamma Statistics											
385	k hat (MLE)					0.378	k star (bias corrected MLE)					0.331
386	Theta hat (MLE)					2858	Theta star (bias corrected MLE)					3261
387	nu hat (MLE)					7.561	nu star (bias corrected)					6.626
388	MLE Mean (bias corrected)					1080	MLE Sd (bias corrected)					1877
389							Approximate Chi Square Value (0.05)					1.968
390	Adjusted Level of Significance					0.0267	Adjusted Chi Square Value					1.558
391												
392	Assuming Gamma Distribution											
393	95% Approximate Gamma UCL (use when n>=50))					3638	95% Adjusted Gamma UCL (use when n<50)					4594
394												
395	Lognormal GOF Test											
396	Shapiro Wilk Test Statistic					0.824	Shapiro Wilk Lognormal GOF Test					
397	5% Shapiro Wilk Critical Value					0.842	Data Not Lognormal at 5% Significance Level					
398	Lilliefors Test Statistic					0.334	Lilliefors Lognormal GOF Test					
399	5% Lilliefors Critical Value					0.262	Data Not Lognormal at 5% Significance Level					
400	Data Not Lognormal at 5% Significance Level											
401												
402	Lognormal Statistics											
403	Minimum of Logged Data					3.178	Mean of logged Data					5.229
404	Maximum of Logged Data					8.949	SD of logged Data					1.773
405												
406	Assuming Lognormal Distribution											
407	95% H-UCL					15755	90% Chebyshev (MVUE) UCL					1833
408	95% Chebyshev (MVUE) UCL					2363	97.5% Chebyshev (MVUE) UCL					3097
409	99% Chebyshev (MVUE) UCL					4540						
410												
411	Nonparametric Distribution Free UCL Statistics											
412	Data do not follow a Discernible Distribution (0.05)											
413												
414	Nonparametric Distribution Free UCLs											
415	95% CLT UCL					2343	95% Jackknife UCL					2487
416	95% Standard Bootstrap UCL					2282	95% Bootstrap-t UCL					54369
417	95% Hall's Bootstrap UCL					28880	95% Percentile Bootstrap UCL					2396
418	95% BCA Bootstrap UCL					3350						
419	90% Chebyshev(Mean, Sd) UCL					3383	95% Chebyshev(Mean, Sd) UCL					4426
420	97.5% Chebyshev(Mean, Sd) UCL					5873	99% Chebyshev(Mean, Sd) UCL					8716
421												
422	Suggested UCL to Use											
423	99% Chebyshev (Mean, Sd) UCL					8716						
424												

425	Recommended UCL exceeds the maximum observation										
426											
427	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
428	Recommendations are based upon data size, data distribution, and skewness.										
429	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
430	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
431											
432											
433	BaP										
434											
435	General Statistics										
436	Total Number of Observations			10			Number of Distinct Observations			9	
437							Number of Missing Observations			0	
438	Minimum			26			Mean			1130	
439	Maximum			7800			Median			140	
440	SD			2461			Std. Error of Mean			778.2	
441	Coefficient of Variation			2.178			Skewness			2.713	
442											
443	Normal GOF Test										
444	Shapiro Wilk Test Statistic			0.521			Shapiro Wilk GOF Test				
445	5% Shapiro Wilk Critical Value			0.842			Data Not Normal at 5% Significance Level				
446	Lilliefors Test Statistic			0.435			Lilliefors GOF Test				
447	5% Lilliefors Critical Value			0.262			Data Not Normal at 5% Significance Level				
448	Data Not Normal at 5% Significance Level										
449											
450	Assuming Normal Distribution										
451	95% Normal UCL						95% UCLs (Adjusted for Skewness)				
452	95% Student's-t UCL			2556			95% Adjusted-CLT UCL (Chen-1995)			3123	
453							95% Modified-t UCL (Johnson-1978)			2667	
454											
455	Gamma GOF Test										
456	A-D Test Statistic			1.223			Anderson-Darling Gamma GOF Test				
457	5% A-D Critical Value			0.797			Data Not Gamma Distributed at 5% Significance Level				
458	K-S Test Statistic			0.358			Kolmogorov-Smirnov Gamma GOF Test				
459	5% K-S Critical Value			0.285			Data Not Gamma Distributed at 5% Significance Level				
460	Data Not Gamma Distributed at 5% Significance Level										
461											
462	Gamma Statistics										
463	k hat (MLE)			0.389			k star (bias corrected MLE)			0.339	
464	Theta hat (MLE)			2907			Theta star (bias corrected MLE)			3336	
465	nu hat (MLE)			7.772			nu star (bias corrected)			6.773	
466	MLE Mean (bias corrected)			1130			MLE Sd (bias corrected)			1941	
467							Approximate Chi Square Value (0.05)			2.047	
468	Adjusted Level of Significance			0.0267			Adjusted Chi Square Value			1.627	
469											
470	Assuming Gamma Distribution										
471	95% Approximate Gamma UCL (use when n>=50))			3738			95% Adjusted Gamma UCL (use when n<50)			4703	
472											
473	Lognormal GOF Test										
474	Shapiro Wilk Test Statistic			0.879			Shapiro Wilk Lognormal GOF Test				
475	5% Shapiro Wilk Critical Value			0.842			Data appear Lognormal at 5% Significance Level				
476	Lilliefors Test Statistic			0.232			Lilliefors Lognormal GOF Test				
477	5% Lilliefors Critical Value			0.262			Data appear Lognormal at 5% Significance Level				

478	Data appear Lognormal at 5% Significance Level										
479											
480	Lognormal Statistics										
481					Minimum of Logged Data	3.258			Mean of logged Data	5.328	
482					Maximum of Logged Data	8.962			SD of logged Data	1.794	
483											
484	Assuming Lognormal Distribution										
485					95% H-UCL	19302			90% Chebyshev (MVUE) UCL	2098	
486					95% Chebyshev (MVUE) UCL	2706			97.5% Chebyshev (MVUE) UCL	3549	
487					99% Chebyshev (MVUE) UCL	5207					
488											
489	Nonparametric Distribution Free UCL Statistics										
490	Data appear to follow a Discernible Distribution at 5% Significance Level										
491											
492	Nonparametric Distribution Free UCLs										
493					95% CLT UCL	2410			95% Jackknife UCL	2556	
494					95% Standard Bootstrap UCL	2326			95% Bootstrap-t UCL	32044	
495					95% Hall's Bootstrap UCL	12877			95% Percentile Bootstrap UCL	2634	
496					95% BCA Bootstrap UCL	3408					
497					90% Chebyshev(Mean, Sd) UCL	3464			95% Chebyshev(Mean, Sd) UCL	4522	
498					97.5% Chebyshev(Mean, Sd) UCL	5990			99% Chebyshev(Mean, Sd) UCL	8873	
499											
500	Suggested UCL to Use										
501					99% Chebyshev (Mean, Sd) UCL	8873					
502											
503	Recommended UCL exceeds the maximum observation										
504											
505	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
506	Recommendations are based upon data size, data distribution, and skewness.										
507	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
508	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
509											
510											
511	BbF										
512											
513	General Statistics										
514					Total Number of Observations	10			Number of Distinct Observations	9	
515									Number of Missing Observations	0	
516					Minimum	51			Mean	1673	
517					Maximum	11000			Median	245	
518					SD	3477			Std. Error of Mean	1100	
519					Coefficient of Variation	2.079			Skewness	2.636	
520											
521	Normal GOF Test										
522					Shapiro Wilk Test Statistic	0.536			Shapiro Wilk GOF Test		
523					5% Shapiro Wilk Critical Value	0.842			Data Not Normal at 5% Significance Level		
524					Lilliefors Test Statistic	0.432			Lilliefors GOF Test		
525					5% Lilliefors Critical Value	0.262			Data Not Normal at 5% Significance Level		
526	Data Not Normal at 5% Significance Level										
527											
528	Assuming Normal Distribution										
529	95% Normal UCL								95% UCLs (Adjusted for Skewness)		
530					95% Student's-t UCL	3688			95% Adjusted-CLT UCL (Chen-1995)	4461	

531							95% Modified-t UCL (Johnson-1978)				3841
532											
533	Gamma GOF Test										
534				A-D Test Statistic	1.188	Anderson-Darling Gamma GOF Test					
535				5% A-D Critical Value	0.789	Data Not Gamma Distributed at 5% Significance Level					
536				K-S Test Statistic	0.351	Kolmogorov-Smirnov Gamma GOF Test					
537				5% K-S Critical Value	0.283	Data Not Gamma Distributed at 5% Significance Level					
538	Data Not Gamma Distributed at 5% Significance Level										
539											
540	Gamma Statistics										
541				k hat (MLE)	0.432	k star (bias corrected MLE)					0.369
542				Theta hat (MLE)	3875	Theta star (bias corrected MLE)					4535
543				nu hat (MLE)	8.634	nu star (bias corrected)					7.377
544				MLE Mean (bias corrected)	1673	MLE Sd (bias corrected)					2754
545						Approximate Chi Square Value (0.05)					2.38
546				Adjusted Level of Significance	0.0267	Adjusted Chi Square Value					1.917
547											
548	Assuming Gamma Distribution										
549				95% Approximate Gamma UCL (use when n>=50))	5185	95% Adjusted Gamma UCL (use when n<50)					6437
550											
551	Lognormal GOF Test										
552				Shapiro Wilk Test Statistic	0.884	Shapiro Wilk Lognormal GOF Test					
553				5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level					
554				Lilliefors Test Statistic	0.23	Lilliefors Lognormal GOF Test					
555				5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level					
556	Data appear Lognormal at 5% Significance Level										
557											
558	Lognormal Statistics										
559				Minimum of Logged Data	3.932	Mean of logged Data					5.916
560				Maximum of Logged Data	9.306	SD of logged Data					1.683
561											
562	Assuming Lognormal Distribution										
563				95% H-UCL	20630	90% Chebyshev (MVUE) UCL					3157
564				95% Chebyshev (MVUE) UCL	4053	97.5% Chebyshev (MVUE) UCL					5296
565				99% Chebyshev (MVUE) UCL	7738						
566											
567	Nonparametric Distribution Free UCL Statistics										
568	Data appear to follow a Discernible Distribution at 5% Significance Level										
569											
570	Nonparametric Distribution Free UCLs										
571				95% CLT UCL	3481	95% Jackknife UCL					3688
572				95% Standard Bootstrap UCL	3408	95% Bootstrap-t UCL					39577
573				95% Hall's Bootstrap UCL	18104	95% Percentile Bootstrap UCL					3542
574				95% BCA Bootstrap UCL	4874						
575				90% Chebyshev(Mean, Sd) UCL	4971	95% Chebyshev(Mean, Sd) UCL					6465
576				97.5% Chebyshev(Mean, Sd) UCL	8539	99% Chebyshev(Mean, Sd) UCL					12613
577											
578	Suggested UCL to Use										
579				99% Chebyshev (Mean, Sd) UCL	12613						
580											
581	Recommended UCL exceeds the maximum observation										
582											
583	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										

584	Recommendations are based upon data size, data distribution, and skewness.										
585	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
586	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
587											
588	BghiP										
589											
590	General Statistics										
591				Total Number of Observations	10			Number of Distinct Observations	10		
592				Number of Detects	9			Number of Non-Detects	1		
593				Number of Distinct Detects	9			Number of Distinct Non-Detects	1		
594				Minimum Detect	18			Minimum Non-Detect	140		
595				Maximum Detect	4200			Maximum Non-Detect	140		
596				Variance Detects	1910543			Percent Non-Detects	10%		
597				Mean Detects	703.4			SD Detects	1382		
598				Median Detects	100			CV Detects	1.965		
599				Skewness Detects	2.524			Kurtosis Detects	6.489		
600				Mean of Logged Detects	5.061			SD of Logged Detects	1.776		
601											
602	Normal GOF Test on Detects Only										
603				Shapiro Wilk Test Statistic	0.573			Shapiro Wilk GOF Test			
604				5% Shapiro Wilk Critical Value	0.829			Detected Data Not Normal at 5% Significance Level			
605				Lilliefors Test Statistic	0.387			Lilliefors GOF Test			
606				5% Lilliefors Critical Value	0.274			Detected Data Not Normal at 5% Significance Level			
607	Detected Data Not Normal at 5% Significance Level										
608											
609	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
610				KM Mean	640			KM Standard Error of Mean	419.6		
611				KM SD	1251			95% KM (BCA) UCL	1458		
612				95% KM (t) UCL	1409			95% KM (Percentile Bootstrap) UCL	1341		
613				95% KM (z) UCL	1330			95% KM Bootstrap t UCL	8854		
614				90% KM Chebyshev UCL	1899			95% KM Chebyshev UCL	2469		
615				97.5% KM Chebyshev UCL	3260			99% KM Chebyshev UCL	4815		
616											
617	Gamma GOF Tests on Detected Observations Only										
618				A-D Test Statistic	0.846			Anderson-Darling GOF Test			
619				5% A-D Critical Value	0.783			Detected Data Not Gamma Distributed at 5% Significance Level			
620				K-S Test Statistic	0.323			Kolmogorov-Smirnov GOF			
621				5% K-S Critical Value	0.297			Detected Data Not Gamma Distributed at 5% Significance Level			
622	Detected Data Not Gamma Distributed at 5% Significance Level										
623											
624	Gamma Statistics on Detected Data Only										
625				k hat (MLE)	0.434			k star (bias corrected MLE)	0.364		
626				Theta hat (MLE)	1619			Theta star (bias corrected MLE)	1934		
627				nu hat (MLE)	7.819			nu star (bias corrected)	6.546		
628				Mean (detects)	703.4						
629											
630	Gamma ROS Statistics using Imputed Non-Detects										
631	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs										
632	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)										
633	For such situations, GROS method may yield incorrect values of UCLs and BTVs										
634	This is especially true when the sample size is small.										
635	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates										
636				Minimum	0.01			Mean	633.1		

637					Maximum	4200				Median	93
638					SD	1322				CV	2.088
639					k hat (MLE)	0.294				k star (bias corrected MLE)	0.272
640					Theta hat (MLE)	2156				Theta star (bias corrected MLE)	2325
641					nu hat (MLE)	5.874				nu star (bias corrected)	5.445
642					Adjusted Level of Significance (β)	0.0267					
643					Approximate Chi Square Value (5.44, α)	1.363				Adjusted Chi Square Value (5.44, β)	1.043
644					95% Gamma Approximate UCL (use when n>=50)	2529				95% Gamma Adjusted UCL (use when n<50)	3306
645											
646					Estimates of Gamma Parameters using KM Estimates						
647					Mean (KM)	640				SD (KM)	1251
648					Variance (KM)	1564840				SE of Mean (KM)	419.6
649					k hat (KM)	0.262				k star (KM)	0.25
650					nu hat (KM)	5.234				nu star (KM)	4.997
651					theta hat (KM)	2445				theta star (KM)	2561
652					80% gamma percentile (KM)	929.2				90% gamma percentile (KM)	1921
653					95% gamma percentile (KM)	3098				99% gamma percentile (KM)	6232
654											
655					Gamma Kaplan-Meier (KM) Statistics						
656					Approximate Chi Square Value (5.00, α)	1.151				Adjusted Chi Square Value (5.00, β)	0.866
657					95% Gamma Approximate KM-UCL (use when n>=50)	2779				95% Gamma Adjusted KM-UCL (use when n<50)	3694
658											
659					Lognormal GOF Test on Detected Observations Only						
660					Shapiro Wilk Test Statistic	0.919				Shapiro Wilk GOF Test	
661					5% Shapiro Wilk Critical Value	0.829				Detected Data appear Lognormal at 5% Significance Level	
662					Lilliefors Test Statistic	0.247				Lilliefors GOF Test	
663					5% Lilliefors Critical Value	0.274				Detected Data appear Lognormal at 5% Significance Level	
664					Detected Data appear Lognormal at 5% Significance Level						
665											
666					Lognormal ROS Statistics Using Imputed Non-Detects						
667					Mean in Original Scale	639.8				Mean in Log Scale	4.975
668					SD in Original Scale	1319				SD in Log Scale	1.696
669					95% t UCL (assumes normality of ROS data)	1404				95% Percentile Bootstrap UCL	1439
670					95% BCA Bootstrap UCL	1849				95% Bootstrap t UCL	9042
671					95% H-UCL (Log ROS)	8540					
672											
673					Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution						
674					KM Mean (logged)	4.958				KM Geo Mean	142.3
675					KM SD (logged)	1.633				95% Critical H Value (KM-Log)	4.517
676					KM Standard Error of Mean (logged)	0.553				95% H-UCL (KM -Log)	6306
677					KM SD (logged)	1.633				95% Critical H Value (KM-Log)	4.517
678					KM Standard Error of Mean (logged)	0.553					
679											
680					DL/2 Statistics						
681					DL/2 Normal					DL/2 Log-Transformed	
682					Mean in Original Scale	640.1				Mean in Log Scale	4.98
683					SD in Original Scale	1318				SD in Log Scale	1.694
684					95% t UCL (Assumes normality)	1404				95% H-Stat UCL	8490
685					DL/2 is not a recommended method, provided for comparisons and historical reasons						
686											
687					Nonparametric Distribution Free UCL Statistics						
688					Detected Data appear Lognormal Distributed at 5% Significance Level						
689											

	A	B	C	D	E	F	G	H	I	J	K	L
690	Suggested UCL to Use											
691				97.5% KM (Chebyshev) UCL		3260			99% KM (Chebyshev) UCL			4815
692	Warning: Recommended UCL exceeds the maximum observation											
693												
694	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
695	Recommendations are based upon data size, data distribution, and skewness.											
696	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
697	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
698												
699	BkF											
700												
701	General Statistics											
702					Total Number of Observations	10			Number of Distinct Observations			10
703					Number of Detects	8			Number of Non-Detects			2
704					Number of Distinct Detects	8			Number of Distinct Non-Detects			2
705					Minimum Detect	26			Minimum Non-Detect			52
706					Maximum Detect	3900			Maximum Non-Detect			210
707					Variance Detects	1854999			Percent Non-Detects			20%
708					Mean Detects	728			SD Detects			1362
709					Median Detects	103			CV Detects			1.871
710					Skewness Detects	2.309			Kurtosis Detects			5.31
711					Mean of Logged Detects	5.193			SD of Logged Detects			1.687
712												
713	Normal GOF Test on Detects Only											
714					Shapiro Wilk Test Statistic	0.596			Shapiro Wilk GOF Test			
715					5% Shapiro Wilk Critical Value	0.818			Detected Data Not Normal at 5% Significance Level			
716					Lilliefors Test Statistic	0.414			Lilliefors GOF Test			
717					5% Lilliefors Critical Value	0.283			Detected Data Not Normal at 5% Significance Level			
718	Detected Data Not Normal at 5% Significance Level											
719												
720	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
721					KM Mean	592.9			KM Standard Error of Mean			396
722					KM SD	1171			95% KM (BCA) UCL			1241
723					95% KM (t) UCL	1319			95% KM (Percentile Bootstrap) UCL			1255
724					95% KM (z) UCL	1244			95% KM Bootstrap t UCL			15552
725					90% KM Chebyshev UCL	1781			95% KM Chebyshev UCL			2319
726					97.5% KM Chebyshev UCL	3066			99% KM Chebyshev UCL			4533
727												
728	Gamma GOF Tests on Detected Observations Only											
729					A-D Test Statistic	0.996			Anderson-Darling GOF Test			
730					5% A-D Critical Value	0.769			Detected Data Not Gamma Distributed at 5% Significance Level			
731					K-S Test Statistic	0.379			Kolmogorov-Smirnov GOF			
732					5% K-S Critical Value	0.311			Detected Data Not Gamma Distributed at 5% Significance Level			
733	Detected Data Not Gamma Distributed at 5% Significance Level											
734												
735	Gamma Statistics on Detected Data Only											
736					k hat (MLE)	0.46			k star (bias corrected MLE)			0.371
737					Theta hat (MLE)	1581			Theta star (bias corrected MLE)			1962
738					nu hat (MLE)	7.367			nu star (bias corrected)			5.938
739					Mean (detects)	728						
740												
741	Gamma ROS Statistics using Imputed Non-Detects											
742	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											

743	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)										
744	For such situations, GROS method may yield incorrect values of UCLs and BTVs										
745	This is especially true when the sample size is small.										
746	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates										
747					Minimum	0.01			Mean	582.4	
748					Maximum	3900			Median	89.5	
749					SD	1240			CV	2.129	
750					k hat (MLE)	0.23			k star (bias corrected MLE)	0.227	
751					Theta hat (MLE)	2535			Theta star (bias corrected MLE)	2560	
752					nu hat (MLE)	4.595			nu star (bias corrected)	4.55	
753					Adjusted Level of Significance (β)	0.0267					
754					Approximate Chi Square Value (4.55, α)	0.95			Adjusted Chi Square Value (4.55, β)	0.701	
755					95% Gamma Approximate UCL (use when n>=50)	2789			95% Gamma Adjusted UCL (use when n<50)	3779	
756											
757	Estimates of Gamma Parameters using KM Estimates										
758					Mean (KM)	592.9			SD (KM)	1171	
759					Variance (KM)	1371868			SE of Mean (KM)	396	
760					k hat (KM)	0.256			k star (KM)	0.246	
761					nu hat (KM)	5.124			nu star (KM)	4.92	
762					theta hat (KM)	2314			theta star (KM)	2410	
763					80% gamma percentile (KM)	856.1			90% gamma percentile (KM)	1781	
764					95% gamma percentile (KM)	2883			99% gamma percentile (KM)	5823	
765											
766	Gamma Kaplan-Meier (KM) Statistics										
767					Approximate Chi Square Value (4.92, α)	1.115			Adjusted Chi Square Value (4.92, β)	0.836	
768					95% Gamma Approximate KM-UCL (use when n>=50)	2615			95% Gamma Adjusted KM-UCL (use when n<50)	3487	
769											
770	Lognormal GOF Test on Detected Observations Only										
771					Shapiro Wilk Test Statistic	0.862			Shapiro Wilk GOF Test		
772					5% Shapiro Wilk Critical Value	0.818			Detected Data appear Lognormal at 5% Significance Level		
773					Lilliefors Test Statistic	0.293			Lilliefors GOF Test		
774					5% Lilliefors Critical Value	0.283			Detected Data Not Lognormal at 5% Significance Level		
775	Detected Data appear Approximate Lognormal at 5% Significance Level										
776											
777	Lognormal ROS Statistics Using Imputed Non-Detects										
778					Mean in Original Scale	591.6			Mean in Log Scale	4.851	
779					SD in Original Scale	1235			SD in Log Scale	1.704	
780					95% t UCL (assumes normality of ROS data)	1308			95% Percentile Bootstrap UCL	1245	
781					95% BCA Bootstrap UCL	1617			95% Bootstrap t UCL	16350	
782					95% H-UCL (Log ROS)	7812					
783											
784	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										
785					KM Mean (logged)	4.898			KM Geo Mean	134.1	
786					KM SD (logged)	1.557			95% Critical H Value (KM-Log)	4.338	
787					KM Standard Error of Mean (logged)	0.531			95% H-UCL (KM -Log)	4278	
788					KM SD (logged)	1.557			95% Critical H Value (KM-Log)	4.338	
789					KM Standard Error of Mean (logged)	0.531					
790											
791	DL/2 Statistics										
792					DL/2 Normal				DL/2 Log-Transformed		
793					Mean in Original Scale	595.5			Mean in Log Scale	4.945	
794					SD in Original Scale	1233			SD in Log Scale	1.611	
795					95% t UCL (Assumes normality)	1310			95% H-Stat UCL	5652	

796	DL/2 is not a recommended method, provided for comparisons and historical reasons										
797											
798	Nonparametric Distribution Free UCL Statistics										
799	Detected Data appear Approximate Lognormal Distributed at 5% Significance Level										
800											
801	Suggested UCL to Use										
802	97.5% KM (Chebyshev) UCL			3066			99% KM (Chebyshev) UCL			4533	
803	Warning: Recommended UCL exceeds the maximum observation										
804											
805	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
806	Recommendations are based upon data size, data distribution, and skewness.										
807	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
808	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
809											
810											
811	Chrysene										
812											
813	General Statistics										
814	Total Number of Observations			10			Number of Distinct Observations			9	
815							Number of Missing Observations			0	
816	Minimum			45			Mean			1163	
817	Maximum			7500			Median			205	
818	SD			2343			Std. Error of Mean			741	
819	Coefficient of Variation			2.014			Skewness			2.692	
820											
821	Normal GOF Test										
822	Shapiro Wilk Test Statistic			0.539			Shapiro Wilk GOF Test				
823	5% Shapiro Wilk Critical Value			0.842			Data Not Normal at 5% Significance Level				
824	Lilliefors Test Statistic			0.424			Lilliefors GOF Test				
825	5% Lilliefors Critical Value			0.262			Data Not Normal at 5% Significance Level				
826	Data Not Normal at 5% Significance Level										
827											
828	Assuming Normal Distribution										
829	95% Normal UCL						95% UCLs (Adjusted for Skewness)				
830	95% Student's-t UCL			2522			95% Adjusted-CLT UCL (Chen-1995)			3056	
831							95% Modified-t UCL (Johnson-1978)			2627	
832											
833	Gamma GOF Test										
834	A-D Test Statistic			1.091			Anderson-Darling Gamma GOF Test				
835	5% A-D Critical Value			0.78			Data Not Gamma Distributed at 5% Significance Level				
836	K-S Test Statistic			0.34			Kolmogorov-Smirnov Gamma GOF Test				
837	5% K-S Critical Value			0.281			Data Not Gamma Distributed at 5% Significance Level				
838	Data Not Gamma Distributed at 5% Significance Level										
839											
840	Gamma Statistics										
841	k hat (MLE)			0.483			k star (bias corrected MLE)			0.405	
842	Theta hat (MLE)			2410			Theta star (bias corrected MLE)			2875	
843	nu hat (MLE)			9.656			nu star (bias corrected)			8.092	
844	MLE Mean (bias corrected)			1163			MLE Sd (bias corrected)			1829	
845							Approximate Chi Square Value (0.05)			2.789	
846	Adjusted Level of Significance			0.0267			Adjusted Chi Square Value			2.277	
847											
848	Assuming Gamma Distribution										

849					95% Approximate Gamma UCL (use when n>=50))	3376			95% Adjusted Gamma UCL (use when n<50)		4135	
850												
851						Lognormal GOF Test						
852					Shapiro Wilk Test Statistic	0.894			Shapiro Wilk Lognormal GOF Test			
853					5% Shapiro Wilk Critical Value	0.842			Data appear Lognormal at 5% Significance Level			
854					Lilliefors Test Statistic	0.224			Lilliefors Lognormal GOF Test			
855					5% Lilliefors Critical Value	0.262			Data appear Lognormal at 5% Significance Level			
856						Data appear Lognormal at 5% Significance Level						
857												
858						Lognormal Statistics						
859					Minimum of Logged Data	3.807			Mean of logged Data		5.736	
860					Maximum of Logged Data	8.923			SD of logged Data		1.589	
861												
862						Assuming Lognormal Distribution						
863					95% H-UCL	11333			90% Chebyshev (MVUE) UCL		2268	
864					95% Chebyshev (MVUE) UCL	2899			97.5% Chebyshev (MVUE) UCL		3774	
865					99% Chebyshev (MVUE) UCL	5493						
866												
867						Nonparametric Distribution Free UCL Statistics						
868						Data appear to follow a Discernible Distribution at 5% Significance Level						
869												
870						Nonparametric Distribution Free UCLs						
871					95% CLT UCL	2382			95% Jackknife UCL		2522	
872					95% Standard Bootstrap UCL	2311			95% Bootstrap-t UCL		19388	
873					95% Hall's Bootstrap UCL	10148			95% Percentile Bootstrap UCL		2581	
874					95% BCA Bootstrap UCL	3320						
875					90% Chebyshev(Mean, Sd) UCL	3386			95% Chebyshev(Mean, Sd) UCL		4393	
876					97.5% Chebyshev(Mean, Sd) UCL	5791			99% Chebyshev(Mean, Sd) UCL		8536	
877												
878						Suggested UCL to Use						
879					99% Chebyshev (Mean, Sd) UCL	8536						
880												
881						Recommended UCL exceeds the maximum observation						
882												
883						Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
884						Recommendations are based upon data size, data distribution, and skewness.						
885						These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).						
886						However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.						
887												
888	DahA											
889												
890						General Statistics						
891					Total Number of Observations	10			Number of Distinct Observations		10	
892					Number of Detects	4			Number of Non-Detects		6	
893					Number of Distinct Detects	4			Number of Distinct Non-Detects		6	
894					Minimum Detect	15			Minimum Non-Detect		52	
895					Maximum Detect	1300			Maximum Non-Detect		210	
896					Variance Detects	355323			Percent Non-Detects		60%	
897					Mean Detects	426.3			SD Detects		596.1	
898					Median Detects	195			CV Detects		1.398	
899					Skewness Detects	1.745			Kurtosis Detects		3.027	
900					Mean of Logged Detects	4.999			SD of Logged Detects		1.905	
901												

	A	B	C	D	E	F	G	H	I	J	K	L
902	Normal GOF Test on Detects Only											
903					Shapiro Wilk Test Statistic	0.797	Shapiro Wilk GOF Test					
904					5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level					
905					Lilliefors Test Statistic	0.327	Lilliefors GOF Test					
906					5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level					
907	Detected Data appear Normal at 5% Significance Level											
908												
909	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
910					KM Mean	190.3			KM Standard Error of Mean	139.3		
911					KM SD	379.7			95% KM (BCA) UCL	N/A		
912					95% KM (t) UCL	445.6			95% KM (Percentile Bootstrap) UCL	N/A		
913					95% KM (z) UCL	419.4			95% KM Bootstrap t UCL	N/A		
914					90% KM Chebyshev UCL	608.1			95% KM Chebyshev UCL	797.4		
915					97.5% KM Chebyshev UCL	1060			99% KM Chebyshev UCL	1576		
916												
917	Gamma GOF Tests on Detected Observations Only											
918					A-D Test Statistic	0.222	Anderson-Darling GOF Test					
919					5% A-D Critical Value	0.677	Detected data appear Gamma Distributed at 5% Significance Level					
920					K-S Test Statistic	0.205	Kolmogorov-Smirnov GOF					
921					5% K-S Critical Value	0.408	Detected data appear Gamma Distributed at 5% Significance Level					
922	Detected data appear Gamma Distributed at 5% Significance Level											
923												
924	Gamma Statistics on Detected Data Only											
925					k hat (MLE)	0.587			k star (bias corrected MLE)	0.313		
926					Theta hat (MLE)	726			Theta star (bias corrected MLE)	1360		
927					nu hat (MLE)	4.697			nu star (bias corrected)	2.508		
928					Mean (detects)	426.3						
929												
930	Gamma ROS Statistics using Imputed Non-Detects											
931	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
932	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
933	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
934	This is especially true when the sample size is small.											
935	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
936					Minimum	0.01			Mean	170.5		
937					Maximum	1300			Median	0.01		
938					SD	408.5			CV	2.396		
939					k hat (MLE)	0.133			k star (bias corrected MLE)	0.159		
940					Theta hat (MLE)	1286			Theta star (bias corrected MLE)	1069		
941					nu hat (MLE)	2.651			nu star (bias corrected)	3.189		
942					Adjusted Level of Significance (β)	0.0267						
943					Approximate Chi Square Value (3.19, α)	0.431			Adjusted Chi Square Value (3.19, β)	0.297		
944					95% Gamma Approximate UCL (use when n>=50)	1263			95% Gamma Adjusted UCL (use when n<50)	N/A		
945												
946	Estimates of Gamma Parameters using KM Estimates											
947					Mean (KM)	190.3			SD (KM)	379.7		
948					Variance (KM)	144210			SE of Mean (KM)	139.3		
949					k hat (KM)	0.251			k star (KM)	0.243		
950					nu hat (KM)	5.024			nu star (KM)	4.85		
951					theta hat (KM)	757.7			theta star (KM)	784.8		
952					80% gamma percentile (KM)	273.4			90% gamma percentile (KM)	572.4		
953					95% gamma percentile (KM)	929.6			99% gamma percentile (KM)	1884		
954												

	A	B	C	D	E	F	G	H	I	J	K	L
955	Gamma Kaplan-Meier (KM) Statistics											
956	Approximate Chi Square Value (4.85, α)					1.084	Adjusted Chi Square Value (4.85, β)					0.81
957	95% Gamma Approximate KM-UCL (use when n>=50)					851.9	95% Gamma Adjusted KM-UCL (use when n<50)					1139
958												
959	Lognormal GOF Test on Detected Observations Only											
960	Shapiro Wilk Test Statistic					0.996	Shapiro Wilk GOF Test					
961	5% Shapiro Wilk Critical Value					0.748	Detected Data appear Lognormal at 5% Significance Level					
962	Lilliefors Test Statistic					0.151	Lilliefors GOF Test					
963	5% Lilliefors Critical Value					0.375	Detected Data appear Lognormal at 5% Significance Level					
964	Detected Data appear Lognormal at 5% Significance Level											
965												
966	Lognormal ROS Statistics Using Imputed Non-Detects											
967	Mean in Original Scale					184.9	Mean in Log Scale					3.886
968	SD in Original Scale					402	SD in Log Scale					1.476
969	95% t UCL (assumes normality of ROS data)					417.9	95% Percentile Bootstrap UCL					411
970	95% BCA Bootstrap UCL					561.9	95% Bootstrap t UCL					3546
971	95% H-UCL (Log ROS)					1117						
972												
973	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
974	KM Mean (logged)					3.904	KM Geo Mean					49.58
975	KM SD (logged)					1.492	95% Critical H Value (KM-Log)					4.189
976	KM Standard Error of Mean (logged)					0.638	95% H-UCL (KM -Log)					1212
977	KM SD (logged)					1.492	95% Critical H Value (KM-Log)					4.189
978	KM Standard Error of Mean (logged)					0.638						
979												
980	DL/2 Statistics											
981	DL/2 Normal						DL/2 Log-Transformed					
982	Mean in Original Scale					218.1	Mean in Log Scale					4.57
983	SD in Original Scale					388.6	SD in Log Scale					1.224
984	95% t UCL (Assumes normality)					443.4	95% H-Stat UCL					881.2
985	DL/2 is not a recommended method, provided for comparisons and historical reasons											
986												
987	Nonparametric Distribution Free UCL Statistics											
988	Detected Data appear Normal Distributed at 5% Significance Level											
989												
990	Suggested UCL to Use											
991	95% KM (t) UCL					445.6						
992												
993	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
994	Recommendations are based upon data size, data distribution, and skewness.											
995	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
996	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
997												
998												
999	Fluoranthene											
1000												
1001	General Statistics											
1002	Total Number of Observations					10	Number of Distinct Observations					9
1003							Number of Missing Observations					0
1004	Minimum					45	Mean					2610
1005	Maximum					20000	Median					295
1006	SD					6237	Std. Error of Mean					1972
1007	Coefficient of Variation					2.389	Skewness					2.952

	A	B	C	D	E	F	G	H	I	J	K	L
1008												
1009					Normal GOF Test							
1010					Shapiro Wilk Test Statistic	0.47			Shapiro Wilk GOF Test			
1011					5% Shapiro Wilk Critical Value	0.842			Data Not Normal at 5% Significance Level			
1012					Lilliefors Test Statistic	0.442			Lilliefors GOF Test			
1013					5% Lilliefors Critical Value	0.262			Data Not Normal at 5% Significance Level			
1014					Data Not Normal at 5% Significance Level							
1015												
1016					Assuming Normal Distribution							
1017					95% Normal UCL				95% UCLs (Adjusted for Skewness)			
1018					95% Student's-t UCL	6225			95% Adjusted-CLT UCL (Chen-1995)	7821		
1019									95% Modified-t UCL (Johnson-1978)	6532		
1020												
1021					Gamma GOF Test							
1022					A-D Test Statistic	1.595			Anderson-Darling Gamma GOF Test			
1023					5% A-D Critical Value	0.801			Data Not Gamma Distributed at 5% Significance Level			
1024					K-S Test Statistic	0.439			Kolmogorov-Smirnov Gamma GOF Test			
1025					5% K-S Critical Value	0.285			Data Not Gamma Distributed at 5% Significance Level			
1026					Data Not Gamma Distributed at 5% Significance Level							
1027												
1028					Gamma Statistics							
1029					k hat (MLE)	0.37			k star (bias corrected MLE)	0.326		
1030					Theta hat (MLE)	7050			Theta star (bias corrected MLE)	8011		
1031					nu hat (MLE)	7.405			nu star (bias corrected)	6.517		
1032					MLE Mean (bias corrected)	2610			MLE Sd (bias corrected)	4573		
1033									Approximate Chi Square Value (0.05)	1.909		
1034					Adjusted Level of Significance	0.0267			Adjusted Chi Square Value	1.508		
1035												
1036					Assuming Gamma Distribution							
1037					95% Approximate Gamma UCL (use when n>=50))	8908			95% Adjusted Gamma UCL (use when n<50)	11280		
1038												
1039					Lognormal GOF Test							
1040					Shapiro Wilk Test Statistic	0.826			Shapiro Wilk Lognormal GOF Test			
1041					5% Shapiro Wilk Critical Value	0.842			Data Not Lognormal at 5% Significance Level			
1042					Lilliefors Test Statistic	0.354			Lilliefors Lognormal GOF Test			
1043					5% Lilliefors Critical Value	0.262			Data Not Lognormal at 5% Significance Level			
1044					Data Not Lognormal at 5% Significance Level							
1045												
1046					Lognormal Statistics							
1047					Minimum of Logged Data	3.807			Mean of logged Data	6.067		
1048					Maximum of Logged Data	9.903			SD of logged Data	1.772		
1049												
1050					Assuming Lognormal Distribution							
1051					95% H-UCL	36251			90% Chebyshev (MVUE) UCL	4234		
1052					95% Chebyshev (MVUE) UCL	5456			97.5% Chebyshev (MVUE) UCL	7152		
1053					99% Chebyshev (MVUE) UCL	10483						
1054												
1055					Nonparametric Distribution Free UCL Statistics							
1056					Data do not follow a Discernible Distribution (0.05)							
1057												
1058					Nonparametric Distribution Free UCLs							
1059					95% CLT UCL	5854			95% Jackknife UCL	6225		
1060					95% Standard Bootstrap UCL	5699			95% Bootstrap-t UCL	147523		

1061				95% Hall's Bootstrap UCL	101658			95% Percentile Bootstrap UCL		6519	
1062				95% BCA Bootstrap UCL	8492						
1063				90% Chebyshev(Mean, Sd) UCL	8527			95% Chebyshev(Mean, Sd) UCL		11207	
1064				97.5% Chebyshev(Mean, Sd) UCL	14926			99% Chebyshev(Mean, Sd) UCL		22233	
1065											
1066					Suggested UCL to Use						
1067				99% Chebyshev (Mean, Sd) UCL	22233						
1068											
1069					Recommended UCL exceeds the maximum observation						
1070											
1071					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
1072					Recommendations are based upon data size, data distribution, and skewness.						
1073					These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).						
1074					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.						
1075											
1076	Fluorene										
1077											
1078					General Statistics						
1079				Total Number of Observations	10			Number of Distinct Observations		10	
1080				Number of Detects	9			Number of Non-Detects		1	
1081				Number of Distinct Detects	9			Number of Distinct Non-Detects		1	
1082				Minimum Detect	11			Minimum Non-Detect		63	
1083				Maximum Detect	1500			Maximum Non-Detect		63	
1084				Variance Detects	238389			Percent Non-Detects		10%	
1085				Mean Detects	299.8			SD Detects		488.3	
1086				Median Detects	75			CV Detects		1.629	
1087				Skewness Detects	2.318			Kurtosis Detects		5.366	
1088				Mean of Logged Detects	4.737			SD of Logged Detects		1.451	
1089											
1090					Normal GOF Test on Detects Only						
1091				Shapiro Wilk Test Statistic	0.629			Shapiro Wilk GOF Test			
1092				5% Shapiro Wilk Critical Value	0.829			Detected Data Not Normal at 5% Significance Level			
1093				Lilliefors Test Statistic	0.351			Lilliefors GOF Test			
1094				5% Lilliefors Critical Value	0.274			Detected Data Not Normal at 5% Significance Level			
1095					Detected Data Not Normal at 5% Significance Level						
1096											
1097					Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs						
1098				KM Mean	274			KM Standard Error of Mean		148.8	
1099				KM SD	443.6			95% KM (BCA) UCL		527.9	
1100				95% KM (t) UCL	546.8			95% KM (Percentile Bootstrap) UCL		520.8	
1101				95% KM (z) UCL	518.7			95% KM Bootstrap t UCL		2153	
1102				90% KM Chebyshev UCL	720.4			95% KM Chebyshev UCL		922.6	
1103				97.5% KM Chebyshev UCL	1203			99% KM Chebyshev UCL		1755	
1104											
1105					Gamma GOF Tests on Detected Observations Only						
1106				A-D Test Statistic	0.754			Anderson-Darling GOF Test			
1107				5% A-D Critical Value	0.76			Detected data appear Gamma Distributed at 5% Significance Level			
1108				K-S Test Statistic	0.307			Kolmogorov-Smirnov GOF			
1109				5% K-S Critical Value	0.292			Detected Data Not Gamma Distributed at 5% Significance Level			
1110					Detected data follow Appr. Gamma Distribution at 5% Significance Level						
1111											
1112					Gamma Statistics on Detected Data Only						
1113				k hat (MLE)	0.634			k star (bias corrected MLE)		0.497	

1114				Theta hat (MLE)	472.6			Theta star (bias corrected MLE)			603.3
1115				nu hat (MLE)	11.42			nu star (bias corrected)			8.945
1116				Mean (detects)	299.8						
1117											
1118				Gamma ROS Statistics using Imputed Non-Detects							
1119				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
1120				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
1121				For such situations, GROS method may yield incorrect values of UCLs and BTVs							
1122				This is especially true when the sample size is small.							
1123				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
1124				Minimum	0.01			Mean			269.8
1125				Maximum	1500			Median			71.5
1126				SD	470			CV			1.742
1127				k hat (MLE)	0.371			k star (bias corrected MLE)			0.326
1128				Theta hat (MLE)	727.1			Theta star (bias corrected MLE)			826.6
1129				nu hat (MLE)	7.421			nu star (bias corrected)			6.528
1130				Adjusted Level of Significance (β)	0.0267						
1131				Approximate Chi Square Value (6.53, α)	1.915			Adjusted Chi Square Value (6.53, β)			1.513
1132				95% Gamma Approximate UCL (use when n>=50)	919.5			95% Gamma Adjusted UCL (use when n<50)			1164
1133											
1134				Estimates of Gamma Parameters using KM Estimates							
1135				Mean (KM)	274			SD (KM)			443.6
1136				Variance (KM)	196740			SE of Mean (KM)			148.8
1137				k hat (KM)	0.382			k star (KM)			0.334
1138				nu hat (KM)	7.632			nu star (KM)			6.676
1139				theta hat (KM)	718			theta star (KM)			820.9
1140				80% gamma percentile (KM)	430.1			90% gamma percentile (KM)			796.8
1141				95% gamma percentile (KM)	1210			99% gamma percentile (KM)			2272
1142											
1143				Gamma Kaplan-Meier (KM) Statistics							
1144				Approximate Chi Square Value (6.68, α)	1.994			Adjusted Chi Square Value (6.68, β)			1.581
1145				95% Gamma Approximate KM-UCL (use when n>=50)	917.2			95% Gamma Adjusted KM-UCL (use when n<50)			1157
1146											
1147				Lognormal GOF Test on Detected Observations Only							
1148				Shapiro Wilk Test Statistic	0.93			Shapiro Wilk GOF Test			
1149				5% Shapiro Wilk Critical Value	0.829			Detected Data appear Lognormal at 5% Significance Level			
1150				Lilliefors Test Statistic	0.235			Lilliefors GOF Test			
1151				5% Lilliefors Critical Value	0.274			Detected Data appear Lognormal at 5% Significance Level			
1152				Detected Data appear Lognormal at 5% Significance Level							
1153											
1154				Lognormal ROS Statistics Using Imputed Non-Detects							
1155				Mean in Original Scale	272.4			Mean in Log Scale			4.589
1156				SD in Original Scale	468.4			SD in Log Scale			1.446
1157				95% t UCL (assumes normality of ROS data)	543.9			95% Percentile Bootstrap UCL			517.1
1158				95% BCA Bootstrap UCL	708.4			95% Bootstrap t UCL			1936
1159				95% H-UCL (Log ROS)	2000						
1160											
1161				Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution							
1162				KM Mean (logged)	4.613			KM Geo Mean			100.8
1163				KM SD (logged)	1.372			95% Critical H Value (KM-Log)			3.913
1164				KM Standard Error of Mean (logged)	0.47			95% H-UCL (KM -Log)			1549
1165				KM SD (logged)	1.372			95% Critical H Value (KM-Log)			3.913
1166				KM Standard Error of Mean (logged)	0.47						

1167											
1168	DL/2 Statistics										
1169	DL/2 Normal					DL/2 Log-Transformed					
1170				Mean in Original Scale	273				Mean in Log Scale	4.608	
1171				SD in Original Scale	468.1				SD in Log Scale	1.428	
1172				95% t UCL (Assumes normality)	544.3				95% H-Stat UCL	1899	
1173	DL/2 is not a recommended method, provided for comparisons and historical reasons										
1174											
1175	Nonparametric Distribution Free UCL Statistics										
1176	Detected Data appear Approximate Gamma Distributed at 5% Significance Level										
1177											
1178	Suggested UCL to Use										
1179				95% KM Bootstrap t UCL	2023				95% Hall's Bootstrap	1549	
1180											
1181	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test										
1182	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL										
1183											
1184	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
1185	Recommendations are based upon data size, data distribution, and skewness.										
1186	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
1187	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
1188											
1189	IP										
1190											
1191	General Statistics										
1192				Total Number of Observations	10				Number of Distinct Observations	10	
1193				Number of Detects	7				Number of Non-Detects	3	
1194				Number of Distinct Detects	7				Number of Distinct Non-Detects	3	
1195				Minimum Detect	23				Minimum Non-Detect	140	
1196				Maximum Detect	3900				Maximum Non-Detect	210	
1197				Variance Detects	2088030				Percent Non-Detects	30%	
1198				Mean Detects	820.1				SD Detects	1445	
1199				Median Detects	79				CV Detects	1.762	
1200				Skewness Detects	2.118				Kurtosis Detects	4.405	
1201				Mean of Logged Detects	5.181				SD of Logged Detects	1.93	
1202											
1203	Normal GOF Test on Detects Only										
1204				Shapiro Wilk Test Statistic	0.65	Shapiro Wilk GOF Test					
1205				5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level					
1206				Lilliefors Test Statistic	0.373	Lilliefors GOF Test					
1207				5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level					
1208	Detected Data Not Normal at 5% Significance Level										
1209											
1210	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
1211				KM Mean	589.9				KM Standard Error of Mean	400.8	
1212				KM SD	1173				95% KM (BCA) UCL	1348	
1213				95% KM (t) UCL	1325				95% KM (Percentile Bootstrap) UCL	1243	
1214				95% KM (z) UCL	1249				95% KM Bootstrap t UCL	10406	
1215				90% KM Chebyshev UCL	1792				95% KM Chebyshev UCL	2337	
1216				97.5% KM Chebyshev UCL	3093				99% KM Chebyshev UCL	4578	
1217											
1218	Gamma GOF Tests on Detected Observations Only										
1219				A-D Test Statistic	0.616	Anderson-Darling GOF Test					

1220				5% A-D Critical Value	0.764	Detected data appear Gamma Distributed at 5% Significance Level					
1221				K-S Test Statistic	0.285	Kolmogorov-Smirnov GOF					
1222				5% K-S Critical Value	0.33	Detected data appear Gamma Distributed at 5% Significance Level					
1223				Detected data appear Gamma Distributed at 5% Significance Level							
1224											
1225				Gamma Statistics on Detected Data Only							
1226				k hat (MLE)	0.426	k star (bias corrected MLE)	0.339				
1227				Theta hat (MLE)	1925	Theta star (bias corrected MLE)	2421				
1228				nu hat (MLE)	5.966	nu star (bias corrected)	4.742				
1229				Mean (detects)	820.1						
1230											
1231				Gamma ROS Statistics using Imputed Non-Detects							
1232				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
1233				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
1234				For such situations, GROS method may yield incorrect values of UCLs and BTVs							
1235				This is especially true when the sample size is small.							
1236				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
1237				Minimum	0.01	Mean	574.1				
1238				Maximum	3900	Median	54.5				
1239				SD	1245	CV	2.168				
1240				k hat (MLE)	0.182	k star (bias corrected MLE)	0.194				
1241				Theta hat (MLE)	3158	Theta star (bias corrected MLE)	2960				
1242				nu hat (MLE)	3.636	nu star (bias corrected)	3.879				
1243				Adjusted Level of Significance (β)	0.0267						
1244				Approximate Chi Square Value (3.88, α)	0.674	Adjusted Chi Square Value (3.88, β)	0.481				
1245				95% Gamma Approximate UCL (use when n>=50)	3302	95% Gamma Adjusted UCL (use when n<50)	4625				
1246											
1247				Estimates of Gamma Parameters using KM Estimates							
1248				Mean (KM)	589.9	SD (KM)	1173				
1249				Variance (KM)	1376680	SE of Mean (KM)	400.8				
1250				k hat (KM)	0.253	k star (KM)	0.244				
1251				nu hat (KM)	5.056	nu star (KM)	4.872				
1252				theta hat (KM)	2334	theta star (KM)	2421				
1253				80% gamma percentile (KM)	848.8	90% gamma percentile (KM)	1774				
1254				95% gamma percentile (KM)	2877	99% gamma percentile (KM)	5826				
1255											
1256				Gamma Kaplan-Meier (KM) Statistics							
1257				Approximate Chi Square Value (4.87, α)	1.094	Adjusted Chi Square Value (4.87, β)	0.818				
1258				95% Gamma Approximate KM-UCL (use when n>=50)	2628	95% Gamma Adjusted KM-UCL (use when n<50)	3512				
1259											
1260				Lognormal GOF Test on Detected Observations Only							
1261				Shapiro Wilk Test Statistic	0.906	Shapiro Wilk GOF Test					
1262				5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level					
1263				Lilliefors Test Statistic	0.234	Lilliefors GOF Test					
1264				5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level					
1265				Detected Data appear Lognormal at 5% Significance Level							
1266											
1267				Lognormal ROS Statistics Using Imputed Non-Detects							
1268				Mean in Original Scale	589.9	Mean in Log Scale	4.815				
1269				SD in Original Scale	1237	SD in Log Scale	1.682				
1270				95% t UCL (assumes normality of ROS data)	1307	95% Percentile Bootstrap UCL	1341				
1271				95% BCA Bootstrap UCL	1609	95% Bootstrap t UCL	11394				
1272				95% H-UCL (Log ROS)	6817						

1273											
1274	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										
1275				KM Mean (logged)	4.775			KM Geo Mean	118.5		
1276				KM SD (logged)	1.645			95% Critical H Value (KM-Log)	4.546		
1277				KM Standard Error of Mean (logged)	0.578			95% H-UCL (KM -Log)	5545		
1278				KM SD (logged)	1.645			95% Critical H Value (KM-Log)	4.546		
1279				KM Standard Error of Mean (logged)	0.578						
1280											
1281	DL/2 Statistics										
1282				DL/2 Normal				DL/2 Log-Transformed			
1283				Mean in Original Scale	599.6			Mean in Log Scale	4.955		
1284				SD in Original Scale	1232			SD in Log Scale	1.62		
1285				95% t UCL (Assumes normality)	1314			95% H-Stat UCL	5942		
1286	DL/2 is not a recommended method, provided for comparisons and historical reasons										
1287											
1288	Nonparametric Distribution Free UCL Statistics										
1289	Detected Data appear Gamma Distributed at 5% Significance Level										
1290											
1291	Suggested UCL to Use										
1292				95% KM Bootstrap t UCL	9708			95% Hall's Bootstrap	5545		
1293											
1294	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
1295	Recommendations are based upon data size, data distribution, and skewness.										
1296	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
1297	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
1298											
1299											
1300	Naphthalene										
1301											
1302	General Statistics										
1303				Total Number of Observations	10			Number of Distinct Observations	10		
1304								Number of Missing Observations	0		
1305				Minimum	14			Mean	413		
1306				Maximum	1400			Median	305		
1307				SD	444.8			Std. Error of Mean	140.7		
1308				Coefficient of Variation	1.077			Skewness	1.34		
1309											
1310	Normal GOF Test										
1311				Shapiro Wilk Test Statistic	0.859			Shapiro Wilk GOF Test			
1312				5% Shapiro Wilk Critical Value	0.842			Data appear Normal at 5% Significance Level			
1313				Lilliefors Test Statistic	0.185			Lilliefors GOF Test			
1314				5% Lilliefors Critical Value	0.262			Data appear Normal at 5% Significance Level			
1315	Data appear Normal at 5% Significance Level										
1316											
1317	Assuming Normal Distribution										
1318				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
1319				95% Student's-t UCL	670.8			95% Adjusted-CLT UCL (Chen-1995)	708.1		
1320								95% Modified-t UCL (Johnson-1978)	680.8		
1321											
1322	Gamma GOF Test										
1323				A-D Test Statistic	0.256			Anderson-Darling Gamma GOF Test			
1324				5% A-D Critical Value	0.759			Detected data appear Gamma Distributed at 5% Significance Level			
1325				K-S Test Statistic	0.157			Kolmogorov-Smirnov Gamma GOF Test			

1326				5% K-S Critical Value	0.276	Detected data appear Gamma Distributed at 5% Significance Level						
1327	Detected data appear Gamma Distributed at 5% Significance Level											
1328												
1329	Gamma Statistics											
1330				k hat (MLE)	0.73			k star (bias corrected MLE)	0.577			
1331				Theta hat (MLE)	566			Theta star (bias corrected MLE)	715.2			
1332				nu hat (MLE)	14.59			nu star (bias corrected)	11.55			
1333				MLE Mean (bias corrected)	413			MLE Sd (bias corrected)	543.5			
1334								Approximate Chi Square Value (0.05)	4.932			
1335				Adjusted Level of Significance	0.0267			Adjusted Chi Square Value	4.206			
1336												
1337	Assuming Gamma Distribution											
1338			95% Approximate Gamma UCL (use when n>=50))		967.2			95% Adjusted Gamma UCL (use when n<50)	1134			
1339												
1340	Lognormal GOF Test											
1341				Shapiro Wilk Test Statistic	0.909	Shapiro Wilk Lognormal GOF Test						
1342				5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level						
1343				Lilliefors Test Statistic	0.197	Lilliefors Lognormal GOF Test						
1344				5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level						
1345	Data appear Lognormal at 5% Significance Level											
1346												
1347	Lognormal Statistics											
1348				Minimum of Logged Data	2.639			Mean of logged Data	5.2			
1349				Maximum of Logged Data	7.244			SD of logged Data	1.628			
1350												
1351	Assuming Lognormal Distribution											
1352				95% H-UCL	7857			90% Chebyshev (MVUE) UCL	1411			
1353				95% Chebyshev (MVUE) UCL	1807			97.5% Chebyshev (MVUE) UCL	2356			
1354				99% Chebyshev (MVUE) UCL	3435							
1355												
1356	Nonparametric Distribution Free UCL Statistics											
1357	Data appear to follow a Discernible Distribution at 5% Significance Level											
1358												
1359	Nonparametric Distribution Free UCLs											
1360				95% CLT UCL	644.4			95% Jackknife UCL	670.8			
1361				95% Standard Bootstrap UCL	638.6			95% Bootstrap-t UCL	822.7			
1362				95% Hall's Bootstrap UCL	990.9			95% Percentile Bootstrap UCL	649.4			
1363				95% BCA Bootstrap UCL	673.5							
1364				90% Chebyshev(Mean, Sd) UCL	835			95% Chebyshev(Mean, Sd) UCL	1026			
1365				97.5% Chebyshev(Mean, Sd) UCL	1291			99% Chebyshev(Mean, Sd) UCL	1813			
1366												
1367	Suggested UCL to Use											
1368				95% Student's-t UCL	670.8							
1369												
1370	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1371	Recommendations are based upon data size, data distribution, and skewness.											
1372	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1373	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1374												
1375												
1376	Phenanthrene											
1377												
1378	General Statistics											

1379	Total Number of Observations				10	Number of Distinct Observations					8
1380						Number of Missing Observations					0
1381	Minimum				49	Mean					1650
1382	Maximum				11000	Median					230
1383	SD				3498	Std. Error of Mean					1106
1384	Coefficient of Variation				2.12	Skewness					2.613
1385											
1386	Normal GOF Test										
1387	Shapiro Wilk Test Statistic				0.527	Shapiro Wilk GOF Test					
1388	5% Shapiro Wilk Critical Value				0.842	Data Not Normal at 5% Significance Level					
1389	Lilliefors Test Statistic				0.45	Lilliefors GOF Test					
1390	5% Lilliefors Critical Value				0.262	Data Not Normal at 5% Significance Level					
1391	Data Not Normal at 5% Significance Level										
1392											
1393	Assuming Normal Distribution										
1394	95% Normal UCL					95% UCLs (Adjusted for Skewness)					
1395	95% Student's-t UCL				3678	95% Adjusted-CLT UCL (Chen-1995)					4446
1396						95% Modified-t UCL (Johnson-1978)					3830
1397											
1398	Gamma GOF Test										
1399	A-D Test Statistic				1.467	Anderson-Darling Gamma GOF Test					
1400	5% A-D Critical Value				0.794	Data Not Gamma Distributed at 5% Significance Level					
1401	K-S Test Statistic				0.418	Kolmogorov-Smirnov Gamma GOF Test					
1402	5% K-S Critical Value				0.284	Data Not Gamma Distributed at 5% Significance Level					
1403	Data Not Gamma Distributed at 5% Significance Level										
1404											
1405	Gamma Statistics										
1406	k hat (MLE)				0.408	k star (bias corrected MLE)					0.353
1407	Theta hat (MLE)				4040	Theta star (bias corrected MLE)					4680
1408	nu hat (MLE)				8.167	nu star (bias corrected)					7.05
1409	MLE Mean (bias corrected)				1650	MLE Sd (bias corrected)					2779
1410						Approximate Chi Square Value (0.05)					2.198
1411	Adjusted Level of Significance				0.0267	Adjusted Chi Square Value					1.758
1412											
1413	Assuming Gamma Distribution										
1414	95% Approximate Gamma UCL (use when n>=50))				5292	95% Adjusted Gamma UCL (use when n<50)					6615
1415											
1416	Lognormal GOF Test										
1417	Shapiro Wilk Test Statistic				0.822	Shapiro Wilk Lognormal GOF Test					
1418	5% Shapiro Wilk Critical Value				0.842	Data Not Lognormal at 5% Significance Level					
1419	Lilliefors Test Statistic				0.323	Lilliefors Lognormal GOF Test					
1420	5% Lilliefors Critical Value				0.262	Data Not Lognormal at 5% Significance Level					
1421	Data Not Lognormal at 5% Significance Level										
1422											
1423	Lognormal Statistics										
1424	Minimum of Logged Data				3.892	Mean of logged Data					5.802
1425	Maximum of Logged Data				9.306	SD of logged Data					1.723
1426											
1427	Assuming Lognormal Distribution										
1428	95% H-UCL				22106	90% Chebyshev (MVUE) UCL					3002
1429	95% Chebyshev (MVUE) UCL				3861	97.5% Chebyshev (MVUE) UCL					5052
1430	99% Chebyshev (MVUE) UCL				7393						
1431											

1432	Nonparametric Distribution Free UCL Statistics										
1433	Data do not follow a Discernible Distribution (0.05)										
1434											
1435	Nonparametric Distribution Free UCLs										
1436				95% CLT UCL	3469			95% Jackknife UCL	3678		
1437				95% Standard Bootstrap UCL	3382			95% Bootstrap-t UCL	60426		
1438				95% Hall's Bootstrap UCL	37884			95% Percentile Bootstrap UCL	3481		
1439				95% BCA Bootstrap UCL	4219						
1440				90% Chebyshev(Mean, Sd) UCL	4968			95% Chebyshev(Mean, Sd) UCL	6471		
1441				97.5% Chebyshev(Mean, Sd) UCL	8558			99% Chebyshev(Mean, Sd) UCL	12656		
1442											
1443	Suggested UCL to Use										
1444				99% Chebyshev (Mean, Sd) UCL	12656						
1445											
1446	Recommended UCL exceeds the maximum observation										
1447											
1448	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
1449	Recommendations are based upon data size, data distribution, and skewness.										
1450	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
1451	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
1452											
1453											
1454	Pyrene										
1455											
1456	General Statistics										
1457				Total Number of Observations	10			Number of Distinct Observations	10		
1458								Number of Missing Observations	0		
1459				Minimum	75			Mean	2609		
1460				Maximum	14000			Median	335		
1461				SD	4900			Std. Error of Mean	1550		
1462				Coefficient of Variation	1.878			Skewness	1.984		
1463											
1464	Normal GOF Test										
1465				Shapiro Wilk Test Statistic	0.582			Shapiro Wilk GOF Test			
1466				5% Shapiro Wilk Critical Value	0.842			Data Not Normal at 5% Significance Level			
1467				Lilliefors Test Statistic	0.421			Lilliefors GOF Test			
1468				5% Lilliefors Critical Value	0.262			Data Not Normal at 5% Significance Level			
1469	Data Not Normal at 5% Significance Level										
1470											
1471	Assuming Normal Distribution										
1472				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
1473				95% Student's-t UCL	5450			95% Adjusted-CLT UCL (Chen-1995)	6196		
1474								95% Modified-t UCL (Johnson-1978)	5612		
1475											
1476	Gamma GOF Test										
1477				A-D Test Statistic	1.266			Anderson-Darling Gamma GOF Test			
1478				5% A-D Critical Value	0.792			Data Not Gamma Distributed at 5% Significance Level			
1479				K-S Test Statistic	0.366			Kolmogorov-Smirnov Gamma GOF Test			
1480				5% K-S Critical Value	0.284			Data Not Gamma Distributed at 5% Significance Level			
1481	Data Not Gamma Distributed at 5% Significance Level										
1482											
1483	Gamma Statistics										
1484				k hat (MLE)	0.417			k star (bias corrected MLE)	0.359		

1485				Theta hat (MLE)	6257			Theta star (bias corrected MLE)	7276		
1486				nu hat (MLE)	8.339			nu star (bias corrected)	7.171		
1487				MLE Mean (bias corrected)	2609			MLE Sd (bias corrected)	4357		
1488								Approximate Chi Square Value (0.05)	2.265		
1489				Adjusted Level of Significance	0.0267			Adjusted Chi Square Value	1.816		
1490											
1491					Assuming Gamma Distribution						
1492				95% Approximate Gamma UCL (use when n>=50))	8260			95% Adjusted Gamma UCL (use when n<50)	10299		
1493											
1494					Lognormal GOF Test						
1495				Shapiro Wilk Test Statistic	0.85			Shapiro Wilk Lognormal GOF Test			
1496				5% Shapiro Wilk Critical Value	0.842			Data appear Lognormal at 5% Significance Level			
1497				Lilliefors Test Statistic	0.298			Lilliefors Lognormal GOF Test			
1498				5% Lilliefors Critical Value	0.262			Data Not Lognormal at 5% Significance Level			
1499					Data appear Approximate Lognormal at 5% Significance Level						
1500											
1501					Lognormal Statistics						
1502				Minimum of Logged Data	4.317			Mean of logged Data	6.299		
1503				Maximum of Logged Data	9.547			SD of logged Data	1.776		
1504											
1505					Assuming Lognormal Distribution						
1506				95% H-UCL	46706			90% Chebyshev (MVUE) UCL	5377		
1507				95% Chebyshev (MVUE) UCL	6930			97.5% Chebyshev (MVUE) UCL	9085		
1508				99% Chebyshev (MVUE) UCL	13319						
1509											
1510					Nonparametric Distribution Free UCL Statistics						
1511					Data appear to follow a Discernible Distribution at 5% Significance Level						
1512											
1513					Nonparametric Distribution Free UCLs						
1514				95% CLT UCL	5158			95% Jackknife UCL	5450		
1515				95% Standard Bootstrap UCL	4984			95% Bootstrap-t UCL	40519		
1516				95% Hall's Bootstrap UCL	44211			95% Percentile Bootstrap UCL	5298		
1517				95% BCA Bootstrap UCL	5810						
1518				90% Chebyshev(Mean, Sd) UCL	7258			95% Chebyshev(Mean, Sd) UCL	9364		
1519				97.5% Chebyshev(Mean, Sd) UCL	12286			99% Chebyshev(Mean, Sd) UCL	18028		
1520											
1521					Suggested UCL to Use						
1522				99% Chebyshev (Mean, Sd) UCL	18028						
1523											
1524					Recommended UCL exceeds the maximum observation						
1525											
1526					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
1527					Recommendations are based upon data size, data distribution, and skewness.						
1528					These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).						
1529					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.						
1530											
1531											
1532	LMWPAH										
1533											
1534					General Statistics						
1535				Total Number of Observations	10			Number of Distinct Observations	10		
1536								Number of Missing Observations	0		
1537				Minimum	147.8			Mean	3205		

1538				Maximum	17390				Median	1002	
1539				SD	5382				Std. Error of Mean	1702	
1540				Coefficient of Variation	1.679				Skewness	2.482	
1541											
1542				Normal GOF Test							
1543				Shapiro Wilk Test Statistic	0.619			Shapiro Wilk GOF Test			
1544				5% Shapiro Wilk Critical Value	0.842			Data Not Normal at 5% Significance Level			
1545				Lilliefors Test Statistic	0.339			Lilliefors GOF Test			
1546				5% Lilliefors Critical Value	0.262			Data Not Normal at 5% Significance Level			
1547				Data Not Normal at 5% Significance Level							
1548											
1549				Assuming Normal Distribution							
1550				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
1551				95% Student's-t UCL	6325			95% Adjusted-CLT UCL (Chen-1995)	7432		
1552								95% Modified-t UCL (Johnson-1978)	6548		
1553											
1554				Gamma GOF Test							
1555				A-D Test Statistic	0.593			Anderson-Darling Gamma GOF Test			
1556				5% A-D Critical Value	0.768			Detected data appear Gamma Distributed at 5% Significance Level			
1557				K-S Test Statistic	0.267			Kolmogorov-Smirnov Gamma GOF Test			
1558				5% K-S Critical Value	0.279			Detected data appear Gamma Distributed at 5% Significance Level			
1559				Detected data appear Gamma Distributed at 5% Significance Level							
1560											
1561				Gamma Statistics							
1562				k hat (MLE)	0.61			k star (bias corrected MLE)	0.494		
1563				Theta hat (MLE)	5253			Theta star (bias corrected MLE)	6491		
1564				nu hat (MLE)	12.2			nu star (bias corrected)	9.876		
1565				MLE Mean (bias corrected)	3205			MLE Sd (bias corrected)	4562		
1566								Approximate Chi Square Value (0.05)	3.864		
1567				Adjusted Level of Significance	0.0267			Adjusted Chi Square Value	3.238		
1568											
1569				Assuming Gamma Distribution							
1570				95% Approximate Gamma UCL (use when n>=50)	8192			95% Adjusted Gamma UCL (use when n<50)	9777		
1571											
1572				Lognormal GOF Test							
1573				Shapiro Wilk Test Statistic	0.963			Shapiro Wilk Lognormal GOF Test			
1574				5% Shapiro Wilk Critical Value	0.842			Data appear Lognormal at 5% Significance Level			
1575				Lilliefors Test Statistic	0.174			Lilliefors Lognormal GOF Test			
1576				5% Lilliefors Critical Value	0.262			Data appear Lognormal at 5% Significance Level			
1577				Data appear Lognormal at 5% Significance Level							
1578											
1579				Lognormal Statistics							
1580				Minimum of Logged Data	4.996			Mean of logged Data	7.063		
1581				Maximum of Logged Data	9.764			SD of logged Data	1.476		
1582											
1583				Assuming Lognormal Distribution							
1584				95% H-UCL	26707			90% Chebyshev (MVUE) UCL	7165		
1585				95% Chebyshev (MVUE) UCL	9102			97.5% Chebyshev (MVUE) UCL	11789		
1586				99% Chebyshev (MVUE) UCL	17069						
1587											
1588				Nonparametric Distribution Free UCL Statistics							
1589				Data appear to follow a Discernible Distribution at 5% Significance Level							
1590											

	A	B	C	D	E	F	G	H	I	J	K	L
1591	Nonparametric Distribution Free UCLs											
1592					95% CLT UCL	6005			95% Jackknife UCL	6325		
1593					95% Standard Bootstrap UCL	5847			95% Bootstrap-t UCL	18464		
1594					95% Hall's Bootstrap UCL	17477			95% Percentile Bootstrap UCL	6142		
1595					95% BCA Bootstrap UCL	7450						
1596					90% Chebyshev(Mean, Sd) UCL	8311			95% Chebyshev(Mean, Sd) UCL	10624		
1597					97.5% Chebyshev(Mean, Sd) UCL	13833			99% Chebyshev(Mean, Sd) UCL	20139		
1598												
1599	Suggested UCL to Use											
1600					95% Adjusted Gamma UCL	9777						
1601												
1602	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1603	Recommendations are based upon data size, data distribution, and skewness.											
1604	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1605	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1606												
1607												
1608	HMWPAH											
1609												
1610	General Statistics											
1611					Total Number of Observations	10			Number of Distinct Observations	10		
1612									Number of Missing Observations	0		
1613					Minimum	367			Mean	12318		
1614					Maximum	81300			Median	1698		
1615					SD	25759			Std. Error of Mean	8146		
1616					Coefficient of Variation	2.091			Skewness	2.624		
1617												
1618	Normal GOF Test											
1619					Shapiro Wilk Test Statistic	0.532			Shapiro Wilk GOF Test			
1620					5% Shapiro Wilk Critical Value	0.842			Data Not Normal at 5% Significance Level			
1621					Lilliefors Test Statistic	0.435			Lilliefors GOF Test			
1622					5% Lilliefors Critical Value	0.262			Data Not Normal at 5% Significance Level			
1623	Data Not Normal at 5% Significance Level											
1624												
1625	Assuming Normal Distribution											
1626					95% Normal UCL				95% UCLs (Adjusted for Skewness)			
1627					95% Student's-t UCL	27251			95% Adjusted-CLT UCL (Chen-1995)	32940		
1628									95% Modified-t UCL (Johnson-1978)	28377		
1629												
1630	Gamma GOF Test											
1631					A-D Test Statistic	1.342			Anderson-Darling Gamma GOF Test			
1632					5% A-D Critical Value	0.791			Data Not Gamma Distributed at 5% Significance Level			
1633					K-S Test Statistic	0.36			Kolmogorov-Smirnov Gamma GOF Test			
1634					5% K-S Critical Value	0.283			Data Not Gamma Distributed at 5% Significance Level			
1635	Data Not Gamma Distributed at 5% Significance Level											
1636												
1637	Gamma Statistics											
1638					k hat (MLE)	0.426			k star (bias corrected MLE)	0.365		
1639					Theta hat (MLE)	28920			Theta star (bias corrected MLE)	33765		
1640					nu hat (MLE)	8.519			nu star (bias corrected)	7.297		
1641					MLE Mean (bias corrected)	12318			MLE Sd (bias corrected)	20394		
1642									Approximate Chi Square Value (0.05)	2.335		
1643					Adjusted Level of Significance	0.0267			Adjusted Chi Square Value	1.878		

1644											
1645						Assuming Gamma Distribution					
1646					95% Approximate Gamma UCL (use when n>=50))	38497		95% Adjusted Gamma UCL (use when n<50)		47871	
1647											
1648						Lognormal GOF Test					
1649					Shapiro Wilk Test Statistic	0.853		Shapiro Wilk Lognormal GOF Test			
1650					5% Shapiro Wilk Critical Value	0.842		Data appear Lognormal at 5% Significance Level			
1651					Lilliefors Test Statistic	0.274		Lilliefors Lognormal GOF Test			
1652					5% Lilliefors Critical Value	0.262		Data Not Lognormal at 5% Significance Level			
1653						Data appear Approximate Lognormal at 5% Significance Level					
1654											
1655						Lognormal Statistics					
1656					Minimum of Logged Data	5.905		Mean of logged Data		7.889	
1657					Maximum of Logged Data	11.31		SD of logged Data		1.685	
1658											
1659						Assuming Lognormal Distribution					
1660					95% H-UCL	149869		90% Chebyshev (MVUE) UCL		22786	
1661					95% Chebyshev (MVUE) UCL	29254		97.5% Chebyshev (MVUE) UCL		38231	
1662					99% Chebyshev (MVUE) UCL	55864					
1663											
1664						Nonparametric Distribution Free UCL Statistics					
1665						Data appear to follow a Discernible Distribution at 5% Significance Level					
1666											
1667						Nonparametric Distribution Free UCLs					
1668					95% CLT UCL	25717		95% Jackknife UCL		27251	
1669					95% Standard Bootstrap UCL	24591		95% Bootstrap-t UCL		328834	
1670					95% Hall's Bootstrap UCL	139062		95% Percentile Bootstrap UCL		27822	
1671					95% BCA Bootstrap UCL	33565					
1672					90% Chebyshev(Mean, Sd) UCL	36756		95% Chebyshev(Mean, Sd) UCL		47825	
1673					97.5% Chebyshev(Mean, Sd) UCL	63189		99% Chebyshev(Mean, Sd) UCL		93368	
1674											
1675						Suggested UCL to Use					
1676					99% Chebyshev (Mean, Sd) UCL	93368					
1677											
1678						Recommended UCL exceeds the maximum observation					
1679											
1680						Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.					
1681						Recommendations are based upon data size, data distribution, and skewness.					
1682						These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).					
1683						However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.					
1684											
1685	BEHP										
1686											
1687						General Statistics					
1688					Total Number of Observations	10		Number of Distinct Observations		9	
1689					Number of Detects	4		Number of Non-Detects		6	
1690					Number of Distinct Detects	4		Number of Distinct Non-Detects		6	
1691					Minimum Detect	380		Minimum Non-Detect		260	
1692					Maximum Detect	15000		Maximum Non-Detect		1000	
1693					Variance Detects	50064267		Percent Non-Detects		60%	
1694					Mean Detects	6520		SD Detects		7076	
1695					Median Detects	5350		CV Detects		1.085	
1696					Skewness Detects	0.456		Kurtosis Detects		-3.362	

1697				Mean of Logged Detects	7.911				SD of Logged Detects	1.771	
1698											
1699					Normal GOF Test on Detects Only						
1700				Shapiro Wilk Test Statistic	0.881			Shapiro Wilk GOF Test			
1701				5% Shapiro Wilk Critical Value	0.748			Detected Data appear Normal at 5% Significance Level			
1702				Lilliefors Test Statistic	0.282			Lilliefors GOF Test			
1703				5% Lilliefors Critical Value	0.375			Detected Data appear Normal at 5% Significance Level			
1704					Detected Data appear Normal at 5% Significance Level						
1705											
1706					Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs						
1707				KM Mean	2780			KM Standard Error of Mean	1802		
1708				KM SD	4934			95% KM (BCA) UCL	N/A		
1709				95% KM (t) UCL	6083			95% KM (Percentile Bootstrap) UCL	N/A		
1710				95% KM (z) UCL	5744			95% KM Bootstrap t UCL	N/A		
1711				90% KM Chebyshev UCL	8185			95% KM Chebyshev UCL	10634		
1712				97.5% KM Chebyshev UCL	14032			99% KM Chebyshev UCL	20708		
1713											
1714					Gamma GOF Tests on Detected Observations Only						
1715				A-D Test Statistic	0.382			Anderson-Darling GOF Test			
1716				5% A-D Critical Value	0.673			Detected data appear Gamma Distributed at 5% Significance Level			
1717				K-S Test Statistic	0.277			Kolmogorov-Smirnov GOF			
1718				5% K-S Critical Value	0.406			Detected data appear Gamma Distributed at 5% Significance Level			
1719					Detected data appear Gamma Distributed at 5% Significance Level						
1720											
1721					Gamma Statistics on Detected Data Only						
1722				k hat (MLE)	0.694			k star (bias corrected MLE)	0.34		
1723				Theta hat (MLE)	9394			Theta star (bias corrected MLE)	19166		
1724				nu hat (MLE)	5.553			nu star (bias corrected)	2.722		
1725				Mean (detects)	6520						
1726											
1727					Gamma ROS Statistics using Imputed Non-Detects						
1728					GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs						
1729					GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)						
1730					For such situations, GROS method may yield incorrect values of UCLs and BTVs						
1731					This is especially true when the sample size is small.						
1732					For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates						
1733				Minimum	0.01			Mean	2608		
1734				Maximum	15000			Median	0.01		
1735				SD	5294			CV	2.03		
1736				k hat (MLE)	0.108			k star (bias corrected MLE)	0.142		
1737				Theta hat (MLE)	24203			Theta star (bias corrected MLE)	18354		
1738				nu hat (MLE)	2.155			nu star (bias corrected)	2.842		
1739				Adjusted Level of Significance (β)	0.0267						
1740				Approximate Chi Square Value (2.84, α)	0.327			Adjusted Chi Square Value (2.84, β)	0.224		
1741				95% Gamma Approximate UCL (use when n>=50)	22654			95% Gamma Adjusted UCL (use when n<50)	N/A		
1742											
1743					Estimates of Gamma Parameters using KM Estimates						
1744				Mean (KM)	2780			SD (KM)	4934		
1745				Variance (KM)	24345840			SE of Mean (KM)	1802		
1746				k hat (KM)	0.317			k star (KM)	0.289		
1747				nu hat (KM)	6.349			nu star (KM)	5.778		
1748				theta hat (KM)	8757			theta star (KM)	9623		
1749				80% gamma percentile (KM)	4222			90% gamma percentile (KM)	8235		

1750				95% gamma percentile (KM)	12871			99% gamma percentile (KM)	24978		
1751											
1752				Gamma Kaplan-Meier (KM) Statistics							
1753				Approximate Chi Square Value (5.78, α)	1.527			Adjusted Chi Square Value (5.78, β)	1.181		
1754				95% Gamma Approximate KM-UCL (use when n>=50)	10517			95% Gamma Adjusted KM-UCL (use when n<50)	13599		
1755											
1756				Lognormal GOF Test on Detected Observations Only							
1757				Shapiro Wilk Test Statistic	0.898			Shapiro Wilk GOF Test			
1758				5% Shapiro Wilk Critical Value	0.748			Detected Data appear Lognormal at 5% Significance Level			
1759				Lilliefors Test Statistic	0.263			Lilliefors GOF Test			
1760				5% Lilliefors Critical Value	0.375			Detected Data appear Lognormal at 5% Significance Level			
1761				Detected Data appear Lognormal at 5% Significance Level							
1762											
1763				Lognormal ROS Statistics Using Imputed Non-Detects							
1764				Mean in Original Scale	2630			Mean in Log Scale	5.262		
1765				SD in Original Scale	5282			SD in Log Scale	2.535		
1766				95% t UCL (assumes normality of ROS data)	5692			95% Percentile Bootstrap UCL	5489		
1767				95% BCA Bootstrap UCL	6461			95% Bootstrap t UCL	43431		
1768				95% H-UCL (Log ROS)	1389450						
1769											
1770				Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution							
1771				KM Mean (logged)	6.551			KM Geo Mean	700.2		
1772				KM SD (logged)	1.479			95% Critical H Value (KM-Log)	4.158		
1773				KM Standard Error of Mean (logged)	0.544			95% H-UCL (KM -Log)	16246		
1774				KM SD (logged)	1.479			95% Critical H Value (KM-Log)	4.158		
1775				KM Standard Error of Mean (logged)	0.544						
1776											
1777				DL/2 Statistics							
1778				DL/2 Normal				DL/2 Log-Transformed			
1779				Mean in Original Scale	2811			Mean in Log Scale	6.585		
1780				SD in Original Scale	5186			SD in Log Scale	1.592		
1781				95% t UCL (Assumes normality)	5817			95% H-Stat UCL	26871		
1782				DL/2 is not a recommended method, provided for comparisons and historical reasons							
1783											
1784				Nonparametric Distribution Free UCL Statistics							
1785				Detected Data appear Normal Distributed at 5% Significance Level							
1786											
1787				Suggested UCL to Use							
1788				95% KM (t) UCL	6083						
1789											
1790				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
1791				Recommendations are based upon data size, data distribution, and skewness.							
1792				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
1793				However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
1794											
1795	BBP										
1796											
1797				General Statistics							
1798				Total Number of Observations	10			Number of Distinct Observations	10		
1799				Number of Detects	2			Number of Non-Detects	8		
1800				Number of Distinct Detects	2			Number of Distinct Non-Detects	8		
1801				Minimum Detect	280			Minimum Non-Detect	260		
1802				Maximum Detect	16000			Maximum Non-Detect	1100		

1803				Variance Detects	1.236E+8				Percent Non-Detects		80%
1804				Mean Detects	8140				SD Detects		11116
1805				Median Detects	8140				CV Detects		1.366
1806				Skewness Detects	N/A				Kurtosis Detects		N/A
1807				Mean of Logged Detects	7.658				SD of Logged Detects		2.861
1808											
1809				Warning: Data set has only 2 Detected Values.							
1810				This is not enough to compute meaningful or reliable statistics and estimates.							
1811											
1812											
1813				Normal GOF Test on Detects Only							
1814				Not Enough Data to Perform GOF Test							
1815											
1816				Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs							
1817				KM Mean	1843				KM Standard Error of Mean		2110
1818				KM SD	4719				95% KM (BCA) UCL		N/A
1819				95% KM (t) UCL	5712				95% KM (Percentile Bootstrap) UCL		N/A
1820				95% KM (z) UCL	5314				95% KM Bootstrap t UCL		N/A
1821				90% KM Chebyshev UCL	8174				95% KM Chebyshev UCL		11042
1822				97.5% KM Chebyshev UCL	15023				99% KM Chebyshev UCL		22841
1823											
1824				Gamma GOF Tests on Detected Observations Only							
1825				Not Enough Data to Perform GOF Test							
1826											
1827				Gamma Statistics on Detected Data Only							
1828				k hat (MLE)	0.475				k star (bias corrected MLE)		N/A
1829				Theta hat (MLE)	17126				Theta star (bias corrected MLE)		N/A
1830				nu hat (MLE)	1.901				nu star (bias corrected)		N/A
1831				Mean (detects)	8140						
1832											
1833				Estimates of Gamma Parameters using KM Estimates							
1834				Mean (KM)	1843				SD (KM)		4719
1835				Variance (KM)	22269051				SE of Mean (KM)		2110
1836				k hat (KM)	0.153				k star (KM)		0.173
1837				nu hat (KM)	3.051				nu star (KM)		3.469
1838				theta hat (KM)	12083				theta star (KM)		10626
1839				80% gamma percentile (KM)	2233				90% gamma percentile (KM)		5546
1840				95% gamma percentile (KM)	9835				99% gamma percentile (KM)		21936
1841											
1842				Gamma Kaplan-Meier (KM) Statistics							
1843									Adjusted Level of Significance (β)		0.0267
1844				Approximate Chi Square Value (3.47, α)	0.524				Adjusted Chi Square Value (3.47, β)		0.366
1845				95% Gamma Approximate KM-UCL (use when n>=50)	12204				95% Gamma Adjusted KM-UCL (use when n<50)		17462
1846											
1847				Lognormal GOF Test on Detected Observations Only							
1848				Not Enough Data to Perform GOF Test							
1849											
1850				Lognormal ROS Statistics Using Imputed Non-Detects							
1851				Mean in Original Scale	1656				Mean in Log Scale		4.251
1852				SD in Original Scale	5041				SD in Log Scale		2.14
1853				95% t UCL (assumes normality of ROS data)	4578				95% Percentile Bootstrap UCL		N/A
1854				95% BCA Bootstrap UCL	N/A				95% Bootstrap t UCL		N/A
1855				95% H-UCL (Log ROS)	41342						

1856											
1857	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										
1858				KM Mean (logged)	6.006			KM Geo Mean	405.9		
1859				KM SD (logged)	1.225			95% Critical H Value (KM-Log)	3.584		
1860				KM Standard Error of Mean (logged)	0.549			95% H-UCL (KM -Log)	3716		
1861				KM SD (logged)	1.225			95% Critical H Value (KM-Log)	3.584		
1862				KM Standard Error of Mean (logged)	0.549						
1863											
1864	DL/2 Statistics										
1865				DL/2 Normal				DL/2 Log-Transformed			
1866				Mean in Original Scale	1906			Mean in Log Scale	6.111		
1867				SD in Original Scale	4954			SD in Log Scale	1.35		
1868				95% t UCL (Assumes normality)	4778			95% H-Stat UCL	6377		
1869	DL/2 is not a recommended method, provided for comparisons and historical reasons										
1870											
1871	Nonparametric Distribution Free UCL Statistics										
1872	Data do not follow a Discernible Distribution at 5% Significance Level										
1873											
1874	Suggested UCL to Use										
1875				KM Bootstrap t UCL	N/A						
1876											
1877	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
1878	Recommendations are based upon data size, data distribution, and skewness.										
1879	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
1880	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
1881											
1882	Carbazole										
1883											
1884	General Statistics										
1885				Total Number of Observations	10			Number of Distinct Observations	10		
1886				Number of Detects	2			Number of Non-Detects	8		
1887				Number of Distinct Detects	2			Number of Distinct Non-Detects	8		
1888				Minimum Detect	800			Minimum Non-Detect	260		
1889				Maximum Detect	1600			Maximum Non-Detect	1100		
1890				Variance Detects	320000			Percent Non-Detects	80%		
1891				Mean Detects	1200			SD Detects	565.7		
1892				Median Detects	1200			CV Detects	0.471		
1893				Skewness Detects	N/A			Kurtosis Detects	N/A		
1894				Mean of Logged Detects	7.031			SD of Logged Detects	0.49		
1895											
1896	Warning: Data set has only 2 Detected Values.										
1897	This is not enough to compute meaningful or reliable statistics and estimates.										
1898											
1899											
1900	Normal GOF Test on Detects Only										
1901	Not Enough Data to Perform GOF Test										
1902											
1903	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
1904				KM Mean	491.2			KM Standard Error of Mean	206		
1905				KM SD	422.6			95% KM (BCA) UCL	N/A		
1906				95% KM (t) UCL	868.8			95% KM (Percentile Bootstrap) UCL	N/A		
1907				95% KM (z) UCL	830			95% KM Bootstrap t UCL	N/A		
1908				90% KM Chebyshev UCL	1109			95% KM Chebyshev UCL	1389		

1909				97.5% KM Chebyshev UCL	1778			99% KM Chebyshev UCL	2541		
1910											
1911					Gamma GOF Tests on Detected Observations Only						
1912					Not Enough Data to Perform GOF Test						
1913											
1914					Gamma Statistics on Detected Data Only						
1915				k hat (MLE)	8.653			k star (bias corrected MLE)	N/A		
1916				Theta hat (MLE)	138.7			Theta star (bias corrected MLE)	N/A		
1917				nu hat (MLE)	34.61			nu star (bias corrected)	N/A		
1918				Mean (detects)	1200						
1919											
1920					Estimates of Gamma Parameters using KM Estimates						
1921				Mean (KM)	491.2			SD (KM)	422.6		
1922				Variance (KM)	178595			SE of Mean (KM)	206		
1923				k hat (KM)	1.351			k star (KM)	1.012		
1924				nu hat (KM)	27.02			nu star (KM)	20.25		
1925				theta hat (KM)	363.6			theta star (KM)	485.2		
1926				80% gamma percentile (KM)	789.8			90% gamma percentile (KM)	1128		
1927				95% gamma percentile (KM)	1465			99% gamma percentile (KM)	2248		
1928											
1929					Gamma Kaplan-Meier (KM) Statistics						
1930								Adjusted Level of Significance (β)	0.0267		
1931				Approximate Chi Square Value (20.25, α)	11.03			Adjusted Chi Square Value (20.25, β)	9.871		
1932				95% Gamma Approximate KM-UCL (use when n>=50)	901.4			95% Gamma Adjusted KM-UCL (use when n<50)	1007		
1933											
1934					Lognormal GOF Test on Detected Observations Only						
1935					Not Enough Data to Perform GOF Test						
1936											
1937					Lognormal ROS Statistics Using Imputed Non-Detects						
1938				Mean in Original Scale	473.9			Mean in Log Scale	5.944		
1939				SD in Original Scale	427.6			SD in Log Scale	0.604		
1940				95% t UCL (assumes normality of ROS data)	721.8			95% Percentile Bootstrap UCL	N/A		
1941				95% BCA Bootstrap UCL	N/A			95% Bootstrap t UCL	N/A		
1942				95% H-UCL (Log ROS)	738.4						
1943											
1944					Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution						
1945				KM Mean (logged)	5.945			KM Geo Mean	381.7		
1946				KM SD (logged)	0.64			95% Critical H Value (KM-Log)	2.432		
1947				KM Standard Error of Mean (logged)	0.333			95% H-UCL (KM -Log)	787.6		
1948				KM SD (logged)	0.64			95% Critical H Value (KM-Log)	2.432		
1949				KM Standard Error of Mean (logged)	0.333						
1950											
1951					DL/2 Statistics						
1952				DL/2 Normal				DL/2 Log-Transformed			
1953				Mean in Original Scale	513.5			Mean in Log Scale	5.963		
1954				SD in Original Scale	434.8			SD in Log Scale	0.788		
1955				95% t UCL (Assumes normality)	765.5			95% H-Stat UCL	1074		
1956					DL/2 is not a recommended method, provided for comparisons and historical reasons						
1957											
1958					Nonparametric Distribution Free UCL Statistics						
1959					Data do not follow a Discernible Distribution at 5% Significance Level						
1960											
1961					Suggested UCL to Use						

1962				95% KM (t) UCL	868.8					KM H-UCL	787.6
1963				95% KM (BCA) UCL	N/A						
1964	Warning: One or more Recommended UCL(s) not available!										
1965											
1966	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
1967	Recommendations are based upon data size, data distribution, and skewness.										
1968	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
1969	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
1970											
1971	Dibenzofuran										
1972											
1973	General Statistics										
1974				Total Number of Observations	10			Number of Distinct Observations	9		
1975				Number of Detects	3			Number of Non-Detects	7		
1976				Number of Distinct Detects	3			Number of Distinct Non-Detects	7		
1977				Minimum Detect	170			Minimum Non-Detect	260		
1978				Maximum Detect	730			Maximum Non-Detect	1100		
1979				Variance Detects	84033			Percent Non-Detects	70%		
1980				Mean Detects	406.7			SD Detects	289.9		
1981				Median Detects	320			CV Detects	0.713		
1982				Skewness Detects	1.225			Kurtosis Detects	N/A		
1983				Mean of Logged Detects	5.832			SD of Logged Detects	0.731		
1984											
1985	Warning: Data set has only 3 Detected Values.										
1986	This is not enough to compute meaningful or reliable statistics and estimates.										
1987											
1988											
1989	Normal GOF Test on Detects Only										
1990				Shapiro Wilk Test Statistic	0.933			Shapiro Wilk GOF Test			
1991				5% Shapiro Wilk Critical Value	0.767			Detected Data appear Normal at 5% Significance Level			
1992				Lilliefors Test Statistic	0.284			Lilliefors GOF Test			
1993				5% Lilliefors Critical Value	0.425			Detected Data appear Normal at 5% Significance Level			
1994	Detected Data appear Normal at 5% Significance Level										
1995											
1996	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
1997				KM Mean	294.6			KM Standard Error of Mean	102.8		
1998				KM SD	203.6			95% KM (BCA) UCL	N/A		
1999				95% KM (t) UCL	483.1			95% KM (Percentile Bootstrap) UCL	N/A		
2000				95% KM (z) UCL	463.8			95% KM Bootstrap t UCL	N/A		
2001				90% KM Chebyshev UCL	603.1			95% KM Chebyshev UCL	742.9		
2002				97.5% KM Chebyshev UCL	936.9			99% KM Chebyshev UCL	1318		
2003											
2004	Gamma GOF Tests on Detected Observations Only										
2005	Not Enough Data to Perform GOF Test										
2006											
2007	Gamma Statistics on Detected Data Only										
2008				k hat (MLE)	3.004			k star (bias corrected MLE)	N/A		
2009				Theta hat (MLE)	135.4			Theta star (bias corrected MLE)	N/A		
2010				nu hat (MLE)	18.02			nu star (bias corrected)	N/A		
2011				Mean (detects)	406.7						
2012											
2013	Gamma ROS Statistics using Imputed Non-Detects										
2014	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs										

2015	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)										
2016	For such situations, GROS method may yield incorrect values of UCLs and BTVs										
2017	This is especially true when the sample size is small.										
2018	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates										
2019					Minimum	126.2			Mean	260.4	
2020					Maximum	730			Median	236.4	
2021					SD	175.1			CV	0.673	
2022					k hat (MLE)	3.832			k star (bias corrected MLE)	2.749	
2023					Theta hat (MLE)	67.95			Theta star (bias corrected MLE)	94.72	
2024					nu hat (MLE)	76.65			nu star (bias corrected)	54.99	
2025					Adjusted Level of Significance (β)	0.0267					
2026					Approximate Chi Square Value (54.99, α)	38.95			Adjusted Chi Square Value (54.99, β)	36.61	
2027					95% Gamma Approximate UCL (use when n>=50)	367.7			95% Gamma Adjusted UCL (use when n<50)	N/A	
2028											
2029	Estimates of Gamma Parameters using KM Estimates										
2030					Mean (KM)	294.6			SD (KM)	203.6	
2031					Variance (KM)	41433			SE of Mean (KM)	102.8	
2032					k hat (KM)	2.094			k star (KM)	1.533	
2033					nu hat (KM)	41.89			nu star (KM)	30.66	
2034					theta hat (KM)	140.7			theta star (KM)	192.2	
2035					80% gamma percentile (KM)	454.7			90% gamma percentile (KM)	610.6	
2036					95% gamma percentile (KM)	761.8			99% gamma percentile (KM)	1103	
2037											
2038	Gamma Kaplan-Meier (KM) Statistics										
2039					Approximate Chi Square Value (30.66, α)	19.01			Adjusted Chi Square Value (30.66, β)	17.43	
2040					95% Gamma Approximate KM-UCL (use when n>=50)	475.1			95% Gamma Adjusted KM-UCL (use when n<50)	518.1	
2041											
2042	Lognormal GOF Test on Detected Observations Only										
2043					Shapiro Wilk Test Statistic	0.994			Shapiro Wilk GOF Test		
2044					5% Shapiro Wilk Critical Value	0.767			Detected Data appear Lognormal at 5% Significance Level		
2045					Lilliefors Test Statistic	0.202			Lilliefors GOF Test		
2046					5% Lilliefors Critical Value	0.425			Detected Data appear Lognormal at 5% Significance Level		
2047	Detected Data appear Lognormal at 5% Significance Level										
2048											
2049	Lognormal ROS Statistics Using Imputed Non-Detects										
2050					Mean in Original Scale	266.8			Mean in Log Scale	5.473	
2051					SD in Original Scale	169.7			SD in Log Scale	0.448	
2052					95% t UCL (assumes normality of ROS data)	365.1			95% Percentile Bootstrap UCL	360.3	
2053					95% BCA Bootstrap UCL	417			95% Bootstrap t UCL	596.3	
2054					95% H-UCL (Log ROS)	363.1					
2055											
2056	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										
2057					KM Mean (logged)	5.51			KM Geo Mean	247.3	
2058					KM SD (logged)	0.545			95% Critical H Value (KM-Log)	2.284	
2059					KM Standard Error of Mean (logged)	0.28			95% H-UCL (KM -Log)	434.3	
2060					KM SD (logged)	0.545			95% Critical H Value (KM-Log)	2.284	
2061					KM Standard Error of Mean (logged)	0.28					
2062											
2063	DL/2 Statistics										
2064					DL/2 Normal				DL/2 Log-Transformed		
2065					Mean in Original Scale	380			Mean in Log Scale	5.802	
2066					SD in Original Scale	192.7			SD in Log Scale	0.585	
2067					95% t UCL (Assumes normality)	491.7			95% H-Stat UCL	620.2	

2068	DL/2 is not a recommended method, provided for comparisons and historical reasons										
2069											
2070	Nonparametric Distribution Free UCL Statistics										
2071	Detected Data appear Normal Distributed at 5% Significance Level										
2072											
2073	Suggested UCL to Use										
2074	95% KM (t) UCL	483.1									
2075											
2076	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
2077	Recommendations are based upon data size, data distribution, and skewness.										
2078	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
2079	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
2080											
2081	DNBP										
2082											
2083	General Statistics										
2084	Total Number of Observations	10					Number of Distinct Observations	10			
2085	Number of Detects	1					Number of Non-Detects	9			
2086	Number of Distinct Detects	1					Number of Distinct Non-Detects	9			
2087											
2088	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!										
2089	s suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BT										
2090											
2091	The data set for variable DNBP was not processed!										
2092											
2093											
2094	Phenol										
2095											
2096	General Statistics										
2097	Total Number of Observations	10					Number of Distinct Observations	9			
2098	Number of Detects	1					Number of Non-Detects	9			
2099	Number of Distinct Detects	1					Number of Distinct Non-Detects	9			
2100											
2101	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!										
2102	s suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BT										
2103											
2104	The data set for variable Phenol was not processed!										
2105											
2106											
2107	PCB-1248										
2108											
2109	General Statistics										
2110	Total Number of Observations	10					Number of Distinct Observations	10			
2111	Number of Detects	4					Number of Non-Detects	6			
2112	Number of Distinct Detects	4					Number of Distinct Non-Detects	6			
2113	Minimum Detect	120					Minimum Non-Detect	43			
2114	Maximum Detect	1900					Maximum Non-Detect	110			
2115	Variance Detects	718833					Percent Non-Detects	60%			
2116	Mean Detects	635					SD Detects	847.8			
2117	Median Detects	260					CV Detects	1.335			
2118	Skewness Detects	1.937					Kurtosis Detects	3.782			
2119	Mean of Logged Detects	5.846					SD of Logged Detects	1.209			
2120											

	A	B	C	D	E	F	G	H	I	J	K	L
2121	Normal GOF Test on Detects Only											
2122					Shapiro Wilk Test Statistic	0.721	Shapiro Wilk GOF Test					
2123					5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level					
2124					Lilliefors Test Statistic	0.39	Lilliefors GOF Test					
2125					5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level					
2126	Detected Data Not Normal at 5% Significance Level											
2127												
2128	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
2129					KM Mean	279.8	KM Standard Error of Mean	199.9				
2130					KM SD	547.5	95% KM (BCA) UCL	N/A				
2131					95% KM (t) UCL	646.3	95% KM (Percentile Bootstrap) UCL	N/A				
2132					95% KM (z) UCL	608.6	95% KM Bootstrap t UCL	N/A				
2133					90% KM Chebyshev UCL	879.6	95% KM Chebyshev UCL	1151				
2134					97.5% KM Chebyshev UCL	1528	99% KM Chebyshev UCL	2269				
2135												
2136	Gamma GOF Tests on Detected Observations Only											
2137					A-D Test Statistic	0.489	Anderson-Darling GOF Test					
2138					5% A-D Critical Value	0.667	Detected data appear Gamma Distributed at 5% Significance Level					
2139					K-S Test Statistic	0.336	Kolmogorov-Smirnov GOF					
2140					5% K-S Critical Value	0.403	Detected data appear Gamma Distributed at 5% Significance Level					
2141	Detected data appear Gamma Distributed at 5% Significance Level											
2142												
2143	Gamma Statistics on Detected Data Only											
2144					k hat (MLE)	0.955	k star (bias corrected MLE)	0.405				
2145					Theta hat (MLE)	665	Theta star (bias corrected MLE)	1566				
2146					nu hat (MLE)	7.639	nu star (bias corrected)	3.243				
2147					Mean (detects)	635						
2148												
2149	Gamma ROS Statistics using Imputed Non-Detects											
2150	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
2151	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
2152	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
2153	This is especially true when the sample size is small.											
2154	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
2155					Minimum	0.01	Mean	254				
2156					Maximum	1900	Median	0.01				
2157					SD	589.2	CV	2.32				
2158					k hat (MLE)	0.131	k star (bias corrected MLE)	0.159				
2159					Theta hat (MLE)	1934	Theta star (bias corrected MLE)	1601				
2160					nu hat (MLE)	2.627	nu star (bias corrected)	3.172				
2161					Adjusted Level of Significance (β)	0.0267						
2162					Approximate Chi Square Value (3.17, α)	0.425	Adjusted Chi Square Value (3.17, β)	0.293				
2163					95% Gamma Approximate UCL (use when n>=50)	1895	95% Gamma Adjusted UCL (use when n<50)	N/A				
2164												
2165	Estimates of Gamma Parameters using KM Estimates											
2166					Mean (KM)	279.8	SD (KM)	547.5				
2167					Variance (KM)	299761	SE of Mean (KM)	199.9				
2168					k hat (KM)	0.261	k star (KM)	0.249				
2169					nu hat (KM)	5.223	nu star (KM)	4.99				
2170					theta hat (KM)	1071	theta star (KM)	1122				
2171					80% gamma percentile (KM)	406.1	90% gamma percentile (KM)	840				
2172					95% gamma percentile (KM)	1355	99% gamma percentile (KM)	2727				
2173												

	A	B	C	D	E	F	G	H	I	J	K	L
2174	Gamma Kaplan-Meier (KM) Statistics											
2175	Approximate Chi Square Value (4.99, α)					1.147	Adjusted Chi Square Value (4.99, β)					0.863
2176	95% Gamma Approximate KM-UCL (use when n>=50)					1217	95% Gamma Adjusted KM-UCL (use when n<50)					1618
2177												
2178	Lognormal GOF Test on Detected Observations Only											
2179	Shapiro Wilk Test Statistic					0.904	Shapiro Wilk GOF Test					
2180	5% Shapiro Wilk Critical Value					0.748	Detected Data appear Lognormal at 5% Significance Level					
2181	Lilliefors Test Statistic					0.265	Lilliefors GOF Test					
2182	5% Lilliefors Critical Value					0.375	Detected Data appear Lognormal at 5% Significance Level					
2183	Detected Data appear Lognormal at 5% Significance Level											
2184												
2185	Lognormal ROS Statistics Using Imputed Non-Detects											
2186	Mean in Original Scale					257.3	Mean in Log Scale					3.355
2187	SD in Original Scale					587.6	SD in Log Scale					2.255
2188	95% t UCL (assumes normality of ROS data)					597.9	95% Percentile Bootstrap UCL					610.7
2189	95% BCA Bootstrap UCL					795.7	95% Bootstrap t UCL					2258
2190	95% H-UCL (Log ROS)					33429						
2191												
2192	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
2193	KM Mean (logged)					4.595	KM Geo Mean					98.99
2194	KM SD (logged)					1.217	95% Critical H Value (KM-Log)					3.566
2195	KM Standard Error of Mean (logged)					0.444	95% H-UCL (KM -Log)					882.1
2196	KM SD (logged)					1.217	95% Critical H Value (KM-Log)					3.566
2197	KM Standard Error of Mean (logged)					0.444						
2198												
2199	DL/2 Statistics											
2200	DL/2 Normal						DL/2 Log-Transformed					
2201	Mean in Original Scale					279.1	Mean in Log Scale					4.551
2202	SD in Original Scale					577.5	SD in Log Scale					1.339
2203	95% t UCL (Assumes normality)					613.8	95% H-Stat UCL					1287
2204	DL/2 is not a recommended method, provided for comparisons and historical reasons											
2205												
2206	Nonparametric Distribution Free UCL Statistics											
2207	Detected Data appear Gamma Distributed at 5% Significance Level											
2208												
2209	Suggested UCL to Use											
2210	95% KM Bootstrap t UCL					N/A	95% Hall's Bootstrap					882.1
2211												
2212	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
2213	Recommendations are based upon data size, data distribution, and skewness.											
2214	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
2215	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
2216												
2217	PCB-1254											
2218												
2219	General Statistics											
2220	Total Number of Observations					10	Number of Distinct Observations					10
2221	Number of Detects					1	Number of Non-Detects					9
2222	Number of Distinct Detects					1	Number of Distinct Non-Detects					9
2223												
2224	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
2225	s suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BT											
2226												

	A	B	C	D	E	F	G	H	I	J	K	L
2227	The data set for variable PCB-1254 was not processed!											
2228												
2229												
2230	T-PCBs											
2231												
2232	General Statistics											
2233					Total Number of Observations	10			Number of Distinct Observations	10		
2234					Number of Detects	5			Number of Non-Detects	5		
2235					Number of Distinct Detects	5			Number of Distinct Non-Detects	5		
2236					Minimum Detect	286			Minimum Non-Detect	249		
2237					Maximum Detect	6400			Maximum Non-Detect	385		
2238					Variance Detects	7034203			Percent Non-Detects	50%		
2239					Mean Detects	1662			SD Detects	2652		
2240					Median Detects	510			CV Detects	1.596		
2241					Skewness Detects	2.222			Kurtosis Detects	4.95		
2242					Mean of Logged Detects	6.652			SD of Logged Detects	1.219		
2243												
2244	Normal GOF Test on Detects Only											
2245					Shapiro Wilk Test Statistic	0.601			Shapiro Wilk GOF Test			
2246					5% Shapiro Wilk Critical Value	0.762			Detected Data Not Normal at 5% Significance Level			
2247					Lilliefors Test Statistic	0.447			Lilliefors GOF Test			
2248					5% Lilliefors Critical Value	0.343			Detected Data Not Normal at 5% Significance Level			
2249	Detected Data Not Normal at 5% Significance Level											
2250												
2251	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
2252					KM Mean	962.7			KM Standard Error of Mean	642.5		
2253					KM SD	1817			95% KM (BCA) UCL	2198		
2254					95% KM (t) UCL	2141			95% KM (Percentile Bootstrap) UCL	2143		
2255					95% KM (z) UCL	2020			95% KM Bootstrap t UCL	11113		
2256					90% KM Chebyshev UCL	2890			95% KM Chebyshev UCL	3763		
2257					97.5% KM Chebyshev UCL	4975			99% KM Chebyshev UCL	7356		
2258												
2259	Gamma GOF Tests on Detected Observations Only											
2260					A-D Test Statistic	0.883			Anderson-Darling GOF Test			
2261					5% A-D Critical Value	0.697			Detected Data Not Gamma Distributed at 5% Significance Level			
2262					K-S Test Statistic	0.421			Kolmogorov-Smirnov GOF			
2263					5% K-S Critical Value	0.366			Detected Data Not Gamma Distributed at 5% Significance Level			
2264	Detected Data Not Gamma Distributed at 5% Significance Level											
2265												
2266	Gamma Statistics on Detected Data Only											
2267					k hat (MLE)	0.78			k star (bias corrected MLE)	0.445		
2268					Theta hat (MLE)	2130			Theta star (bias corrected MLE)	3731		
2269					nu hat (MLE)	7.801			nu star (bias corrected)	4.454		
2270					Mean (detects)	1662						
2271												
2272	Gamma ROS Statistics using Imputed Non-Detects											
2273	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
2274	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
2275	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
2276	This is especially true when the sample size is small.											
2277	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
2278					Minimum	0.01			Mean	830.8		
2279					Maximum	6400			Median	143		

2280					SD	1973				CV	2.375
2281					k hat (MLE)	0.137				k star (bias corrected MLE)	0.162
2282					Theta hat (MLE)	6079				Theta star (bias corrected MLE)	5118
2283					nu hat (MLE)	2.734				nu star (bias corrected)	3.247
2284					Adjusted Level of Significance (β)	0.0267					
2285					Approximate Chi Square Value (3.25, α)	0.449				Adjusted Chi Square Value (3.25, β)	0.311
2286					95% Gamma Approximate UCL (use when n>=50)	6006				95% Gamma Adjusted UCL (use when n<50)	8685
2287											
2288						Estimates of Gamma Parameters using KM Estimates						
2289					Mean (KM)	962.7				SD (KM)	1817
2290					Variance (KM)	3302307				SE of Mean (KM)	642.5
2291					k hat (KM)	0.281				k star (KM)	0.263
2292					nu hat (KM)	5.613				nu star (KM)	5.262
2293					theta hat (KM)	3430				theta star (KM)	3659
2294					80% gamma percentile (KM)	1423				90% gamma percentile (KM)	2878
2295					95% gamma percentile (KM)	4589				99% gamma percentile (KM)	9110
2296											
2297						Gamma Kaplan-Meier (KM) Statistics						
2298					Approximate Chi Square Value (5.26, α)	1.275				Adjusted Chi Square Value (5.26, β)	0.969
2299					95% Gamma Approximate KM-UCL (use when n>=50)	3972				95% Gamma Adjusted KM-UCL (use when n<50)	5228
2300											
2301						Lognormal GOF Test on Detected Observations Only						
2302					Shapiro Wilk Test Statistic	0.783				Shapiro Wilk GOF Test	
2303					5% Shapiro Wilk Critical Value	0.762				Detected Data appear Lognormal at 5% Significance Level	
2304					Lilliefors Test Statistic	0.353				Lilliefors GOF Test	
2305					5% Lilliefors Critical Value	0.343				Detected Data Not Lognormal at 5% Significance Level	
2306						Detected Data appear Approximate Lognormal at 5% Significance Level					
2307											
2308						Lognormal ROS Statistics Using Imputed Non-Detects					
2309					Mean in Original Scale	868.7				Mean in Log Scale	5.462
2310					SD in Original Scale	1956				SD in Log Scale	1.52
2311					95% t UCL (assumes normality of ROS data)	2002				95% Percentile Bootstrap UCL	2069
2312					95% BCA Bootstrap UCL	2695				95% Bootstrap t UCL	8416
2313					95% H-UCL (Log ROS)	6458					
2314											
2315						Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution					
2316					KM Mean (logged)	6.113				KM Geo Mean	451.5
2317					KM SD (logged)	0.942				95% Critical H Value (KM-Log)	2.986
2318					KM Standard Error of Mean (logged)	0.334				95% H-UCL (KM -Log)	1797
2319					KM SD (logged)	0.942				95% Critical H Value (KM-Log)	2.986
2320					KM Standard Error of Mean (logged)	0.334					
2321											
2322						DL/2 Statistics					
2323					DL/2 Normal					DL/2 Log-Transformed	
2324					Mean in Original Scale	911				Mean in Log Scale	5.859
2325					SD in Original Scale	1937				SD in Log Scale	1.171
2326					95% t UCL (Assumes normality)	2034				95% H-Stat UCL	2692
2327						DL/2 is not a recommended method, provided for comparisons and historical reasons					
2328											
2329						Nonparametric Distribution Free UCL Statistics					
2330						Detected Data appear Approximate Lognormal Distributed at 5% Significance Level					
2331											
2332						Suggested UCL to Use					

2333				95% KM (Chebyshev) UCL	3763						
2334											
2335	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
2336	Recommendations are based upon data size, data distribution, and skewness.										
2337	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
2338	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
2339											
2340											
2341	Barium										
2342											
2343	General Statistics										
2344				Total Number of Observations	10			Number of Distinct Observations	9		
2345								Number of Missing Observations	0		
2346				Minimum	74			Mean	537.3		
2347				Maximum	2400			Median	245		
2348				SD	720.7			Std. Error of Mean	227.9		
2349				Coefficient of Variation	1.341			Skewness	2.336		
2350											
2351	Normal GOF Test										
2352				Shapiro Wilk Test Statistic	0.668			Shapiro Wilk GOF Test			
2353				5% Shapiro Wilk Critical Value	0.842			Data Not Normal at 5% Significance Level			
2354				Lilliefors Test Statistic	0.31			Lilliefors GOF Test			
2355				5% Lilliefors Critical Value	0.262			Data Not Normal at 5% Significance Level			
2356	Data Not Normal at 5% Significance Level										
2357											
2358	Assuming Normal Distribution										
2359				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
2360				95% Student's-t UCL	955.1			95% Adjusted-CLT UCL (Chen-1995)	1092		
2361								95% Modified-t UCL (Johnson-1978)	983.1		
2362											
2363	Gamma GOF Test										
2364				A-D Test Statistic	0.581			Anderson-Darling Gamma GOF Test			
2365				5% A-D Critical Value	0.749			Detected data appear Gamma Distributed at 5% Significance Level			
2366				K-S Test Statistic	0.213			Kolmogorov-Smirnov Gamma GOF Test			
2367				5% K-S Critical Value	0.274			Detected data appear Gamma Distributed at 5% Significance Level			
2368	Detected data appear Gamma Distributed at 5% Significance Level										
2369											
2370	Gamma Statistics										
2371				k hat (MLE)	0.984			k star (bias corrected MLE)	0.756		
2372				Theta hat (MLE)	546			Theta star (bias corrected MLE)	711.1		
2373				nu hat (MLE)	19.68			nu star (bias corrected)	15.11		
2374				MLE Mean (bias corrected)	537.3			MLE Sd (bias corrected)	618.1		
2375								Approximate Chi Square Value (0.05)	7.339		
2376				Adjusted Level of Significance	0.0267			Adjusted Chi Square Value	6.42		
2377											
2378	Assuming Gamma Distribution										
2379				95% Approximate Gamma UCL (use when n>=50)	1106			95% Adjusted Gamma UCL (use when n<50)	1265		
2380											
2381	Lognormal GOF Test										
2382				Shapiro Wilk Test Statistic	0.949			Shapiro Wilk Lognormal GOF Test			
2383				5% Shapiro Wilk Critical Value	0.842			Data appear Lognormal at 5% Significance Level			
2384				Lilliefors Test Statistic	0.151			Lilliefors Lognormal GOF Test			
2385				5% Lilliefors Critical Value	0.262			Data appear Lognormal at 5% Significance Level			

2386	Data appear Lognormal at 5% Significance Level										
2387											
2388	Lognormal Statistics										
2389					Minimum of Logged Data	4.304			Mean of logged Data	5.699	
2390					Maximum of Logged Data	7.783			SD of logged Data	1.081	
2391											
2392	Assuming Lognormal Distribution										
2393					95% H-UCL	1741			90% Chebyshev (MVUE) UCL	1027	
2394					95% Chebyshev (MVUE) UCL	1268			97.5% Chebyshev (MVUE) UCL	1603	
2395					99% Chebyshev (MVUE) UCL	2261					
2396											
2397	Nonparametric Distribution Free UCL Statistics										
2398	Data appear to follow a Discernible Distribution at 5% Significance Level										
2399											
2400	Nonparametric Distribution Free UCLs										
2401					95% CLT UCL	912.2			95% Jackknife UCL	955.1	
2402					95% Standard Bootstrap UCL	901			95% Bootstrap-t UCL	2120	
2403					95% Hall's Bootstrap UCL	2539			95% Percentile Bootstrap UCL	948.9	
2404					95% BCA Bootstrap UCL	1136					
2405					90% Chebyshev(Mean, Sd) UCL	1221			95% Chebyshev(Mean, Sd) UCL	1531	
2406					97.5% Chebyshev(Mean, Sd) UCL	1961			99% Chebyshev(Mean, Sd) UCL	2805	
2407											
2408	Suggested UCL to Use										
2409					95% Adjusted Gamma UCL	1265					
2410											
2411	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
2412	Recommendations are based upon data size, data distribution, and skewness.										
2413	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
2414	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
2415											
2416											
2417	Chromium										
2418											
2419	General Statistics										
2420					Total Number of Observations	10			Number of Distinct Observations	10	
2421									Number of Missing Observations	0	
2422					Minimum	11			Mean	49.6	
2423					Maximum	130			Median	42	
2424					SD	31.34			Std. Error of Mean	9.911	
2425					Coefficient of Variation	0.632			Skewness	2.053	
2426											
2427	Normal GOF Test										
2428					Shapiro Wilk Test Statistic	0.777			Shapiro Wilk GOF Test		
2429					5% Shapiro Wilk Critical Value	0.842			Data Not Normal at 5% Significance Level		
2430					Lilliefors Test Statistic	0.269			Lilliefors GOF Test		
2431					5% Lilliefors Critical Value	0.262			Data Not Normal at 5% Significance Level		
2432	Data Not Normal at 5% Significance Level										
2433											
2434	Assuming Normal Distribution										
2435					95% Normal UCL				95% UCLs (Adjusted for Skewness)		
2436					95% Student's-t UCL	67.77			95% Adjusted-CLT UCL (Chen-1995)	72.78	
2437									95% Modified-t UCL (Johnson-1978)	68.84	
2438											

	A	B	C	D	E	F	G	H	I	J	K	L
2439	Gamma GOF Test											
2440					A-D Test Statistic	0.592	Anderson-Darling Gamma GOF Test					
2441					5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level					
2442					K-S Test Statistic	0.193	Kolmogorov-Smirnov Gamma GOF Test					
2443					5% K-S Critical Value	0.268	Detected data appear Gamma Distributed at 5% Significance Level					
2444	Detected data appear Gamma Distributed at 5% Significance Level											
2445												
2446	Gamma Statistics											
2447					k hat (MLE)	3.294	k star (bias corrected MLE)	2.373				
2448					Theta hat (MLE)	15.06	Theta star (bias corrected MLE)	20.91				
2449					nu hat (MLE)	65.88	nu star (bias corrected)	47.45				
2450					MLE Mean (bias corrected)	49.6	MLE Sd (bias corrected)	32.2				
2451							Approximate Chi Square Value (0.05)	32.64				
2452					Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	30.52				
2453												
2454	Assuming Gamma Distribution											
2455					95% Approximate Gamma UCL (use when n>=50)	72.1	95% Adjusted Gamma UCL (use when n<50)	77.11				
2456												
2457	Lognormal GOF Test											
2458					Shapiro Wilk Test Statistic	0.892	Shapiro Wilk Lognormal GOF Test					
2459					5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level					
2460					Lilliefors Test Statistic	0.225	Lilliefors Lognormal GOF Test					
2461					5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level					
2462	Data appear Lognormal at 5% Significance Level											
2463												
2464	Lognormal Statistics											
2465					Minimum of Logged Data	2.398	Mean of logged Data	3.745				
2466					Maximum of Logged Data	4.868	SD of logged Data	0.614				
2467												
2468	Assuming Lognormal Distribution											
2469					95% H-UCL	83.32	90% Chebyshev (MVUE) UCL	79.86				
2470					95% Chebyshev (MVUE) UCL	93.39	97.5% Chebyshev (MVUE) UCL	112.2				
2471					99% Chebyshev (MVUE) UCL	149						
2472												
2473	Nonparametric Distribution Free UCL Statistics											
2474	Data appear to follow a Discernible Distribution at 5% Significance Level											
2475												
2476	Nonparametric Distribution Free UCLs											
2477					95% CLT UCL	65.9	95% Jackknife UCL	67.77				
2478					95% Standard Bootstrap UCL	65.12	95% Bootstrap-t UCL	83.92				
2479					95% Hall's Bootstrap UCL	151.9	95% Percentile Bootstrap UCL	66.9				
2480					95% BCA Bootstrap UCL	70.5						
2481					90% Chebyshev(Mean, Sd) UCL	79.33	95% Chebyshev(Mean, Sd) UCL	92.8				
2482					97.5% Chebyshev(Mean, Sd) UCL	111.5	99% Chebyshev(Mean, Sd) UCL	148.2				
2483												
2484	Suggested UCL to Use											
2485					95% Adjusted Gamma UCL	77.11						
2486												
2487	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
2488	Recommendations are based upon data size, data distribution, and skewness.											
2489	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
2490	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
2491												

2492											
2493	Copper										
2494											
2495					General Statistics						
2496				Total Number of Observations	10			Number of Distinct Observations	10		
2497								Number of Missing Observations	0		
2498				Minimum	10			Mean	115		
2499				Maximum	320			Median	94		
2500				SD	86.9			Std. Error of Mean	27.48		
2501				Coefficient of Variation	0.756			Skewness	1.57		
2502											
2503					Normal GOF Test						
2504				Shapiro Wilk Test Statistic	0.868			Shapiro Wilk GOF Test			
2505				5% Shapiro Wilk Critical Value	0.842			Data appear Normal at 5% Significance Level			
2506				Lilliefors Test Statistic	0.231			Lilliefors GOF Test			
2507				5% Lilliefors Critical Value	0.262			Data appear Normal at 5% Significance Level			
2508					Data appear Normal at 5% Significance Level						
2509											
2510					Assuming Normal Distribution						
2511				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
2512				95% Student's-t UCL	165.4			95% Adjusted-CLT UCL (Chen-1995)	174.8		
2513								95% Modified-t UCL (Johnson-1978)	167.6		
2514											
2515					Gamma GOF Test						
2516				A-D Test Statistic	0.283			Anderson-Darling Gamma GOF Test			
2517				5% A-D Critical Value	0.737			Detected data appear Gamma Distributed at 5% Significance Level			
2518				K-S Test Statistic	0.17			Kolmogorov-Smirnov Gamma GOF Test			
2519				5% K-S Critical Value	0.27			Detected data appear Gamma Distributed at 5% Significance Level			
2520					Detected data appear Gamma Distributed at 5% Significance Level						
2521											
2522					Gamma Statistics						
2523				k hat (MLE)	1.842			k star (bias corrected MLE)	1.356		
2524				Theta hat (MLE)	62.42			Theta star (bias corrected MLE)	84.79		
2525				nu hat (MLE)	36.85			nu star (bias corrected)	27.13		
2526				MLE Mean (bias corrected)	115			MLE Sd (bias corrected)	98.74		
2527								Approximate Chi Square Value (0.05)	16.25		
2528				Adjusted Level of Significance	0.0267			Adjusted Chi Square Value	14.8		
2529											
2530					Assuming Gamma Distribution						
2531				95% Approximate Gamma UCL (use when n>=50))	192			95% Adjusted Gamma UCL (use when n<50)	210.7		
2532											
2533					Lognormal GOF Test						
2534				Shapiro Wilk Test Statistic	0.899			Shapiro Wilk Lognormal GOF Test			
2535				5% Shapiro Wilk Critical Value	0.842			Data appear Lognormal at 5% Significance Level			
2536				Lilliefors Test Statistic	0.223			Lilliefors Lognormal GOF Test			
2537				5% Lilliefors Critical Value	0.262			Data appear Lognormal at 5% Significance Level			
2538					Data appear Lognormal at 5% Significance Level						
2539											
2540					Lognormal Statistics						
2541				Minimum of Logged Data	2.303			Mean of logged Data	4.45		
2542				Maximum of Logged Data	5.768			SD of logged Data	0.922		
2543											
2544					Assuming Lognormal Distribution						

2545				95% H-UCL	323.4			90% Chebyshev (MVUE) UCL		237.1	
2546				95% Chebyshev (MVUE) UCL	288.3			97.5% Chebyshev (MVUE) UCL		359.5	
2547				99% Chebyshev (MVUE) UCL	499.2						
2548											
2549				Nonparametric Distribution Free UCL Statistics							
2550				Data appear to follow a Discernible Distribution at 5% Significance Level							
2551											
2552				Nonparametric Distribution Free UCLs							
2553				95% CLT UCL	160.2			95% Jackknife UCL		165.4	
2554				95% Standard Bootstrap UCL	157.1			95% Bootstrap-t UCL		206.8	
2555				95% Hall's Bootstrap UCL	437			95% Percentile Bootstrap UCL		164.7	
2556				95% BCA Bootstrap UCL	175.1						
2557				90% Chebyshev(Mean, Sd) UCL	197.4			95% Chebyshev(Mean, Sd) UCL		234.8	
2558				97.5% Chebyshev(Mean, Sd) UCL	286.6			99% Chebyshev(Mean, Sd) UCL		388.4	
2559											
2560				Suggested UCL to Use							
2561				95% Student's-t UCL	165.4						
2562											
2563				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
2564				Recommendations are based upon data size, data distribution, and skewness.							
2565				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
2566				However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
2567											
2568											
2569	Lead										
2570											
2571				General Statistics							
2572				Total Number of Observations	10			Number of Distinct Observations		10	
2573								Number of Missing Observations		0	
2574				Minimum	21			Mean		64.2	
2575				Maximum	140			Median		59.5	
2576				SD	33.38			Std. Error of Mean		10.55	
2577				Coefficient of Variation	0.52			Skewness		1.193	
2578											
2579				Normal GOF Test							
2580				Shapiro Wilk Test Statistic	0.912			Shapiro Wilk GOF Test			
2581				5% Shapiro Wilk Critical Value	0.842			Data appear Normal at 5% Significance Level			
2582				Lilliefors Test Statistic	0.207			Lilliefors GOF Test			
2583				5% Lilliefors Critical Value	0.262			Data appear Normal at 5% Significance Level			
2584				Data appear Normal at 5% Significance Level							
2585											
2586				Assuming Normal Distribution							
2587				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
2588				95% Student's-t UCL	83.55			95% Adjusted-CLT UCL (Chen-1995)		85.82	
2589								95% Modified-t UCL (Johnson-1978)		84.21	
2590											
2591				Gamma GOF Test							
2592				A-D Test Statistic	0.204			Anderson-Darling Gamma GOF Test			
2593				5% A-D Critical Value	0.729			Detected data appear Gamma Distributed at 5% Significance Level			
2594				K-S Test Statistic	0.155			Kolmogorov-Smirnov Gamma GOF Test			
2595				5% K-S Critical Value	0.268			Detected data appear Gamma Distributed at 5% Significance Level			
2596				Detected data appear Gamma Distributed at 5% Significance Level							
2597											

	A	B	C	D	E	F	G	H	I	J	K	L
2598	Gamma Statistics											
2599					k hat (MLE)	4.272			k star (bias corrected MLE)			3.057
2600					Theta hat (MLE)	15.03			Theta star (bias corrected MLE)			21
2601					nu hat (MLE)	85.45			nu star (bias corrected)			61.15
2602					MLE Mean (bias corrected)	64.2			MLE Sd (bias corrected)			36.72
2603									Approximate Chi Square Value (0.05)			44.16
2604					Adjusted Level of Significance	0.0267			Adjusted Chi Square Value			41.66
2605												
2606	Assuming Gamma Distribution											
2607			95% Approximate Gamma UCL (use when n>=50))			88.89			95% Adjusted Gamma UCL (use when n<50)			94.22
2608												
2609	Lognormal GOF Test											
2610					Shapiro Wilk Test Statistic	0.974			Shapiro Wilk Lognormal GOF Test			
2611					5% Shapiro Wilk Critical Value	0.842			Data appear Lognormal at 5% Significance Level			
2612					Lilliefors Test Statistic	0.153			Lilliefors Lognormal GOF Test			
2613					5% Lilliefors Critical Value	0.262			Data appear Lognormal at 5% Significance Level			
2614	Data appear Lognormal at 5% Significance Level											
2615												
2616	Lognormal Statistics											
2617					Minimum of Logged Data	3.045			Mean of logged Data			4.04
2618					Maximum of Logged Data	4.942			SD of logged Data			0.533
2619												
2620	Assuming Lognormal Distribution											
2621					95% H-UCL	98.03			90% Chebyshev (MVUE) UCL			97.78
2622					95% Chebyshev (MVUE) UCL	112.9			97.5% Chebyshev (MVUE) UCL			133.8
2623					99% Chebyshev (MVUE) UCL	174.9						
2624												
2625	Nonparametric Distribution Free UCL Statistics											
2626	Data appear to follow a Discernible Distribution at 5% Significance Level											
2627												
2628	Nonparametric Distribution Free UCLs											
2629					95% CLT UCL	81.56			95% Jackknife UCL			83.55
2630					95% Standard Bootstrap UCL	80.94			95% Bootstrap-t UCL			89.21
2631					95% Hall's Bootstrap UCL	102.6			95% Percentile Bootstrap UCL			81.9
2632					95% BCA Bootstrap UCL	84.2						
2633					90% Chebyshev(Mean, Sd) UCL	95.86			95% Chebyshev(Mean, Sd) UCL			110.2
2634					97.5% Chebyshev(Mean, Sd) UCL	130.1			99% Chebyshev(Mean, Sd) UCL			169.2
2635												
2636	Suggested UCL to Use											
2637					95% Student's-t UCL	83.55						
2638												
2639	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
2640	Recommendations are based upon data size, data distribution, and skewness.											
2641	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
2642	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
2643												
2644												
2645	Nickel											
2646												
2647	General Statistics											
2648					Total Number of Observations	10			Number of Distinct Observations			8
2649									Number of Missing Observations			0
2650					Minimum	7.1			Mean			32.91

2651				Maximum	75			Median	32.5		
2652				SD	17.79			Std. Error of Mean	5.627		
2653				Coefficient of Variation	0.541			Skewness	1.346		
2654											
2655				Normal GOF Test							
2656				Shapiro Wilk Test Statistic	0.87			Shapiro Wilk GOF Test			
2657				5% Shapiro Wilk Critical Value	0.842			Data appear Normal at 5% Significance Level			
2658				Lilliefors Test Statistic	0.266			Lilliefors GOF Test			
2659				5% Lilliefors Critical Value	0.262			Data Not Normal at 5% Significance Level			
2660				Data appear Approximate Normal at 5% Significance Level							
2661											
2662				Assuming Normal Distribution							
2663				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
2664				95% Student's-t UCL	43.23			95% Adjusted-CLT UCL (Chen-1995)	44.72		
2665								95% Modified-t UCL (Johnson-1978)	43.62		
2666											
2667				Gamma GOF Test							
2668				A-D Test Statistic	0.465			Anderson-Darling Gamma GOF Test			
2669				5% A-D Critical Value	0.73			Detected data appear Gamma Distributed at 5% Significance Level			
2670				K-S Test Statistic	0.206			Kolmogorov-Smirnov Gamma GOF Test			
2671				5% K-S Critical Value	0.268			Detected data appear Gamma Distributed at 5% Significance Level			
2672				Detected data appear Gamma Distributed at 5% Significance Level							
2673											
2674				Gamma Statistics							
2675				k hat (MLE)	3.652			k star (bias corrected MLE)	2.623		
2676				Theta hat (MLE)	9.01			Theta star (bias corrected MLE)	12.54		
2677				nu hat (MLE)	73.05			nu star (bias corrected)	52.47		
2678				MLE Mean (bias corrected)	32.91			MLE Sd (bias corrected)	20.32		
2679								Approximate Chi Square Value (0.05)	36.83		
2680				Adjusted Level of Significance	0.0267			Adjusted Chi Square Value	34.56		
2681											
2682				Assuming Gamma Distribution							
2683				95% Approximate Gamma UCL (use when n>=50))	46.88			95% Adjusted Gamma UCL (use when n<50)	49.96		
2684											
2685				Lognormal GOF Test							
2686				Shapiro Wilk Test Statistic	0.886			Shapiro Wilk Lognormal GOF Test			
2687				5% Shapiro Wilk Critical Value	0.842			Data appear Lognormal at 5% Significance Level			
2688				Lilliefors Test Statistic	0.235			Lilliefors Lognormal GOF Test			
2689				5% Lilliefors Critical Value	0.262			Data appear Lognormal at 5% Significance Level			
2690				Data appear Lognormal at 5% Significance Level							
2691											
2692				Lognormal Statistics							
2693				Minimum of Logged Data	1.96			Mean of logged Data	3.351		
2694				Maximum of Logged Data	4.317			SD of logged Data	0.608		
2695											
2696				Assuming Lognormal Distribution							
2697				95% H-UCL	55.55			90% Chebyshev (MVUE) UCL	53.44		
2698				95% Chebyshev (MVUE) UCL	62.43			97.5% Chebyshev (MVUE) UCL	74.91		
2699				99% Chebyshev (MVUE) UCL	99.42						
2700											
2701				Nonparametric Distribution Free UCL Statistics							
2702				Data appear to follow a Discernible Distribution at 5% Significance Level							
2703											

2704	Nonparametric Distribution Free UCLs										
2705				95% CLT UCL	42.17			95% Jackknife UCL	43.23		
2706				95% Standard Bootstrap UCL	41.66			95% Bootstrap-t UCL	46.47		
2707				95% Hall's Bootstrap UCL	95.29			95% Percentile Bootstrap UCL	42.01		
2708				95% BCA Bootstrap UCL	44.3						
2709				90% Chebyshev(Mean, Sd) UCL	49.79			95% Chebyshev(Mean, Sd) UCL	57.44		
2710				97.5% Chebyshev(Mean, Sd) UCL	68.05			99% Chebyshev(Mean, Sd) UCL	88.9		
2711											
2712	Suggested UCL to Use										
2713				95% Student's-t UCL	43.23						
2714											
2715	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test										
2716	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL										
2717											
2718	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
2719	Recommendations are based upon data size, data distribution, and skewness.										
2720	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
2721	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
2722											
2723	Selenium										
2724											
2725	General Statistics										
2726				Total Number of Observations	10			Number of Distinct Observations	10		
2727				Number of Detects	9			Number of Non-Detects	1		
2728				Number of Distinct Detects	9			Number of Distinct Non-Detects	1		
2729				Minimum Detect	0.77			Minimum Non-Detect	6.1		
2730				Maximum Detect	3.5			Maximum Non-Detect	6.1		
2731				Variance Detects	0.816			Percent Non-Detects	10%		
2732				Mean Detects	2.086			SD Detects	0.903		
2733				Median Detects	2			CV Detects	0.433		
2734				Skewness Detects	0.237			Kurtosis Detects	-0.815		
2735				Mean of Logged Detects	0.64			SD of Logged Detects	0.484		
2736											
2737	Normal GOF Test on Detects Only										
2738				Shapiro Wilk Test Statistic	0.973			Shapiro Wilk GOF Test			
2739				5% Shapiro Wilk Critical Value	0.829			Detected Data appear Normal at 5% Significance Level			
2740				Lilliefors Test Statistic	0.114			Lilliefors GOF Test			
2741				5% Lilliefors Critical Value	0.274			Detected Data appear Normal at 5% Significance Level			
2742	Detected Data appear Normal at 5% Significance Level										
2743											
2744	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
2745				KM Mean	2.086			KM Standard Error of Mean	0.301		
2746				KM SD	0.852			95% KM (BCA) UCL	2.544		
2747				95% KM (t) UCL	2.637			95% KM (Percentile Bootstrap) UCL	2.56		
2748				95% KM (z) UCL	2.581			95% KM Bootstrap t UCL	2.694		
2749				90% KM Chebyshev UCL	2.989			95% KM Chebyshev UCL	3.398		
2750				97.5% KM Chebyshev UCL	3.966			99% KM Chebyshev UCL	5.081		
2751											
2752	Gamma GOF Tests on Detected Observations Only										
2753				A-D Test Statistic	0.153			Anderson-Darling GOF Test			
2754				5% A-D Critical Value	0.723			Detected data appear Gamma Distributed at 5% Significance Level			
2755				K-S Test Statistic	0.128			Kolmogorov-Smirnov GOF			
2756				5% K-S Critical Value	0.28			Detected data appear Gamma Distributed at 5% Significance Level			

2757	Detected data appear Gamma Distributed at 5% Significance Level										
2758											
2759	Gamma Statistics on Detected Data Only										
2760						k hat (MLE)	5.409			k star (bias corrected MLE)	3.68
2761						Theta hat (MLE)	0.386			Theta star (bias corrected MLE)	0.567
2762						nu hat (MLE)	97.37			nu star (bias corrected)	66.24
2763						Mean (detects)	2.086				
2764											
2765	Gamma ROS Statistics using Imputed Non-Detects										
2766	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs										
2767	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)										
2768	For such situations, GROS method may yield incorrect values of UCLs and BTVs										
2769	This is especially true when the sample size is small.										
2770	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates										
2771						Minimum	0.77			Mean	2.076
2772						Maximum	3.5			Median	1.995
2773						SD	0.852			CV	0.41
2774						k hat (MLE)	5.986			k star (bias corrected MLE)	4.257
2775						Theta hat (MLE)	0.347			Theta star (bias corrected MLE)	0.488
2776						nu hat (MLE)	119.7			nu star (bias corrected)	85.14
2777						Adjusted Level of Significance (β)	0.0267				
2778						Approximate Chi Square Value (85.14, α)	64.87			Adjusted Chi Square Value (85.14, β)	61.81
2779						95% Gamma Approximate UCL (use when n>=50)	2.725			95% Gamma Adjusted UCL (use when n<50)	2.86
2780											
2781	Estimates of Gamma Parameters using KM Estimates										
2782						Mean (KM)	2.086			SD (KM)	0.852
2783						Variance (KM)	0.725			SE of Mean (KM)	0.301
2784						k hat (KM)	5.998			k star (KM)	4.265
2785						nu hat (KM)	120			nu star (KM)	85.3
2786						theta hat (KM)	0.348			theta star (KM)	0.489
2787						80% gamma percentile (KM)	2.854			90% gamma percentile (KM)	3.439
2788						95% gamma percentile (KM)	3.975			99% gamma percentile (KM)	5.117
2789											
2790	Gamma Kaplan-Meier (KM) Statistics										
2791						Approximate Chi Square Value (85.30, α)	65.01			Adjusted Chi Square Value (85.30, β)	61.94
2792						95% Gamma Approximate KM-UCL (use when n>=50)	2.736			95% Gamma Adjusted KM-UCL (use when n<50)	2.872
2793											
2794	Lognormal GOF Test on Detected Observations Only										
2795						Shapiro Wilk Test Statistic	0.964			Shapiro Wilk GOF Test	
2796						5% Shapiro Wilk Critical Value	0.829			Detected Data appear Lognormal at 5% Significance Level	
2797						Lilliefors Test Statistic	0.131			Lilliefors GOF Test	
2798						5% Lilliefors Critical Value	0.274			Detected Data appear Lognormal at 5% Significance Level	
2799	Detected Data appear Lognormal at 5% Significance Level										
2800											
2801	Lognormal ROS Statistics Using Imputed Non-Detects										
2802						Mean in Original Scale	2.067			Mean in Log Scale	0.64
2803						SD in Original Scale	0.854			SD in Log Scale	0.456
2804						95% t UCL (assumes normality of ROS data)	2.561			95% Percentile Bootstrap UCL	2.489
2805						95% BCA Bootstrap UCL	2.49			95% Bootstrap t UCL	2.597
2806						95% H-UCL (Log ROS)	2.922				
2807											
2808	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										
2809						KM Mean (logged)	0.64			KM Geo Mean	1.896

2810				KM SD (logged)	0.456			95% Critical H Value (KM-Log)			2.16	
2811				KM Standard Error of Mean (logged)	0.161			95% H-UCL (KM -Log)			2.922	
2812				KM SD (logged)	0.456			95% Critical H Value (KM-Log)			2.16	
2813				KM Standard Error of Mean (logged)	0.161							
2814												
2815				DL/2 Statistics								
2816				DL/2 Normal				DL/2 Log-Transformed				
2817				Mean in Original Scale	2.182			Mean in Log Scale			0.687	
2818				SD in Original Scale	0.905			SD in Log Scale			0.48	
2819				95% t UCL (Assumes normality)	2.706			95% H-Stat UCL			3.17	
2820				DL/2 is not a recommended method, provided for comparisons and historical reasons								
2821												
2822				Nonparametric Distribution Free UCL Statistics								
2823				Detected Data appear Normal Distributed at 5% Significance Level								
2824												
2825				Suggested UCL to Use								
2826				95% KM (t) UCL	2.637							
2827												
2828				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.								
2829				Recommendations are based upon data size, data distribution, and skewness.								
2830				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).								
2831				However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.								
2832												
2833												
2834	Zinc											
2835												
2836				General Statistics								
2837				Total Number of Observations	10			Number of Distinct Observations			9	
2838								Number of Missing Observations			0	
2839				Minimum	88			Mean			274.8	
2840				Maximum	640			Median			265	
2841				SD	149.1			Std. Error of Mean			47.14	
2842				Coefficient of Variation	0.542			Skewness			1.72	
2843												
2844				Normal GOF Test								
2845				Shapiro Wilk Test Statistic	0.839			Shapiro Wilk GOF Test				
2846				5% Shapiro Wilk Critical Value	0.842			Data Not Normal at 5% Significance Level				
2847				Lilliefors Test Statistic	0.286			Lilliefors GOF Test				
2848				5% Lilliefors Critical Value	0.262			Data Not Normal at 5% Significance Level				
2849				Data Not Normal at 5% Significance Level								
2850												
2851				Assuming Normal Distribution								
2852				95% Normal UCL				95% UCLs (Adjusted for Skewness)				
2853				95% Student's-t UCL	361.2			95% Adjusted-CLT UCL (Chen-1995)			379.7	
2854								95% Modified-t UCL (Johnson-1978)			365.5	
2855												
2856				Gamma GOF Test								
2857				A-D Test Statistic	0.393			Anderson-Darling Gamma GOF Test				
2858				5% A-D Critical Value	0.729			Detected data appear Gamma Distributed at 5% Significance Level				
2859				K-S Test Statistic	0.221			Kolmogorov-Smirnov Gamma GOF Test				
2860				5% K-S Critical Value	0.268			Detected data appear Gamma Distributed at 5% Significance Level				
2861				Detected data appear Gamma Distributed at 5% Significance Level								
2862												

	A	B	C	D	E	F	G	H	I	J	K	L
2863	Gamma Statistics											
2864					k hat (MLE)	4.376	k star (bias corrected MLE)					3.13
2865					Theta hat (MLE)	62.8	Theta star (bias corrected MLE)					87.8
2866					nu hat (MLE)	87.52	nu star (bias corrected)					62.6
2867					MLE Mean (bias corrected)	274.8	MLE Sd (bias corrected)					155.3
2868							Approximate Chi Square Value (0.05)					45.4
2869					Adjusted Level of Significance	0.0267	Adjusted Chi Square Value					42.86
2870												
2871	Assuming Gamma Distribution											
2872			95% Approximate Gamma UCL (use when n>=50)			378.9	95% Adjusted Gamma UCL (use when n<50)					401.3
2873												
2874	Lognormal GOF Test											
2875					Shapiro Wilk Test Statistic	0.949	Shapiro Wilk Lognormal GOF Test					
2876					5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level					
2877					Lilliefors Test Statistic	0.195	Lilliefors Lognormal GOF Test					
2878					5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level					
2879	Data appear Lognormal at 5% Significance Level											
2880												
2881	Lognormal Statistics											
2882					Minimum of Logged Data	4.477	Mean of logged Data					5.497
2883					Maximum of Logged Data	6.461	SD of logged Data					0.517
2884												
2885	Assuming Lognormal Distribution											
2886					95% H-UCL	410.5	90% Chebyshev (MVUE) UCL					412.1
2887					95% Chebyshev (MVUE) UCL	474.3	97.5% Chebyshev (MVUE) UCL					560.6
2888					99% Chebyshev (MVUE) UCL	730.2						
2889												
2890	Nonparametric Distribution Free UCL Statistics											
2891	Data appear to follow a Discernible Distribution at 5% Significance Level											
2892												
2893	Nonparametric Distribution Free UCLs											
2894					95% CLT UCL	352.3	95% Jackknife UCL					361.2
2895					95% Standard Bootstrap UCL	348.4	95% Bootstrap-t UCL					412.6
2896					95% Hall's Bootstrap UCL	798	95% Percentile Bootstrap UCL					353
2897					95% BCA Bootstrap UCL	377						
2898					90% Chebyshev(Mean, Sd) UCL	416.2	95% Chebyshev(Mean, Sd) UCL					480.3
2899					97.5% Chebyshev(Mean, Sd) UCL	569.2	99% Chebyshev(Mean, Sd) UCL					743.8
2900												
2901	Suggested UCL to Use											
2902					95% Adjusted Gamma UCL	401.3						
2903												
2904	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
2905	Recommendations are based upon data size, data distribution, and skewness.											
2906	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
2907	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
2908												

Southern Pond 95% UCLs

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation	ProUCL 5.13/19/2019 8:00:20 PM										
5	From File	ProUCL Setup Sed-RERA-eco-0-1ft-rev-Mar-19-2019_a.xls										
6	Full Precision	OFF										
7	Confidence Coefficient	95%										
8	Number of Bootstrap Operations	2000										
9												
10	T-PCBs											
11												
12	General Statistics											
13	Total Number of Observations	13				Number of Distinct Observations	12					
14	Number of Detects	11				Number of Non-Detects	2					
15	Number of Distinct Detects	11				Number of Distinct Non-Detects	1					
16	Minimum Detect	116				Minimum Non-Detect	84					
17	Maximum Detect	132000				Maximum Non-Detect	84					
18	Variance Detects	1.586E+9				Percent Non-Detects	15.38%					
19	Mean Detects	17887				SD Detects	39821					
20	Median Detects	300				CV Detects	2.226					
21	Skewness Detects	2.811				Kurtosis Detects	8.262					
22	Mean of Logged Detects	7.132				SD of Logged Detects	2.51					
23												
24	Normal GOF Test on Detects Only											
25	Shapiro Wilk Test Statistic	0.531				Shapiro Wilk GOF Test						
26	5% Shapiro Wilk Critical Value	0.85				Detected Data Not Normal at 5% Significance Level						
27	Lilliefors Test Statistic	0.378				Lilliefors GOF Test						
28	5% Lilliefors Critical Value	0.251				Detected Data Not Normal at 5% Significance Level						
29	Detected Data Not Normal at 5% Significance Level											
30												
31	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
32	KM Mean	15148				KM Standard Error of Mean	10330					
33	KM SD	35511				95% KM (BCA) UCL	35632					
34	95% KM (t) UCL	33558				95% KM (Percentile Bootstrap) UCL	33729					
35	95% KM (z) UCL	32139				95% KM Bootstrap t UCL	93573					
36	90% KM Chebyshev UCL	46137				95% KM Chebyshev UCL	60174					
37	97.5% KM Chebyshev UCL	79657				99% KM Chebyshev UCL	117928					
38												
39	Gamma GOF Tests on Detected Observations Only											
40	A-D Test Statistic	1.291				Anderson-Darling GOF Test						
41	5% A-D Critical Value	0.835				Detected Data Not Gamma Distributed at 5% Significance Level						
42	K-S Test Statistic	0.323				Kolmogorov-Smirnov GOF						
43	5% K-S Critical Value	0.278				Detected Data Not Gamma Distributed at 5% Significance Level						
44	Detected Data Not Gamma Distributed at 5% Significance Level											
45												
46	Gamma Statistics on Detected Data Only											
47	k hat (MLE)	0.265				k star (bias corrected MLE)	0.253					
48	Theta hat (MLE)	67602				Theta star (bias corrected MLE)	70689					
49	nu hat (MLE)	5.821				nu star (bias corrected)	5.567					
50	Mean (detects)	17887										
51												
52	Gamma ROS Statistics using Imputed Non-Detects											
53	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											

54	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)										
55	For such situations, GROS method may yield incorrect values of UCLs and BTVs										
56	This is especially true when the sample size is small.										
57	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates										
58					Minimum	0.01			Mean	15135	
59					Maximum	132000			Median	262	
60					SD	36967			CV	2.443	
61					k hat (MLE)	0.175			k star (bias corrected MLE)	0.186	
62					Theta hat (MLE)	86592			Theta star (bias corrected MLE)	81488	
63					nu hat (MLE)	4.544			nu star (bias corrected)	4.829	
64					Adjusted Level of Significance (β)	0.0301					
65					Approximate Chi Square Value (4.83, α)	1.074			Adjusted Chi Square Value (4.83, β)	0.847	
66					95% Gamma Approximate UCL (use when n>=50)	68050			95% Gamma Adjusted UCL (use when n<50)	86273	
67											
68					Estimates of Gamma Parameters using KM Estimates						
69					Mean (KM)	15148			SD (KM)	35511	
70					Variance (KM)	1.261E+9			SE of Mean (KM)	10330	
71					k hat (KM)	0.182			k star (KM)	0.191	
72					nu hat (KM)	4.731			nu star (KM)	4.972	
73					theta hat (KM)	83250			theta star (KM)	79205	
74					80% gamma percentile (KM)	19480			90% gamma percentile (KM)	45784	
75					95% gamma percentile (KM)	78950			99% gamma percentile (KM)	170940	
76											
77					Gamma Kaplan-Meier (KM) Statistics						
78					Approximate Chi Square Value (4.97, α)	1.139			Adjusted Chi Square Value (4.97, β)	0.903	
79					95% Gamma Approximate KM-UCL (use when n>=50)	66102			95% Gamma Adjusted KM-UCL (use when n<50)	83404	
80											
81					Lognormal GOF Test on Detected Observations Only						
82					Shapiro Wilk Test Statistic	0.818			Shapiro Wilk GOF Test		
83					5% Shapiro Wilk Critical Value	0.85			Detected Data Not Lognormal at 5% Significance Level		
84					Lilliefors Test Statistic	0.261			Lilliefors GOF Test		
85					5% Lilliefors Critical Value	0.251			Detected Data Not Lognormal at 5% Significance Level		
86	Detected Data Not Lognormal at 5% Significance Level										
87											
88					Lognormal ROS Statistics Using Imputed Non-Detects						
89					Mean in Original Scale	15136			Mean in Log Scale	6.244	
90					SD in Original Scale	36967			SD in Log Scale	3.164	
91					95% t UCL (assumes normality of ROS data)	33409			95% Percentile Bootstrap UCL	33706	
92					95% BCA Bootstrap UCL	42236			95% Bootstrap t UCL	93640	
93					95% H-UCL (Log ROS)	60687224					
94											
95					Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution						
96					KM Mean (logged)	6.716			KM Geo Mean	825.7	
97					KM SD (logged)	2.408			95% Critical H Value (KM-Log)	5.679	
98					KM Standard Error of Mean (logged)	0.7			95% H-UCL (KM -Log)	776317	
99					KM SD (logged)	2.408			95% Critical H Value (KM-Log)	5.679	
100					KM Standard Error of Mean (logged)	0.7					
101											
102					DL/2 Statistics						
103					DL/2 Normal				DL/2 Log-Transformed		
104					Mean in Original Scale	15141			Mean in Log Scale	6.61	
105					SD in Original Scale	36964			SD in Log Scale	2.622	
106					95% t UCL (Assumes normality)	33413			95% H-Stat UCL	2389457	

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

Nonparametric Distribution Free UCL Statistics

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

Suggested UCL to Use

KM Bootstrap t UCL	33729

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

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

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

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

LMWPAHs

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	0
Minimum	150.7	Mean	1772
Maximum	9990	Median	282
SD	2974	Std. Error of Mean	767.9
Coefficient of Variation	1.679	Skewness	2.147

Normal GOF Test

Shapiro Wilk Test Statistic	0.614	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.359	Lilliefors GOF Test
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	3124	95% Adjusted-CLT UCL (Chen-1995)	3490
		95% Modified-t UCL (Johnson-1978)	3195

Gamma GOF Test

A-D Test Statistic	1.552	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.787	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.269	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.233	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.581	k star (bias corrected MLE)	0.509
Theta hat (MLE)	3051	Theta star (bias corrected MLE)	3480
nu hat (MLE)	17.42	nu star (bias corrected)	15.27
MLE Mean (bias corrected)	1772	MLE Sd (bias corrected)	2483
		Approximate Chi Square Value (0.05)	7.451
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	6.787

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3631	95% Adjusted Gamma UCL (use when n<50)	3986

160											
161					Lognormal GOF Test						
162				Shapiro Wilk Test Statistic	0.84		Shapiro Wilk Lognormal GOF Test				
163				5% Shapiro Wilk Critical Value	0.881		Data Not Lognormal at 5% Significance Level				
164				Lilliefors Test Statistic	0.241		Lilliefors Lognormal GOF Test				
165				5% Lilliefors Critical Value	0.22		Data Not Lognormal at 5% Significance Level				
166					Data Not Lognormal at 5% Significance Level						
167											
168					Lognormal Statistics						
169				Minimum of Logged Data	5.015		Mean of logged Data	6.411			
170				Maximum of Logged Data	9.209		SD of logged Data	1.41			
171											
172					Assuming Lognormal Distribution						
173				95% H-UCL	6017		90% Chebyshev (MVUE) UCL	3283			
174				95% Chebyshev (MVUE) UCL	4106		97.5% Chebyshev (MVUE) UCL	5248			
175				99% Chebyshev (MVUE) UCL	7492						
176											
177					Nonparametric Distribution Free UCL Statistics						
178					Data do not follow a Discernible Distribution (0.05)						
179											
180					Nonparametric Distribution Free UCLs						
181				95% CLT UCL	3035		95% Jackknife UCL	3124			
182				95% Standard Bootstrap UCL	2984		95% Bootstrap-t UCL	5798			
183				95% Hall's Bootstrap UCL	4926		95% Percentile Bootstrap UCL	3074			
184				95% BCA Bootstrap UCL	3510						
185				90% Chebyshev(Mean, Sd) UCL	4076		95% Chebyshev(Mean, Sd) UCL	5119			
186				97.5% Chebyshev(Mean, Sd) UCL	6568		99% Chebyshev(Mean, Sd) UCL	9413			
187											
188					Suggested UCL to Use						
189				95% Chebyshev (Mean, Sd) UCL	5119						
190											
191					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
192					Recommendations are based upon data size, data distribution, and skewness.						
193					These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).						
194					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.						
195											
196											
197	HMWPAHs										
198											
199					General Statistics						
200				Total Number of Observations	15		Number of Distinct Observations	15			
201							Number of Missing Observations	0			
202				Minimum	280.5		Mean	13711			
203				Maximum	60740		Median	1794			
204				SD	22567		Std. Error of Mean	5827			
205				Coefficient of Variation	1.646		Skewness	1.546			
206											
207					Normal GOF Test						
208				Shapiro Wilk Test Statistic	0.616		Shapiro Wilk GOF Test				
209				5% Shapiro Wilk Critical Value	0.881		Data Not Normal at 5% Significance Level				
210				Lilliefors Test Statistic	0.426		Lilliefors GOF Test				
211				5% Lilliefors Critical Value	0.22		Data Not Normal at 5% Significance Level				
212					Data Not Normal at 5% Significance Level						

213											
214					Assuming Normal Distribution						
215				95% Normal UCL			95% UCLs (Adjusted for Skewness)				
216				95% Student's-t UCL	23974		95% Adjusted-CLT UCL (Chen-1995)	25781			
217							95% Modified-t UCL (Johnson-1978)	24362			
218											
219					Gamma GOF Test						
220				A-D Test Statistic	1.893		Anderson-Darling Gamma GOF Test				
221				5% A-D Critical Value	0.804		Data Not Gamma Distributed at 5% Significance Level				
222				K-S Test Statistic	0.386		Kolmogorov-Smirnov Gamma GOF Test				
223				5% K-S Critical Value	0.235		Data Not Gamma Distributed at 5% Significance Level				
224					Data Not Gamma Distributed at 5% Significance Level						
225											
226					Gamma Statistics						
227				k hat (MLE)	0.449		k star (bias corrected MLE)	0.404			
228				Theta hat (MLE)	30517		Theta star (bias corrected MLE)	33949			
229				nu hat (MLE)	13.48		nu star (bias corrected)	12.12			
230				MLE Mean (bias corrected)	13711		MLE Sd (bias corrected)	21575			
231							Approximate Chi Square Value (0.05)	5.304			
232				Adjusted Level of Significance	0.0324		Adjusted Chi Square Value	4.76			
233											
234					Assuming Gamma Distribution						
235				95% Approximate Gamma UCL (use when n>=50))	31323		95% Adjusted Gamma UCL (use when n<50)	34904			
236											
237					Lognormal GOF Test						
238				Shapiro Wilk Test Statistic	0.83		Shapiro Wilk Lognormal GOF Test				
239				5% Shapiro Wilk Critical Value	0.881		Data Not Lognormal at 5% Significance Level				
240				Lilliefors Test Statistic	0.309		Lilliefors Lognormal GOF Test				
241				5% Lilliefors Critical Value	0.22		Data Not Lognormal at 5% Significance Level				
242					Data Not Lognormal at 5% Significance Level						
243											
244					Lognormal Statistics						
245				Minimum of Logged Data	5.637		Mean of logged Data	8.088			
246				Maximum of Logged Data	11.01		SD of logged Data	1.725			
247											
248					Assuming Lognormal Distribution						
249				95% H-UCL	92691		90% Chebyshev (MVUE) UCL	29969			
250				95% Chebyshev (MVUE) UCL	38194		97.5% Chebyshev (MVUE) UCL	49610			
251				99% Chebyshev (MVUE) UCL	72036						
252											
253					Nonparametric Distribution Free UCL Statistics						
254					Data do not follow a Discernible Distribution (0.05)						
255											
256					Nonparametric Distribution Free UCLs						
257				95% CLT UCL	23296		95% Jackknife UCL	23974			
258				95% Standard Bootstrap UCL	23128		95% Bootstrap-t UCL	27975			
259				95% Hall's Bootstrap UCL	21462		95% Percentile Bootstrap UCL	23179			
260				95% BCA Bootstrap UCL	25923						
261				90% Chebyshev(Mean, Sd) UCL	31192		95% Chebyshev(Mean, Sd) UCL	39110			
262				97.5% Chebyshev(Mean, Sd) UCL	50100		99% Chebyshev(Mean, Sd) UCL	71688			
263											
264					Suggested UCL to Use						
265				99% Chebyshev (Mean, Sd) UCL	71688						

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

DDD

General Statistics

Total Number of Observations	15	Number of Distinct Observations	12
Number of Detects	1	Number of Non-Detects	14
Number of Distinct Detects	1	Number of Distinct Non-Detects	11

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
s suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BT

The data set for variable DDD was not processed!

Dieldrin

General Statistics

Total Number of Observations	15	Number of Distinct Observations	12
Number of Detects	2	Number of Non-Detects	13
Number of Distinct Detects	2	Number of Distinct Non-Detects	10
Minimum Detect	87	Minimum Non-Detect	2
Maximum Detect	120	Maximum Non-Detect	94
Variance Detects	544.5	Percent Non-Detects	86.67%
Mean Detects	103.5	SD Detects	23.33
Median Detects	103.5	CV Detects	0.225
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	4.627	SD of Logged Detects	0.227

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

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

KM Mean	15.97	KM Standard Error of Mean	13.11
KM SD	35.38	95% KM (BCA) UCL	N/A
95% KM (t) UCL	39.06	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	37.53	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	55.29	95% KM Chebyshev UCL	73.11
97.5% KM Chebyshev UCL	97.83	99% KM Chebyshev UCL	146.4

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

	A	B	C	D	E	F	G	H	I	J	K	L
319	Gamma Statistics on Detected Data Only											
320					k hat (MLE)	39.01			k star (bias corrected MLE)			N/A
321					Theta hat (MLE)	2.653			Theta star (bias corrected MLE)			N/A
322					nu hat (MLE)	156			nu star (bias corrected)			N/A
323					Mean (detects)	103.5						
324												
325	Estimates of Gamma Parameters using KM Estimates											
326					Mean (KM)	15.97			SD (KM)			35.38
327					Variance (KM)	1252			SE of Mean (KM)			13.11
328					k hat (KM)	0.204			k star (KM)			0.207
329					nu hat (KM)	6.111			nu star (KM)			6.222
330					theta hat (KM)	78.39			theta star (KM)			76.99
331					80% gamma percentile (KM)	21.44			90% gamma percentile (KM)			48.3
332					95% gamma percentile (KM)	81.5			99% gamma percentile (KM)			172.4
333												
334	Gamma Kaplan-Meier (KM) Statistics											
335									Adjusted Level of Significance (β)			0.0324
336					Approximate Chi Square Value (6.22, α)	1.755			Adjusted Chi Square Value (6.22, β)			1.479
337					95% Gamma Approximate KM-UCL (use when n>=50)	56.63			95% Gamma Adjusted KM-UCL (use when n<50)			67.17
338												
339	Lognormal GOF Test on Detected Observations Only											
340	Not Enough Data to Perform GOF Test											
341												
342	Lognormal ROS Statistics Using Imputed Non-Detects											
343					Mean in Original Scale	47.48			Mean in Log Scale			3.779
344					SD in Original Scale	24.27			SD in Log Scale			0.38
345					95% t UCL (assumes normality of ROS data)	58.52			95% Percentile Bootstrap UCL			58.82
346					95% BCA Bootstrap UCL	62.45			95% Bootstrap t UCL			87.5
347					95% H-UCL (Log ROS)	57.34						
348												
349	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
350					KM Mean (logged)	1.237			KM Geo Mean			3.445
351					KM SD (logged)	1.358			95% Critical H Value (KM-Log)			3.353
352					KM Standard Error of Mean (logged)	0.505			95% H-UCL (KM -Log)			29.24
353					KM SD (logged)	1.358			95% Critical H Value (KM-Log)			3.353
354					KM Standard Error of Mean (logged)	0.505						
355												
356	DL/2 Statistics											
357				DL/2 Normal					DL/2 Log-Transformed			
358					Mean in Original Scale	24.59			Mean in Log Scale			2.405
359					SD in Original Scale	34.8			SD in Log Scale			1.336
360					95% t UCL (Assumes normality)	40.42			95% H-Stat UCL			88.29
361	DL/2 is not a recommended method, provided for comparisons and historical reasons											
362												
363	Nonparametric Distribution Free UCL Statistics											
364	Data do not follow a Discernible Distribution at 5% Significance Level											
365												
366	Suggested UCL to Use											
367					95% KM (t) UCL	39.06					KM H-UCL	29.24
368					95% KM (BCA) UCL	N/A						
369	Warning: One or more Recommended UCL(s) not available!											
370												
371	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											

372	Recommendations are based upon data size, data distribution, and skewness.										
373	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
374	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
375											
376	Acetone										
377											
378	General Statistics										
379			Total Number of Observations		15		Number of Distinct Observations		13		
380			Number of Detects		8		Number of Non-Detects		7		
381			Number of Distinct Detects		8		Number of Distinct Non-Detects		6		
382			Minimum Detect		22		Minimum Non-Detect		19		
383			Maximum Detect		930		Maximum Non-Detect		31		
384			Variance Detects		102048		Percent Non-Detects		46.67%		
385			Mean Detects		246.4		SD Detects		319.4		
386			Median Detects		90.5		CV Detects		1.297		
387			Skewness Detects		1.731		Kurtosis Detects		2.663		
388			Mean of Logged Detects		4.726		SD of Logged Detects		1.377		
389											
390	Normal GOF Test on Detects Only										
391			Shapiro Wilk Test Statistic		0.762		Shapiro Wilk GOF Test				
392			5% Shapiro Wilk Critical Value		0.818		Detected Data Not Normal at 5% Significance Level				
393			Lilliefors Test Statistic		0.279		Lilliefors GOF Test				
394			5% Lilliefors Critical Value		0.283		Detected Data appear Normal at 5% Significance Level				
395	Detected Data appear Approximate Normal at 5% Significance Level										
396											
397	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
398			KM Mean		140.7		KM Standard Error of Mean		67.83		
399			KM SD		245.7		95% KM (BCA) UCL		242.9		
400			95% KM (t) UCL		260.2		95% KM (Percentile Bootstrap) UCL		254.2		
401			95% KM (z) UCL		252.3		95% KM Bootstrap t UCL		485.1		
402			90% KM Chebyshev UCL		344.2		95% KM Chebyshev UCL		436.4		
403			97.5% KM Chebyshev UCL		564.3		99% KM Chebyshev UCL		815.6		
404											
405	Gamma GOF Tests on Detected Observations Only										
406			A-D Test Statistic		0.383		Anderson-Darling GOF Test				
407			5% A-D Critical Value		0.745		Detected data appear Gamma Distributed at 5% Significance Level				
408			K-S Test Statistic		0.22		Kolmogorov-Smirnov GOF				
409			5% K-S Critical Value		0.304		Detected data appear Gamma Distributed at 5% Significance Level				
410	Detected data appear Gamma Distributed at 5% Significance Level										
411											
412	Gamma Statistics on Detected Data Only										
413			k hat (MLE)		0.764		k star (bias corrected MLE)		0.561		
414			Theta hat (MLE)		322.3		Theta star (bias corrected MLE)		439.1		
415			nu hat (MLE)		12.23		nu star (bias corrected)		8.978		
416			Mean (detects)		246.4						
417											
418	Gamma ROS Statistics using Imputed Non-Detects										
419	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs										
420	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)										
421	For such situations, GROS method may yield incorrect values of UCLs and BTVs										
422	This is especially true when the sample size is small.										
423	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates										
424			Minimum		0.01		Mean		131.4		

425					Maximum	930				Median	22
426					SD	259.2				CV	1.973
427					k hat (MLE)	0.168				k star (bias corrected MLE)	0.179
428					Theta hat (MLE)	783.4				Theta star (bias corrected MLE)	735.6
429					nu hat (MLE)	5.032				nu star (bias corrected)	5.359
430					Adjusted Level of Significance (β)	0.0324					
431					Approximate Chi Square Value (5.36, α)	1.322				Adjusted Chi Square Value (5.36, β)	1.093
432					95% Gamma Approximate UCL (use when n>=50)	532.8				95% Gamma Adjusted UCL (use when n<50)	644.1
433											
434					Estimates of Gamma Parameters using KM Estimates						
435					Mean (KM)	140.7				SD (KM)	245.7
436					Variance (KM)	60375				SE of Mean (KM)	67.83
437					k hat (KM)	0.328				k star (KM)	0.307
438					nu hat (KM)	9.843				nu star (KM)	9.208
439					theta hat (KM)	429				theta star (KM)	458.6
440					80% gamma percentile (KM)	217				90% gamma percentile (KM)	414
441					95% gamma percentile (KM)	639.1				99% gamma percentile (KM)	1223
442											
443					Gamma Kaplan-Meier (KM) Statistics						
444					Approximate Chi Square Value (9.21, α)	3.453				Adjusted Chi Square Value (9.21, β)	3.032
445					95% Gamma Approximate KM-UCL (use when n>=50)	375.3				95% Gamma Adjusted KM-UCL (use when n<50)	427.4
446											
447					Lognormal GOF Test on Detected Observations Only						
448					Shapiro Wilk Test Statistic	0.939				Shapiro Wilk GOF Test	
449					5% Shapiro Wilk Critical Value	0.818				Detected Data appear Lognormal at 5% Significance Level	
450					Lilliefors Test Statistic	0.172				Lilliefors GOF Test	
451					5% Lilliefors Critical Value	0.283				Detected Data appear Lognormal at 5% Significance Level	
452					Detected Data appear Lognormal at 5% Significance Level						
453											
454					Lognormal ROS Statistics Using Imputed Non-Detects						
455					Mean in Original Scale	133.9				Mean in Log Scale	3.226
456					SD in Original Scale	257.9				SD in Log Scale	1.967
457					95% t UCL (assumes normality of ROS data)	251.2				95% Percentile Bootstrap UCL	252.6
458					95% BCA Bootstrap UCL	296.7				95% Bootstrap t UCL	488
459					95% H-UCL (Log ROS)	1855					
460											
461					Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution						
462					KM Mean (logged)	3.917				KM Geo Mean	50.25
463					KM SD (logged)	1.279				95% Critical H Value (KM-Log)	3.214
464					KM Standard Error of Mean (logged)	0.354				95% H-UCL (KM -Log)	341.6
465					KM SD (logged)	1.279				95% Critical H Value (KM-Log)	3.214
466					KM Standard Error of Mean (logged)	0.354					
467											
468					DL/2 Statistics						
469					DL/2 Normal					DL/2 Log-Transformed	
470					Mean in Original Scale	137.2				Mean in Log Scale	3.688
471					SD in Original Scale	256.2				SD in Log Scale	1.51
472					95% t UCL (Assumes normality)	253.7				95% H-Stat UCL	540.5
473					DL/2 is not a recommended method, provided for comparisons and historical reasons						
474											
475					Nonparametric Distribution Free UCL Statistics						
476					Detected Data appear Approximate Normal Distributed at 5% Significance Level						
477											

478	Suggested UCL to Use										
479				95% KM (t) UCL	260.2						
480											
481	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test										
482	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL										
483											
484	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
485	Recommendations are based upon data size, data distribution, and skewness.										
486	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
487	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
488											
489	Benzene										
490											
491	General Statistics										
492				Total Number of Observations	15			Number of Distinct Observations	13		
493				Number of Detects	4			Number of Non-Detects	11		
494				Number of Distinct Detects	4			Number of Distinct Non-Detects	10		
495				Minimum Detect	5.4			Minimum Non-Detect	2.1		
496				Maximum Detect	40			Maximum Non-Detect	17		
497				Variance Detects	234.4			Percent Non-Detects	73.33%		
498				Mean Detects	17.6			SD Detects	15.31		
499				Median Detects	12.5			CV Detects	0.87		
500				Skewness Detects	1.7			Kurtosis Detects	3.209		
501				Mean of Logged Detects	2.606			SD of Logged Detects	0.824		
502											
503	Normal GOF Test on Detects Only										
504				Shapiro Wilk Test Statistic	0.815			Shapiro Wilk GOF Test			
505				5% Shapiro Wilk Critical Value	0.748			Detected Data appear Normal at 5% Significance Level			
506				Lilliefors Test Statistic	0.368			Lilliefors GOF Test			
507				5% Lilliefors Critical Value	0.375			Detected Data appear Normal at 5% Significance Level			
508	Detected Data appear Normal at 5% Significance Level										
509											
510	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
511				KM Mean	6.446			KM Standard Error of Mean	2.904		
512				KM SD	9.67			95% KM (BCA) UCL	N/A		
513				95% KM (t) UCL	11.56			95% KM (Percentile Bootstrap) UCL	N/A		
514				95% KM (z) UCL	11.22			95% KM Bootstrap t UCL	N/A		
515				90% KM Chebyshev UCL	15.16			95% KM Chebyshev UCL	19.11		
516				97.5% KM Chebyshev UCL	24.58			99% KM Chebyshev UCL	35.34		
517											
518	Gamma GOF Tests on Detected Observations Only										
519				A-D Test Statistic	0.373			Anderson-Darling GOF Test			
520				5% A-D Critical Value	0.66			Detected data appear Gamma Distributed at 5% Significance Level			
521				K-S Test Statistic	0.319			Kolmogorov-Smirnov GOF			
522				5% K-S Critical Value	0.398			Detected data appear Gamma Distributed at 5% Significance Level			
523	Detected data appear Gamma Distributed at 5% Significance Level										
524											
525	Gamma Statistics on Detected Data Only										
526				k hat (MLE)	2.062			k star (bias corrected MLE)	0.682		
527				Theta hat (MLE)	8.534			Theta star (bias corrected MLE)	25.8		
528				nu hat (MLE)	16.5			nu star (bias corrected)	5.458		
529				Mean (detects)	17.6						
530											

	A	B	C	D	E	F	G	H	I	J	K	L
531	Gamma ROS Statistics using Imputed Non-Detects											
532	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
533	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
534	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
535	This is especially true when the sample size is small.											
536	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
537					Minimum	0.01				Mean	4.701	
538					Maximum	40				Median	0.01	
539					SD	10.73				CV	2.282	
540					k hat (MLE)	0.177				k star (bias corrected MLE)	0.186	
541					Theta hat (MLE)	26.52				Theta star (bias corrected MLE)	25.24	
542					nu hat (MLE)	5.317				nu star (bias corrected)	5.587	
543					Adjusted Level of Significance (β)	0.0324						
544					Approximate Chi Square Value (5.59, α)	1.433				Adjusted Chi Square Value (5.59, β)	1.192	
545					95% Gamma Approximate UCL (use when n>=50)	18.33				95% Gamma Adjusted UCL (use when n<50)	N/A	
546												
547	Estimates of Gamma Parameters using KM Estimates											
548					Mean (KM)	6.446				SD (KM)	9.67	
549					Variance (KM)	93.52				SE of Mean (KM)	2.904	
550					k hat (KM)	0.444				k star (KM)	0.4	
551					nu hat (KM)	13.33				nu star (KM)	12	
552					theta hat (KM)	14.51				theta star (KM)	16.12	
553					80% gamma percentile (KM)	10.4				90% gamma percentile (KM)	18.21	
554					95% gamma percentile (KM)	26.78				99% gamma percentile (KM)	48.35	
555												
556	Gamma Kaplan-Meier (KM) Statistics											
557					Approximate Chi Square Value (12.00, α)	5.224				Adjusted Chi Square Value (12.00, β)	4.685	
558					95% Gamma Approximate KM-UCL (use when n>=50)	14.8				95% Gamma Adjusted KM-UCL (use when n<50)	16.5	
559												
560	Lognormal GOF Test on Detected Observations Only											
561					Shapiro Wilk Test Statistic	0.949				Shapiro Wilk GOF Test		
562					5% Shapiro Wilk Critical Value	0.748				Detected Data appear Lognormal at 5% Significance Level		
563					Lilliefors Test Statistic	0.27				Lilliefors GOF Test		
564					5% Lilliefors Critical Value	0.375				Detected Data appear Lognormal at 5% Significance Level		
565	Detected Data appear Lognormal at 5% Significance Level											
566												
567	Lognormal ROS Statistics Using Imputed Non-Detects											
568					Mean in Original Scale	5.596				Mean in Log Scale	0.814	
569					SD in Original Scale	10.32				SD in Log Scale	1.209	
570					95% t UCL (assumes normality of ROS data)	10.29				95% Percentile Bootstrap UCL	10.09	
571					95% BCA Bootstrap UCL	12.72				95% Bootstrap t UCL	17.74	
572					95% H-UCL (Log ROS)	12.73						
573												
574	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
575					KM Mean (logged)	1.288				KM Geo Mean	3.624	
576					KM SD (logged)	0.909				95% Critical H Value (KM-Log)	2.602	
577					KM Standard Error of Mean (logged)	0.281				95% H-UCL (KM -Log)	10.31	
578					KM SD (logged)	0.909				95% Critical H Value (KM-Log)	2.602	
579					KM Standard Error of Mean (logged)	0.281						
580												
581	DL/2 Statistics											
582	DL/2 Normal						DL/2 Log-Transformed					
583					Mean in Original Scale	6.87				Mean in Log Scale	1.335	

584				SD in Original Scale	9.934					SD in Log Scale	1.045	
585				95% t UCL (Assumes normality)	11.39					95% H-Stat UCL	14.42	
586	DL/2 is not a recommended method, provided for comparisons and historical reasons											
587												
588	Nonparametric Distribution Free UCL Statistics											
589	Detected Data appear Normal Distributed at 5% Significance Level											
590												
591	Suggested UCL to Use											
592				95% KM (t) UCL	11.56							
593												
594	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
595	Recommendations are based upon data size, data distribution, and skewness.											
596	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
597	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
598												
599	Carb Disul											
600												
601	General Statistics											
602				Total Number of Observations	15					Number of Distinct Observations	11	
603				Number of Detects	0					Number of Non-Detects	15	
604				Number of Distinct Detects	0					Number of Distinct Non-Detects	11	
605												
606	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
607	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
608	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
609												
610	The data set for variable Carb Disul was not processed!											
611												
612												
613	Benzoic A											
614												
615	General Statistics											
616				Total Number of Observations	15					Number of Distinct Observations	13	
617				Number of Detects	0					Number of Non-Detects	15	
618				Number of Distinct Detects	0					Number of Distinct Non-Detects	13	
619												
620	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
621	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
622	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
623												
624	The data set for variable Benzoic A was not processed!											
625												
626												
627	3-4-MP											
628												
629	General Statistics											
630				Total Number of Observations	15					Number of Distinct Observations	13	
631				Number of Detects	0					Number of Non-Detects	15	
632				Number of Distinct Detects	0					Number of Distinct Non-Detects	13	
633												
634	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
635	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
636	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											

637											
638	The data set for variable 3-4-MP was not processed!										
639											
640											
641	BEHP										
642											
643	General Statistics										
644				Total Number of Observations	15			Number of Distinct Observations	14		
645				Number of Detects	8			Number of Non-Detects	7		
646				Number of Distinct Detects	7			Number of Distinct Non-Detects	7		
647				Minimum Detect	75			Minimum Non-Detect	220		
648				Maximum Detect	2200			Maximum Non-Detect	8400		
649				Variance Detects	559780			Percent Non-Detects	46.67%		
650				Mean Detects	506.8			SD Detects	748.2		
651				Median Detects	170			CV Detects	1.476		
652				Skewness Detects	2.125			Kurtosis Detects	4.285		
653				Mean of Logged Detects	5.504			SD of Logged Detects	1.174		
654											
655	Normal GOF Test on Detects Only										
656				Shapiro Wilk Test Statistic	0.638			Shapiro Wilk GOF Test			
657				5% Shapiro Wilk Critical Value	0.818			Detected Data Not Normal at 5% Significance Level			
658				Lilliefors Test Statistic	0.409			Lilliefors GOF Test			
659				5% Lilliefors Critical Value	0.283			Detected Data Not Normal at 5% Significance Level			
660	Detected Data Not Normal at 5% Significance Level										
661											
662	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
663				KM Mean	355.7			KM Standard Error of Mean	162		
664				KM SD	561.6			95% KM (BCA) UCL	653.3		
665				95% KM (t) UCL	641			95% KM (Percentile Bootstrap) UCL	624.6		
666				95% KM (z) UCL	622.1			95% KM Bootstrap t UCL	2658		
667				90% KM Chebyshev UCL	841.6			95% KM Chebyshev UCL	1062		
668				97.5% KM Chebyshev UCL	1367			99% KM Chebyshev UCL	1967		
669											
670	Gamma GOF Tests on Detected Observations Only										
671				A-D Test Statistic	0.994			Anderson-Darling GOF Test			
672				5% A-D Critical Value	0.743			Detected Data Not Gamma Distributed at 5% Significance Level			
673				K-S Test Statistic	0.382			Kolmogorov-Smirnov GOF			
674				5% K-S Critical Value	0.303			Detected Data Not Gamma Distributed at 5% Significance Level			
675	Detected Data Not Gamma Distributed at 5% Significance Level										
676											
677	Gamma Statistics on Detected Data Only										
678				k hat (MLE)	0.817			k star (bias corrected MLE)	0.594		
679				Theta hat (MLE)	620.3			Theta star (bias corrected MLE)	853.2		
680				nu hat (MLE)	13.07			nu star (bias corrected)	9.503		
681				Mean (detects)	506.8						
682											
683	Gamma ROS Statistics using Imputed Non-Detects										
684	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs										
685	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)										
686	For such situations, GROS method may yield incorrect values of UCLs and BTVs										
687	This is especially true when the sample size is small.										
688	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates										
689				Minimum	75			Mean	327		

690					Maximum	2200				Median	140
691					SD	565.6				CV	1.73
692					k hat (MLE)	0.929				k star (bias corrected MLE)	0.788
693					Theta hat (MLE)	352.1				Theta star (bias corrected MLE)	415.2
694					nu hat (MLE)	27.87				nu star (bias corrected)	23.63
695					Adjusted Level of Significance (β)	0.0324					
696					Approximate Chi Square Value (23.63, α)	13.56				Adjusted Chi Square Value (23.63, β)	12.63
697					95% Gamma Approximate UCL (use when n>=50)	569.6				95% Gamma Adjusted UCL (use when n<50)	611.6
698											
699					Estimates of Gamma Parameters using KM Estimates						
700					Mean (KM)	355.7				SD (KM)	561.6
701					Variance (KM)	315433				SE of Mean (KM)	162
702					k hat (KM)	0.401				k star (KM)	0.365
703					nu hat (KM)	12.03				nu star (KM)	10.96
704					theta hat (KM)	886.9				theta star (KM)	973.7
705					80% gamma percentile (KM)	567.1				90% gamma percentile (KM)	1020
706					95% gamma percentile (KM)	1524				99% gamma percentile (KM)	2805
707											
708					Gamma Kaplan-Meier (KM) Statistics						
709					Approximate Chi Square Value (10.96, α)	4.549				Adjusted Chi Square Value (10.96, β)	4.053
710					95% Gamma Approximate KM-UCL (use when n>=50)	856.8				95% Gamma Adjusted KM-UCL (use when n<50)	961.8
711											
712					Lognormal GOF Test on Detected Observations Only						
713					Shapiro Wilk Test Statistic	0.836				Shapiro Wilk GOF Test	
714					5% Shapiro Wilk Critical Value	0.818				Detected Data appear Lognormal at 5% Significance Level	
715					Lilliefors Test Statistic	0.319				Lilliefors GOF Test	
716					5% Lilliefors Critical Value	0.283				Detected Data Not Lognormal at 5% Significance Level	
717					Detected Data appear Approximate Lognormal at 5% Significance Level						
718											
719					Lognormal ROS Statistics Using Imputed Non-Detects						
720					Mean in Original Scale	347.3				Mean in Log Scale	5.317
721					SD in Original Scale	557.8				SD in Log Scale	0.857
722					95% t UCL (assumes normality of ROS data)	601				95% Percentile Bootstrap UCL	602.9
723					95% BCA Bootstrap UCL	761.5				95% Bootstrap t UCL	3637
724					95% H-UCL (Log ROS)	524.3					
725											
726					Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution						
727					KM Mean (logged)	5.259				KM Geo Mean	192.2
728					KM SD (logged)	0.917				95% Critical H Value (KM-Log)	2.615
729					KM Standard Error of Mean (logged)	0.281				95% H-UCL (KM -Log)	556
730					KM SD (logged)	0.917				95% Critical H Value (KM-Log)	2.615
731					KM Standard Error of Mean (logged)	0.281					
732											
733					DL/2 Statistics						
734					DL/2 Normal					DL/2 Log-Transformed	
735					Mean in Original Scale	644.9				Mean in Log Scale	5.572
736					SD in Original Scale	1133				SD in Log Scale	1.216
737					95% t UCL (Assumes normality)	1160				95% H-Stat UCL	1512
738					DL/2 is not a recommended method, provided for comparisons and historical reasons						
739											
740					Nonparametric Distribution Free UCL Statistics						
741					Detected Data appear Approximate Lognormal Distributed at 5% Significance Level						
742											

743	Suggested UCL to Use										
744				95% KM (Chebyshev) UCL	1062						
745											
746	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
747	Recommendations are based upon data size, data distribution, and skewness.										
748	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
749	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
750											
751	Carbazole										
752											
753	General Statistics										
754				Total Number of Observations	15			Number of Distinct Observations	13		
755				Number of Detects	0			Number of Non-Detects	15		
756				Number of Distinct Detects	0			Number of Distinct Non-Detects	13		
757											
758	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!										
759	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!										
760	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).										
761											
762	The data set for variable Carbazole was not processed!										
763											
764											
765	Dibenzofuran										
766											
767	General Statistics										
768				Total Number of Observations	15			Number of Distinct Observations	14		
769				Number of Detects	3			Number of Non-Detects	12		
770				Number of Distinct Detects	3			Number of Distinct Non-Detects	11		
771				Minimum Detect	91			Minimum Non-Detect	200		
772				Maximum Detect	2700			Maximum Non-Detect	8400		
773				Variance Detects	2235550			Percent Non-Detects	80%		
774				Mean Detects	973.7			SD Detects	1495		
775				Median Detects	130			CV Detects	1.536		
776				Skewness Detects	1.731			Kurtosis Detects	N/A		
777				Mean of Logged Detects	5.76			SD of Logged Detects	1.863		
778											
779	Warning: Data set has only 3 Detected Values.										
780	This is not enough to compute meaningful or reliable statistics and estimates.										
781											
782											
783	Normal GOF Test on Detects Only										
784				Shapiro Wilk Test Statistic	0.761			Shapiro Wilk GOF Test			
785				5% Shapiro Wilk Critical Value	0.767			Detected Data Not Normal at 5% Significance Level			
786				Lilliefors Test Statistic	0.38			Lilliefors GOF Test			
787				5% Lilliefors Critical Value	0.425			Detected Data appear Normal at 5% Significance Level			
788	Detected Data appear Approximate Normal at 5% Significance Level										
789											
790	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
791				KM Mean	295.5			KM Standard Error of Mean	218.9		
792				KM SD	667.2			95% KM (BCA) UCL	N/A		
793				95% KM (t) UCL	680.9			95% KM (Percentile Bootstrap) UCL	N/A		
794				95% KM (z) UCL	655.5			95% KM Bootstrap t UCL	N/A		
795				90% KM Chebyshev UCL	952			95% KM Chebyshev UCL	1249		

796				97.5% KM Chebyshev UCL	1662			99% KM Chebyshev UCL	2473		
797											
798					Gamma GOF Tests on Detected Observations Only						
799					Not Enough Data to Perform GOF Test						
800											
801					Gamma Statistics on Detected Data Only						
802				k hat (MLE)	0.557			k star (bias corrected MLE)	N/A		
803				Theta hat (MLE)	1748			Theta star (bias corrected MLE)	N/A		
804				nu hat (MLE)	3.343			nu star (bias corrected)	N/A		
805				Mean (detects)	973.7						
806											
807					Gamma ROS Statistics using Imputed Non-Detects						
808					GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs						
809					GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)						
810					For such situations, GROS method may yield incorrect values of UCLs and BTVs						
811					This is especially true when the sample size is small.						
812					For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates						
813				Minimum	0.01			Mean	271.4		
814				Maximum	2700			Median	76.25		
815				SD	675.7			CV	2.49		
816				k hat (MLE)	0.447			k star (bias corrected MLE)	0.402		
817				Theta hat (MLE)	607.7			Theta star (bias corrected MLE)	675.6		
818				nu hat (MLE)	13.4			nu star (bias corrected)	12.05		
819				Adjusted Level of Significance (β)	0.0324						
820				Approximate Chi Square Value (12.05, α)	5.261			Adjusted Chi Square Value (12.05, β)	4.719		
821				95% Gamma Approximate UCL (use when n>=50)	621.7			95% Gamma Adjusted UCL (use when n<50)	N/A		
822											
823					Estimates of Gamma Parameters using KM Estimates						
824				Mean (KM)	295.5			SD (KM)	667.2		
825				Variance (KM)	445106			SE of Mean (KM)	218.9		
826				k hat (KM)	0.196			k star (KM)	0.201		
827				nu hat (KM)	5.884			nu star (KM)	6.04		
828				theta hat (KM)	1506			theta star (KM)	1467		
829				80% gamma percentile (KM)	390.7			90% gamma percentile (KM)	893.7		
830				95% gamma percentile (KM)	1520			99% gamma percentile (KM)	3242		
831											
832					Gamma Kaplan-Meier (KM) Statistics						
833				Approximate Chi Square Value (6.04, α)	1.661			Adjusted Chi Square Value (6.04, β)	1.395		
834				95% Gamma Approximate KM-UCL (use when n>=50)	1075			95% Gamma Adjusted KM-UCL (use when n<50)	1279		
835											
836					Lognormal GOF Test on Detected Observations Only						
837				Shapiro Wilk Test Statistic	0.828			Shapiro Wilk GOF Test			
838				5% Shapiro Wilk Critical Value	0.767			Detected Data appear Lognormal at 5% Significance Level			
839				Lilliefors Test Statistic	0.351			Lilliefors GOF Test			
840				5% Lilliefors Critical Value	0.425			Detected Data appear Lognormal at 5% Significance Level			
841					Detected Data appear Lognormal at 5% Significance Level						
842											
843					Lognormal ROS Statistics Using Imputed Non-Detects						
844				Mean in Original Scale	295.4			Mean in Log Scale	4.994		
845				SD in Original Scale	666			SD in Log Scale	0.842		
846				95% t UCL (assumes normality of ROS data)	598.3			95% Percentile Bootstrap UCL	634.6		
847				95% BCA Bootstrap UCL	817			95% Bootstrap t UCL	7135		
848				95% H-UCL (Log ROS)	369.3						

	A	B	C	D	E	F	G	H	I	J	K	L
849												
850	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
851					KM Mean (logged)	4.919			KM Geo Mean	136.8		
852					KM SD (logged)	0.845			95% Critical H Value (KM-Log)	2.507		
853					KM Standard Error of Mean (logged)	0.306			95% H-UCL (KM -Log)	344.3		
854					KM SD (logged)	0.845			95% Critical H Value (KM-Log)	2.507		
855					KM Standard Error of Mean (logged)	0.306						
856												
857	DL/2 Statistics											
858				DL/2 Normal					DL/2 Log-Transformed			
859					Mean in Original Scale	674.1			Mean in Log Scale	5.49		
860					SD in Original Scale	1201			SD in Log Scale	1.298		
861					95% t UCL (Assumes normality)	1220			95% H-Stat UCL	1735		
862	DL/2 is not a recommended method, provided for comparisons and historical reasons											
863												
864	Nonparametric Distribution Free UCL Statistics											
865	Detected Data appear Approximate Normal Distributed at 5% Significance Level											
866												
867	Suggested UCL to Use											
868					95% KM (t) UCL	680.9						
869												
870	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test											
871	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL											
872												
873	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
874	Recommendations are based upon data size, data distribution, and skewness.											
875	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
876	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
877												
878	Antimony											
879												
880	General Statistics											
881					Total Number of Observations	15			Number of Distinct Observations	15		
882					Number of Detects	12			Number of Non-Detects	3		
883					Number of Distinct Detects	12			Number of Distinct Non-Detects	3		
884					Minimum Detect	0.62			Minimum Non-Detect	1.8		
885					Maximum Detect	13			Maximum Non-Detect	3		
886					Variance Detects	20.32			Percent Non-Detects	20%		
887					Mean Detects	3.927			SD Detects	4.508		
888					Median Detects	1.35			CV Detects	1.148		
889					Skewness Detects	1.194			Kurtosis Detects	-0.119		
890					Mean of Logged Detects	0.75			SD of Logged Detects	1.141		
891												
892	Normal GOF Test on Detects Only											
893					Shapiro Wilk Test Statistic	0.74			Shapiro Wilk GOF Test			
894					5% Shapiro Wilk Critical Value	0.859			Detected Data Not Normal at 5% Significance Level			
895					Lilliefors Test Statistic	0.364			Lilliefors GOF Test			
896					5% Lilliefors Critical Value	0.243			Detected Data Not Normal at 5% Significance Level			
897	Detected Data Not Normal at 5% Significance Level											
898												
899	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
900					KM Mean	3.354			KM Standard Error of Mean	1.088		
901					KM SD	4.029			95% KM (BCA) UCL	4.94		

902				95% KM (t) UCL	5.27			95% KM (Percentile Bootstrap) UCL			5.281
903				95% KM (z) UCL	5.143			95% KM Bootstrap t UCL			6.128
904				90% KM Chebyshev UCL	6.617			95% KM Chebyshev UCL			8.095
905				97.5% KM Chebyshev UCL	10.15			99% KM Chebyshev UCL			14.18
906											
907				Gamma GOF Tests on Detected Observations Only							
908				A-D Test Statistic	1.104			Anderson-Darling GOF Test			
909				5% A-D Critical Value	0.759			Detected Data Not Gamma Distributed at 5% Significance Level			
910				K-S Test Statistic	0.319			Kolmogorov-Smirnov GOF			
911				5% K-S Critical Value	0.253			Detected Data Not Gamma Distributed at 5% Significance Level			
912				Detected Data Not Gamma Distributed at 5% Significance Level							
913											
914				Gamma Statistics on Detected Data Only							
915				k hat (MLE)	0.941			k star (bias corrected MLE)			0.761
916				Theta hat (MLE)	4.174			Theta star (bias corrected MLE)			5.159
917				nu hat (MLE)	22.58			nu star (bias corrected)			18.27
918				Mean (detects)	3.927						
919											
920				Gamma ROS Statistics using Imputed Non-Detects							
921				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
922				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
923				For such situations, GROS method may yield incorrect values of UCLs and BTVs							
924				This is especially true when the sample size is small.							
925				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
926				Minimum	0.62			Mean			3.352
927				Maximum	13			Median			1.2
928				SD	4.169			CV			1.244
929				k hat (MLE)	0.967			k star (bias corrected MLE)			0.818
930				Theta hat (MLE)	3.467			Theta star (bias corrected MLE)			4.099
931				nu hat (MLE)	29			nu star (bias corrected)			24.53
932				Adjusted Level of Significance (β)	0.0324						
933				Approximate Chi Square Value (24.53, α)	14.25			Adjusted Chi Square Value (24.53, β)			13.3
934				95% Gamma Approximate UCL (use when n>=50)	5.768			95% Gamma Adjusted UCL (use when n<50)			6.184
935											
936				Estimates of Gamma Parameters using KM Estimates							
937				Mean (KM)	3.354			SD (KM)			4.029
938				Variance (KM)	16.24			SE of Mean (KM)			1.088
939				k hat (KM)	0.693			k star (KM)			0.599
940				nu hat (KM)	20.79			nu star (KM)			17.97
941				theta hat (KM)	4.84			theta star (KM)			5.601
942				80% gamma percentile (KM)	5.529			90% gamma percentile (KM)			8.728
943				95% gamma percentile (KM)	12.08			99% gamma percentile (KM)			20.18
944											
945				Gamma Kaplan-Meier (KM) Statistics							
946				Approximate Chi Square Value (17.97, α)	9.366			Adjusted Chi Square Value (17.97, β)			8.61
947				95% Gamma Approximate KM-UCL (use when n>=50)	6.434			95% Gamma Adjusted KM-UCL (use when n<50)			6.999
948											
949				Lognormal GOF Test on Detected Observations Only							
950				Shapiro Wilk Test Statistic	0.844			Shapiro Wilk GOF Test			
951				5% Shapiro Wilk Critical Value	0.859			Detected Data Not Lognormal at 5% Significance Level			
952				Lilliefors Test Statistic	0.263			Lilliefors GOF Test			
953				5% Lilliefors Critical Value	0.243			Detected Data Not Lognormal at 5% Significance Level			
954				Detected Data Not Lognormal at 5% Significance Level							

955											
956	Lognormal ROS Statistics Using Imputed Non-Detects										
957				Mean in Original Scale	3.388			Mean in Log Scale	0.642		
958				SD in Original Scale	4.148			SD in Log Scale	1.036		
959			95% t UCL (assumes normality of ROS data)		5.275			95% Percentile Bootstrap UCL	5.189		
960				95% BCA Bootstrap UCL	5.448			95% Bootstrap t UCL	6.06		
961				95% H-UCL (Log ROS)	7.059						
962											
963	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										
964				KM Mean (logged)	0.602			KM Geo Mean	1.825		
965				KM SD (logged)	1.032			95% Critical H Value (KM-Log)	2.795		
966				KM Standard Error of Mean (logged)	0.282			95% H-UCL (KM -Log)	6.719		
967				KM SD (logged)	1.032			95% Critical H Value (KM-Log)	2.795		
968				KM Standard Error of Mean (logged)	0.282						
969											
970	DL/2 Statistics										
971			DL/2 Normal					DL/2 Log-Transformed			
972				Mean in Original Scale	3.398			Mean in Log Scale	0.645		
973				SD in Original Scale	4.145			SD in Log Scale	1.04		
974				95% t UCL (Assumes normality)	5.283			95% H-Stat UCL	7.148		
975	DL/2 is not a recommended method, provided for comparisons and historical reasons										
976											
977	Nonparametric Distribution Free UCL Statistics										
978	Data do not follow a Discernible Distribution at 5% Significance Level										
979											
980	Suggested UCL to Use										
981				95% KM (Chebyshev) UCL	8.095						
982											
983	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
984	Recommendations are based upon data size, data distribution, and skewness.										
985	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
986	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
987											
988											
989	Arsenic										
990											
991	General Statistics										
992				Total Number of Observations	15			Number of Distinct Observations	14		
993								Number of Missing Observations	0		
994				Minimum	4.7			Mean	16		
995				Maximum	71			Median	6.4		
996				SD	18.94			Std. Error of Mean	4.89		
997				Coefficient of Variation	1.184			Skewness	2.107		
998											
999	Normal GOF Test										
1000				Shapiro Wilk Test Statistic	0.643			Shapiro Wilk GOF Test			
1001				5% Shapiro Wilk Critical Value	0.881			Data Not Normal at 5% Significance Level			
1002				Lilliefors Test Statistic	0.389			Lilliefors GOF Test			
1003				5% Lilliefors Critical Value	0.22			Data Not Normal at 5% Significance Level			
1004	Data Not Normal at 5% Significance Level										
1005											
1006	Assuming Normal Distribution										
1007				95% Normal UCL				95% UCLs (Adjusted for Skewness)			

1008				95% Student's-t UCL	24.61			95% Adjusted-CLT UCL (Chen-1995)			26.89
1009								95% Modified-t UCL (Johnson-1978)			25.06
1010											
1011					Gamma GOF Test						
1012				A-D Test Statistic	1.993			Anderson-Darling Gamma GOF Test			
1013				5% A-D Critical Value	0.759			Data Not Gamma Distributed at 5% Significance Level			
1014				K-S Test Statistic	0.365			Kolmogorov-Smirnov Gamma GOF Test			
1015				5% K-S Critical Value	0.227			Data Not Gamma Distributed at 5% Significance Level			
1016					Data Not Gamma Distributed at 5% Significance Level						
1017											
1018					Gamma Statistics						
1019				k hat (MLE)	1.245			k star (bias corrected MLE)			1.04
1020				Theta hat (MLE)	12.85			Theta star (bias corrected MLE)			15.38
1021				nu hat (MLE)	37.35			nu star (bias corrected)			31.21
1022				MLE Mean (bias corrected)	16			MLE Sd (bias corrected)			15.69
1023								Approximate Chi Square Value (0.05)			19.45
1024				Adjusted Level of Significance	0.0324			Adjusted Chi Square Value			18.31
1025											
1026					Assuming Gamma Distribution						
1027				95% Approximate Gamma UCL (use when n>=50))	25.68			95% Adjusted Gamma UCL (use when n<50)			27.27
1028											
1029					Lognormal GOF Test						
1030				Shapiro Wilk Test Statistic	0.762			Shapiro Wilk Lognormal GOF Test			
1031				5% Shapiro Wilk Critical Value	0.881			Data Not Lognormal at 5% Significance Level			
1032				Lilliefors Test Statistic	0.319			Lilliefors Lognormal GOF Test			
1033				5% Lilliefors Critical Value	0.22			Data Not Lognormal at 5% Significance Level			
1034					Data Not Lognormal at 5% Significance Level						
1035											
1036					Lognormal Statistics						
1037				Minimum of Logged Data	1.548			Mean of logged Data			2.32
1038				Maximum of Logged Data	4.263			SD of logged Data			0.888
1039											
1040					Assuming Lognormal Distribution						
1041				95% H-UCL	27.8			90% Chebyshev (MVUE) UCL			25.41
1042				95% Chebyshev (MVUE) UCL	30.32			97.5% Chebyshev (MVUE) UCL			37.12
1043				99% Chebyshev (MVUE) UCL	50.49						
1044											
1045					Nonparametric Distribution Free UCL Statistics						
1046					Data do not follow a Discernible Distribution (0.05)						
1047											
1048					Nonparametric Distribution Free UCLs						
1049				95% CLT UCL	24.04			95% Jackknife UCL			24.61
1050				95% Standard Bootstrap UCL	23.87			95% Bootstrap-t UCL			32.36
1051				95% Hall's Bootstrap UCL	26.52			95% Percentile Bootstrap UCL			24.66
1052				95% BCA Bootstrap UCL	26.56						
1053				90% Chebyshev(Mean, Sd) UCL	30.67			95% Chebyshev(Mean, Sd) UCL			37.31
1054				97.5% Chebyshev(Mean, Sd) UCL	46.54			99% Chebyshev(Mean, Sd) UCL			64.65
1055											
1056					Suggested UCL to Use						
1057				95% Chebyshev (Mean, Sd) UCL	37.31						
1058											
1059					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
1060					Recommendations are based upon data size, data distribution, and skewness.						

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Barium

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	0
Minimum	48	Mean	130.5
Maximum	400	Median	120
SD	90.85	Std. Error of Mean	23.46
Coefficient of Variation	0.696	Skewness	2.029

Normal GOF Test

Shapiro Wilk Test Statistic	0.785	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.215	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	171.8	95% Adjusted-CLT UCL (Chen-1995)	182.2
		95% Modified-t UCL (Johnson-1978)	173.8

Gamma GOF Test

A-D Test Statistic	0.526	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.192	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.223	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.992	k star (bias corrected MLE)	2.438
Theta hat (MLE)	43.61	Theta star (bias corrected MLE)	53.52
nu hat (MLE)	89.75	nu star (bias corrected)	73.13
MLE Mean (bias corrected)	130.5	MLE Sd (bias corrected)	83.56
		Approximate Chi Square Value (0.05)	54.44
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	52.46

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	175.3	95% Adjusted Gamma UCL (use when n<50)	181.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.176	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.871	Mean of logged Data	4.695

1114				Maximum of Logged Data	5.991				SD of logged Data		0.591
1115											
1116					Assuming Lognormal Distribution						
1117				95% H-UCL	183.5				90% Chebyshev (MVUE) UCL		189.7
1118				95% Chebyshev (MVUE) UCL	217.4				97.5% Chebyshev (MVUE) UCL		255.9
1119				99% Chebyshev (MVUE) UCL	331.5						
1120											
1121					Nonparametric Distribution Free UCL Statistics						
1122					Data appear to follow a Discernible Distribution at 5% Significance Level						
1123											
1124					Nonparametric Distribution Free UCLs						
1125				95% CLT UCL	169				95% Jackknife UCL		171.8
1126				95% Standard Bootstrap UCL	168				95% Bootstrap-t UCL		201.3
1127				95% Hall's Bootstrap UCL	332				95% Percentile Bootstrap UCL		170.5
1128				95% BCA Bootstrap UCL	183.1						
1129				90% Chebyshev(Mean, Sd) UCL	200.8				95% Chebyshev(Mean, Sd) UCL		232.7
1130				97.5% Chebyshev(Mean, Sd) UCL	277				99% Chebyshev(Mean, Sd) UCL		363.9
1131											
1132					Suggested UCL to Use						
1133				95% Student's-t UCL	171.8						
1134											
1135					When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test						
1136					When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL						
1137											
1138					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
1139					Recommendations are based upon data size, data distribution, and skewness.						
1140					These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).						
1141					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.						
1142											
1143											
1144	Beryllium										
1145											
1146					General Statistics						
1147				Total Number of Observations	15				Number of Distinct Observations		13
1148									Number of Missing Observations		0
1149				Minimum	0.51				Mean		1.07
1150				Maximum	2.8				Median		0.88
1151				SD	0.623				Std. Error of Mean		0.161
1152				Coefficient of Variation	0.582				Skewness		1.981
1153											
1154					Normal GOF Test						
1155				Shapiro Wilk Test Statistic	0.752				Shapiro Wilk GOF Test		
1156				5% Shapiro Wilk Critical Value	0.881				Data Not Normal at 5% Significance Level		
1157				Lilliefors Test Statistic	0.322				Lilliefors GOF Test		
1158				5% Lilliefors Critical Value	0.22				Data Not Normal at 5% Significance Level		
1159					Data Not Normal at 5% Significance Level						
1160											
1161					Assuming Normal Distribution						
1162				95% Normal UCL					95% UCLs (Adjusted for Skewness)		
1163				95% Student's-t UCL	1.353				95% Adjusted-CLT UCL (Chen-1995)		1.422
1164									95% Modified-t UCL (Johnson-1978)		1.367
1165											
1166					Gamma GOF Test						

1167				A-D Test Statistic	0.913	Anderson-Darling Gamma GOF Test					
1168				5% A-D Critical Value	0.739	Data Not Gamma Distributed at 5% Significance Level					
1169				K-S Test Statistic	0.285	Kolmogorov-Smirnov Gamma GOF Test					
1170				5% K-S Critical Value	0.222	Data Not Gamma Distributed at 5% Significance Level					
1171				Data Not Gamma Distributed at 5% Significance Level							
1172											
1173				Gamma Statistics							
1174				k hat (MLE)	4.458	k star (bias corrected MLE)	3.611				
1175				Theta hat (MLE)	0.24	Theta star (bias corrected MLE)	0.296				
1176				nu hat (MLE)	133.8	nu star (bias corrected)	108.3				
1177				MLE Mean (bias corrected)	1.07	MLE Sd (bias corrected)	0.563				
1178						Approximate Chi Square Value (0.05)	85.31				
1179				Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	82.8				
1180											
1181				Assuming Gamma Distribution							
1182				95% Approximate Gamma UCL (use when n>=50))	1.359	95% Adjusted Gamma UCL (use when n<50)	1.4				
1183											
1184				Lognormal GOF Test							
1185				Shapiro Wilk Test Statistic	0.903	Shapiro Wilk Lognormal GOF Test					
1186				5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level					
1187				Lilliefors Test Statistic	0.254	Lilliefors Lognormal GOF Test					
1188				5% Lilliefors Critical Value	0.22	Data Not Lognormal at 5% Significance Level					
1189				Data appear Approximate Lognormal at 5% Significance Level							
1190											
1191				Lognormal Statistics							
1192				Minimum of Logged Data	-0.673	Mean of logged Data	-0.0487				
1193				Maximum of Logged Data	1.03	SD of logged Data	0.467				
1194											
1195				Assuming Lognormal Distribution							
1196				95% H-UCL	1.369	90% Chebyshev (MVUE) UCL	1.445				
1197				95% Chebyshev (MVUE) UCL	1.622	97.5% Chebyshev (MVUE) UCL	1.868				
1198				99% Chebyshev (MVUE) UCL	2.351						
1199											
1200				Nonparametric Distribution Free UCL Statistics							
1201				Data appear to follow a Discernible Distribution at 5% Significance Level							
1202											
1203				Nonparametric Distribution Free UCLs							
1204				95% CLT UCL	1.335	95% Jackknife UCL	1.353				
1205				95% Standard Bootstrap UCL	1.32	95% Bootstrap-t UCL	1.674				
1206				95% Hall's Bootstrap UCL	2.616	95% Percentile Bootstrap UCL	1.333				
1207				95% BCA Bootstrap UCL	1.405						
1208				90% Chebyshev(Mean, Sd) UCL	1.552	95% Chebyshev(Mean, Sd) UCL	1.771				
1209				97.5% Chebyshev(Mean, Sd) UCL	2.074	99% Chebyshev(Mean, Sd) UCL	2.67				
1210											
1211				Suggested UCL to Use							
1212				95% Student's-t UCL	1.353	or 95% Modified-t UCL	1.367				
1213				or 95% H-UCL	1.369						
1214											
1215				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
1216				Recommendations are based upon data size, data distribution, and skewness.							
1217				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
1218				However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
1219											

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.

Cadmium

General Statistics

Total Number of Observations	15	Number of Distinct Observations	13
		Number of Missing Observations	0
Minimum	0.29	Mean	2.267
Maximum	13	Median	0.64
SD	3.502	Std. Error of Mean	0.904
Coefficient of Variation	1.545	Skewness	2.392

Normal GOF Test

Shapiro Wilk Test Statistic	0.619	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.377	Lilliefors GOF Test
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	3.859	95% Adjusted-CLT UCL (Chen-1995)	4.351
		95% Modified-t UCL (Johnson-1978)	3.952

Gamma GOF Test

A-D Test Statistic	1.621	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.777	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.319	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.231	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.728	k star (bias corrected MLE)	0.627
Theta hat (MLE)	3.113	Theta star (bias corrected MLE)	3.616
nu hat (MLE)	21.84	nu star (bias corrected)	18.81
MLE Mean (bias corrected)	2.267	MLE Sd (bias corrected)	2.863
		Approximate Chi Square Value (0.05)	9.977
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	9.193

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4.273	95% Adjusted Gamma UCL (use when n<50)	4.637

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.828	Shapiro Wilk Lognormal GOF Test
5% Shapiro Wilk Critical Value	0.881	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.238	Lilliefors Lognormal GOF Test
5% Lilliefors Critical Value	0.22	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

	A	B	C	D	E	F	G	H	I	J	K	L
1273	Lognormal Statistics											
1274					Minimum of Logged Data	-1.238				Mean of logged Data		-0.00722
1275					Maximum of Logged Data	2.565				SD of logged Data		1.224
1276												
1277	Assuming Lognormal Distribution											
1278					95% H-UCL	5.829				90% Chebyshev (MVUE) UCL		4.006
1279					95% Chebyshev (MVUE) UCL	4.94				97.5% Chebyshev (MVUE) UCL		6.236
1280					99% Chebyshev (MVUE) UCL	8.782						
1281												
1282	Nonparametric Distribution Free UCL Statistics											
1283	Data do not follow a Discernible Distribution (0.05)											
1284												
1285	Nonparametric Distribution Free UCLs											
1286					95% CLT UCL	3.754				95% Jackknife UCL		3.859
1287					95% Standard Bootstrap UCL	3.71				95% Bootstrap-t UCL		5.532
1288					95% Hall's Bootstrap UCL	4.89				95% Percentile Bootstrap UCL		3.719
1289					95% BCA Bootstrap UCL	4.449						
1290					90% Chebyshev(Mean, Sd) UCL	4.979				95% Chebyshev(Mean, Sd) UCL		6.208
1291					97.5% Chebyshev(Mean, Sd) UCL	7.913				99% Chebyshev(Mean, Sd) UCL		11.26
1292												
1293	Suggested UCL to Use											
1294					95% Chebyshev (Mean, Sd) UCL	6.208						
1295												
1296	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1297	Recommendations are based upon data size, data distribution, and skewness.											
1298	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1299	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1300												
1301												
1302	Chromium											
1303												
1304	General Statistics											
1305					Total Number of Observations	15				Number of Distinct Observations		13
1306										Number of Missing Observations		0
1307					Minimum	23				Mean		330.6
1308					Maximum	1500				Median		53
1309					SD	537.3				Std. Error of Mean		138.7
1310					Coefficient of Variation	1.625				Skewness		1.681
1311												
1312	Normal GOF Test											
1313					Shapiro Wilk Test Statistic	0.613				Shapiro Wilk GOF Test		
1314					5% Shapiro Wilk Critical Value	0.881				Data Not Normal at 5% Significance Level		
1315					Lilliefors Test Statistic	0.423				Lilliefors GOF Test		
1316					5% Lilliefors Critical Value	0.22				Data Not Normal at 5% Significance Level		
1317	Data Not Normal at 5% Significance Level											
1318												
1319	Assuming Normal Distribution											
1320					95% Normal UCL					95% UCLs (Adjusted for Skewness)		
1321					95% Student's-t UCL	574.9				95% Adjusted-CLT UCL (Chen-1995)		623.1
1322										95% Modified-t UCL (Johnson-1978)		585
1323												
1324	Gamma GOF Test											
1325					A-D Test Statistic	2.051				Anderson-Darling Gamma GOF Test		

1326				5% A-D Critical Value	0.792	Data Not Gamma Distributed at 5% Significance Level					
1327				K-S Test Statistic	0.403	Kolmogorov-Smirnov Gamma GOF Test					
1328				5% K-S Critical Value	0.234	Data Not Gamma Distributed at 5% Significance Level					
1329				Data Not Gamma Distributed at 5% Significance Level							
1330											
1331				Gamma Statistics							
1332				k hat (MLE)	0.519	k star (bias corrected MLE)	0.46				
1333				Theta hat (MLE)	636.6	Theta star (bias corrected MLE)	718.9				
1334				nu hat (MLE)	15.58	nu star (bias corrected)	13.8				
1335				MLE Mean (bias corrected)	330.6	MLE Sd (bias corrected)	487.5				
1336						Approximate Chi Square Value (0.05)	6.432				
1337				Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	5.823				
1338											
1339				Assuming Gamma Distribution							
1340				95% Approximate Gamma UCL (use when n>=50))	709.1	95% Adjusted Gamma UCL (use when n<50)	783.3				
1341											
1342				Lognormal GOF Test							
1343				Shapiro Wilk Test Statistic	0.776	Shapiro Wilk Lognormal GOF Test					
1344				5% Shapiro Wilk Critical Value	0.881	Data Not Lognormal at 5% Significance Level					
1345				Lilliefors Test Statistic	0.343	Lilliefors Lognormal GOF Test					
1346				5% Lilliefors Critical Value	0.22	Data Not Lognormal at 5% Significance Level					
1347				Data Not Lognormal at 5% Significance Level							
1348											
1349				Lognormal Statistics							
1350				Minimum of Logged Data	3.135	Mean of logged Data	4.585				
1351				Maximum of Logged Data	7.313	SD of logged Data	1.523				
1352											
1353				Assuming Lognormal Distribution							
1354				95% H-UCL	1383	90% Chebyshev (MVUE) UCL	637.4				
1355				95% Chebyshev (MVUE) UCL	803.2	97.5% Chebyshev (MVUE) UCL	1033				
1356				99% Chebyshev (MVUE) UCL	1485						
1357											
1358				Nonparametric Distribution Free UCL Statistics							
1359				Data do not follow a Discernible Distribution (0.05)							
1360											
1361				Nonparametric Distribution Free UCLs							
1362				95% CLT UCL	558.8	95% Jackknife UCL	574.9				
1363				95% Standard Bootstrap UCL	551.8	95% Bootstrap-t UCL	742				
1364				95% Hall's Bootstrap UCL	565.8	95% Percentile Bootstrap UCL	558.4				
1365				95% BCA Bootstrap UCL	616						
1366				90% Chebyshev(Mean, Sd) UCL	746.8	95% Chebyshev(Mean, Sd) UCL	935.3				
1367				97.5% Chebyshev(Mean, Sd) UCL	1197	99% Chebyshev(Mean, Sd) UCL	1711				
1368											
1369				Suggested UCL to Use							
1370				99% Chebyshev (Mean, Sd) UCL	1711						
1371											
1372				Recommended UCL exceeds the maximum observation							
1373											
1374				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
1375				Recommendations are based upon data size, data distribution, and skewness.							
1376				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
1377				However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
1378											

1379											
1380	Copper										
1381											
1382					General Statistics						
1383				Total Number of Observations	15			Number of Distinct Observations		14	
1384								Number of Missing Observations		0	
1385				Minimum	41			Mean		156.7	
1386				Maximum	640			Median		110	
1387				SD	156			Std. Error of Mean		40.29	
1388				Coefficient of Variation	0.996			Skewness		2.393	
1389											
1390					Normal GOF Test						
1391				Shapiro Wilk Test Statistic	0.711			Shapiro Wilk GOF Test			
1392				5% Shapiro Wilk Critical Value	0.881			Data Not Normal at 5% Significance Level			
1393				Lilliefors Test Statistic	0.276			Lilliefors GOF Test			
1394				5% Lilliefors Critical Value	0.22			Data Not Normal at 5% Significance Level			
1395					Data Not Normal at 5% Significance Level						
1396											
1397					Assuming Normal Distribution						
1398				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
1399				95% Student's-t UCL	227.6			95% Adjusted-CLT UCL (Chen-1995)		249.5	
1400								95% Modified-t UCL (Johnson-1978)		231.8	
1401											
1402					Gamma GOF Test						
1403				A-D Test Statistic	0.626			Anderson-Darling Gamma GOF Test			
1404				5% A-D Critical Value	0.751			Detected data appear Gamma Distributed at 5% Significance Level			
1405				K-S Test Statistic	0.186			Kolmogorov-Smirnov Gamma GOF Test			
1406				5% K-S Critical Value	0.225			Detected data appear Gamma Distributed at 5% Significance Level			
1407					Detected data appear Gamma Distributed at 5% Significance Level						
1408											
1409					Gamma Statistics						
1410				k hat (MLE)	1.679			k star (bias corrected MLE)		1.387	
1411				Theta hat (MLE)	93.32			Theta star (bias corrected MLE)		112.9	
1412				nu hat (MLE)	50.36			nu star (bias corrected)		41.62	
1413				MLE Mean (bias corrected)	156.7			MLE Sd (bias corrected)		133	
1414								Approximate Chi Square Value (0.05)		27.84	
1415				Adjusted Level of Significance	0.0324			Adjusted Chi Square Value		26.45	
1416											
1417					Assuming Gamma Distribution						
1418				95% Approximate Gamma UCL (use when n>=50)	234.3			95% Adjusted Gamma UCL (use when n<50)		246.5	
1419											
1420					Lognormal GOF Test						
1421				Shapiro Wilk Test Statistic	0.935			Shapiro Wilk Lognormal GOF Test			
1422				5% Shapiro Wilk Critical Value	0.881			Data appear Lognormal at 5% Significance Level			
1423				Lilliefors Test Statistic	0.164			Lilliefors Lognormal GOF Test			
1424				5% Lilliefors Critical Value	0.22			Data appear Lognormal at 5% Significance Level			
1425					Data appear Lognormal at 5% Significance Level						
1426											
1427					Lognormal Statistics						
1428				Minimum of Logged Data	3.714			Mean of logged Data		4.728	
1429				Maximum of Logged Data	6.461			SD of logged Data		0.79	
1430											
1431					Assuming Lognormal Distribution						

1432				95% H-UCL	257.8			90% Chebyshev (MVUE) UCL		248.6	
1433				95% Chebyshev (MVUE) UCL	293			97.5% Chebyshev (MVUE) UCL		354.7	
1434				99% Chebyshev (MVUE) UCL	475.8						
1435											
1436				Nonparametric Distribution Free UCL Statistics							
1437				Data appear to follow a Discernible Distribution at 5% Significance Level							
1438											
1439				Nonparametric Distribution Free UCLs							
1440				95% CLT UCL	222.9			95% Jackknife UCL		227.6	
1441				95% Standard Bootstrap UCL	222			95% Bootstrap-t UCL		292.5	
1442				95% Hall's Bootstrap UCL	467.8			95% Percentile Bootstrap UCL		226.4	
1443				95% BCA Bootstrap UCL	253.7						
1444				90% Chebyshev(Mean, Sd) UCL	277.5			95% Chebyshev(Mean, Sd) UCL		332.3	
1445				97.5% Chebyshev(Mean, Sd) UCL	408.3			99% Chebyshev(Mean, Sd) UCL		557.5	
1446											
1447				Suggested UCL to Use							
1448				95% Adjusted Gamma UCL	246.5						
1449											
1450	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
1451	Recommendations are based upon data size, data distribution, and skewness.										
1452	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
1453	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
1454											
1455											
1456	Lead										
1457											
1458				General Statistics							
1459				Total Number of Observations	15			Number of Distinct Observations		13	
1460								Number of Missing Observations		0	
1461				Minimum	26			Mean		411.3	
1462				Maximum	2300			Median		91	
1463				SD	685			Std. Error of Mean		176.9	
1464				Coefficient of Variation	1.666			Skewness		2.085	
1465											
1466				Normal GOF Test							
1467				Shapiro Wilk Test Statistic	0.617			Shapiro Wilk GOF Test			
1468				5% Shapiro Wilk Critical Value	0.881			Data Not Normal at 5% Significance Level			
1469				Lilliefors Test Statistic	0.403			Lilliefors GOF Test			
1470				5% Lilliefors Critical Value	0.22			Data Not Normal at 5% Significance Level			
1471				Data Not Normal at 5% Significance Level							
1472											
1473				Assuming Normal Distribution							
1474				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
1475				95% Student's-t UCL	722.8			95% Adjusted-CLT UCL (Chen-1995)		804	
1476								95% Modified-t UCL (Johnson-1978)		738.7	
1477											
1478				Gamma GOF Test							
1479				A-D Test Statistic	1.725			Anderson-Darling Gamma GOF Test			
1480				5% A-D Critical Value	0.787			Data Not Gamma Distributed at 5% Significance Level			
1481				K-S Test Statistic	0.373			Kolmogorov-Smirnov Gamma GOF Test			
1482				5% K-S Critical Value	0.233			Data Not Gamma Distributed at 5% Significance Level			
1483				Data Not Gamma Distributed at 5% Significance Level							
1484											

	A	B	C	D	E	F	G	H	I	J	K	L
1485	Gamma Statistics											
1486					k hat (MLE)	0.579			k star (bias corrected MLE)			0.508
1487					Theta hat (MLE)	710.2			Theta star (bias corrected MLE)			810.1
1488					nu hat (MLE)	17.37			nu star (bias corrected)			15.23
1489					MLE Mean (bias corrected)	411.3			MLE Sd (bias corrected)			577.2
1490									Approximate Chi Square Value (0.05)			7.423
1491					Adjusted Level of Significance	0.0324			Adjusted Chi Square Value			6.761
1492												
1493	Assuming Gamma Distribution											
1494			95% Approximate Gamma UCL (use when n>=50))			843.9			95% Adjusted Gamma UCL (use when n<50)			926.5
1495												
1496	Lognormal GOF Test											
1497					Shapiro Wilk Test Statistic	0.841			Shapiro Wilk Lognormal GOF Test			
1498					5% Shapiro Wilk Critical Value	0.881			Data Not Lognormal at 5% Significance Level			
1499					Lilliefors Test Statistic	0.303			Lilliefors Lognormal GOF Test			
1500					5% Lilliefors Critical Value	0.22			Data Not Lognormal at 5% Significance Level			
1501	Data Not Lognormal at 5% Significance Level											
1502												
1503	Lognormal Statistics											
1504					Minimum of Logged Data	3.258			Mean of logged Data			4.947
1505					Maximum of Logged Data	7.741			SD of logged Data			1.409
1506												
1507	Assuming Lognormal Distribution											
1508					95% H-UCL	1390			90% Chebyshev (MVUE) UCL			758.8
1509					95% Chebyshev (MVUE) UCL	949			97.5% Chebyshev (MVUE) UCL			1213
1510					99% Chebyshev (MVUE) UCL	1731						
1511												
1512	Nonparametric Distribution Free UCL Statistics											
1513	Data do not follow a Discernible Distribution (0.05)											
1514												
1515	Nonparametric Distribution Free UCLs											
1516					95% CLT UCL	702.2			95% Jackknife UCL			722.8
1517					95% Standard Bootstrap UCL	679.1			95% Bootstrap-t UCL			1090
1518					95% Hall's Bootstrap UCL	856.5			95% Percentile Bootstrap UCL			719.1
1519					95% BCA Bootstrap UCL	790.9						
1520					90% Chebyshev(Mean, Sd) UCL	941.9			95% Chebyshev(Mean, Sd) UCL			1182
1521					97.5% Chebyshev(Mean, Sd) UCL	1516			99% Chebyshev(Mean, Sd) UCL			2171
1522												
1523	Suggested UCL to Use											
1524					95% Chebyshev (Mean, Sd) UCL	1182						
1525												
1526	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1527	Recommendations are based upon data size, data distribution, and skewness.											
1528	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1529	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1530												
1531												
1532	Manganese											
1533												
1534	General Statistics											
1535					Total Number of Observations	15			Number of Distinct Observations			15
1536									Number of Missing Observations			0
1537					Minimum	270			Mean			936

1538				Maximum	4200				Median	580	
1539				SD	991.6				Std. Error of Mean	256	
1540				Coefficient of Variation	1.059				Skewness	2.876	
1541											
1542				Normal GOF Test							
1543				Shapiro Wilk Test Statistic	0.627	Shapiro Wilk GOF Test					
1544				5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level					
1545				Lilliefors Test Statistic	0.28	Lilliefors GOF Test					
1546				5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level					
1547				Data Not Normal at 5% Significance Level							
1548											
1549				Assuming Normal Distribution							
1550				95% Normal UCL		95% UCLs (Adjusted for Skewness)					
1551				95% Student's-t UCL	1387	95% Adjusted-CLT UCL (Chen-1995)	1560				
1552						95% Modified-t UCL (Johnson-1978)	1419				
1553											
1554				Gamma GOF Test							
1555				A-D Test Statistic	0.929	Anderson-Darling Gamma GOF Test					
1556				5% A-D Critical Value	0.75	Data Not Gamma Distributed at 5% Significance Level					
1557				K-S Test Statistic	0.246	Kolmogorov-Smirnov Gamma GOF Test					
1558				5% K-S Critical Value	0.225	Data Not Gamma Distributed at 5% Significance Level					
1559				Data Not Gamma Distributed at 5% Significance Level							
1560											
1561				Gamma Statistics							
1562				k hat (MLE)	1.787	k star (bias corrected MLE)	1.474				
1563				Theta hat (MLE)	523.8	Theta star (bias corrected MLE)	635				
1564				nu hat (MLE)	53.61	nu star (bias corrected)	44.22				
1565				MLE Mean (bias corrected)	936	MLE Sd (bias corrected)	771				
1566						Approximate Chi Square Value (0.05)	29.97				
1567				Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	28.53				
1568											
1569				Assuming Gamma Distribution							
1570				95% Approximate Gamma UCL (use when n>=50))	1381	95% Adjusted Gamma UCL (use when n<50)	1451				
1571											
1572				Lognormal GOF Test							
1573				Shapiro Wilk Test Statistic	0.913	Shapiro Wilk Lognormal GOF Test					
1574				5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level					
1575				Lilliefors Test Statistic	0.199	Lilliefors Lognormal GOF Test					
1576				5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level					
1577				Data appear Lognormal at 5% Significance Level							
1578											
1579				Lognormal Statistics							
1580				Minimum of Logged Data	5.598	Mean of logged Data	6.536				
1581				Maximum of Logged Data	8.343	SD of logged Data	0.727				
1582											
1583				Assuming Lognormal Distribution							
1584				95% H-UCL	1417	90% Chebyshev (MVUE) UCL	1404				
1585				95% Chebyshev (MVUE) UCL	1641	97.5% Chebyshev (MVUE) UCL	1970				
1586				99% Chebyshev (MVUE) UCL	2618						
1587											
1588				Nonparametric Distribution Free UCL Statistics							
1589				Data appear to follow a Discernible Distribution at 5% Significance Level							
1590											

1591	Nonparametric Distribution Free UCLs										
1592				95% CLT UCL	1357			95% Jackknife UCL	1387		
1593				95% Standard Bootstrap UCL	1340			95% Bootstrap-t UCL	2015		
1594				95% Hall's Bootstrap UCL	2869			95% Percentile Bootstrap UCL	1375		
1595				95% BCA Bootstrap UCL	1651						
1596				90% Chebyshev(Mean, Sd) UCL	1704			95% Chebyshev(Mean, Sd) UCL	2052		
1597				97.5% Chebyshev(Mean, Sd) UCL	2535			99% Chebyshev(Mean, Sd) UCL	3484		
1598											
1599	Suggested UCL to Use										
1600				95% H-UCL	1417						
1601											
1602	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
1603	Recommendations are based upon data size, data distribution, and skewness.										
1604	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
1605	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
1606											
1607	ProUCL computes and outputs H-statistic based UCLs for historical reasons only.										
1608	H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.										
1609	It is therefore recommended to avoid the use of H-statistic based 95% UCLs.										
1610	Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.										
1611											
1612											
1613	Nickel										
1614											
1615	General Statistics										
1616				Total Number of Observations	15			Number of Distinct Observations	13		
1617								Number of Missing Observations	0		
1618				Minimum	21			Mean	52.6		
1619				Maximum	140			Median	30		
1620				SD	38.03			Std. Error of Mean	9.818		
1621				Coefficient of Variation	0.723			Skewness	1.301		
1622											
1623	Normal GOF Test										
1624				Shapiro Wilk Test Statistic	0.789			Shapiro Wilk GOF Test			
1625				5% Shapiro Wilk Critical Value	0.881			Data Not Normal at 5% Significance Level			
1626				Lilliefors Test Statistic	0.315			Lilliefors GOF Test			
1627				5% Lilliefors Critical Value	0.22			Data Not Normal at 5% Significance Level			
1628	Data Not Normal at 5% Significance Level										
1629											
1630	Assuming Normal Distribution										
1631				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
1632				95% Student's-t UCL	69.89			95% Adjusted-CLT UCL (Chen-1995)	72.27		
1633								95% Modified-t UCL (Johnson-1978)	70.44		
1634											
1635	Gamma GOF Test										
1636				A-D Test Statistic	1.111			Anderson-Darling Gamma GOF Test			
1637				5% A-D Critical Value	0.746			Data Not Gamma Distributed at 5% Significance Level			
1638				K-S Test Statistic	0.311			Kolmogorov-Smirnov Gamma GOF Test			
1639				5% K-S Critical Value	0.224			Data Not Gamma Distributed at 5% Significance Level			
1640	Data Not Gamma Distributed at 5% Significance Level										
1641											
1642	Gamma Statistics										
1643				k hat (MLE)	2.549			k star (bias corrected MLE)	2.083		

1644				Theta hat (MLE)	20.64			Theta star (bias corrected MLE)			25.25
1645				nu hat (MLE)	76.46			nu star (bias corrected)			62.5
1646				MLE Mean (bias corrected)	52.6			MLE Sd (bias corrected)			36.44
1647								Approximate Chi Square Value (0.05)			45.31
1648				Adjusted Level of Significance	0.0324			Adjusted Chi Square Value			43.52
1649											
1650					Assuming Gamma Distribution						
1651			95% Approximate Gamma UCL (use when n>=50))		72.55			95% Adjusted Gamma UCL (use when n<50)			75.55
1652											
1653					Lognormal GOF Test						
1654				Shapiro Wilk Test Statistic	0.858			Shapiro Wilk Lognormal GOF Test			
1655				5% Shapiro Wilk Critical Value	0.881			Data Not Lognormal at 5% Significance Level			
1656				Lilliefors Test Statistic	0.291			Lilliefors Lognormal GOF Test			
1657				5% Lilliefors Critical Value	0.22			Data Not Lognormal at 5% Significance Level			
1658					Data Not Lognormal at 5% Significance Level						
1659											
1660					Lognormal Statistics						
1661				Minimum of Logged Data	3.045			Mean of logged Data			3.754
1662				Maximum of Logged Data	4.942			SD of logged Data			0.643
1663											
1664					Assuming Lognormal Distribution						
1665				95% H-UCL	77.04			90% Chebyshev (MVUE) UCL			78.58
1666				95% Chebyshev (MVUE) UCL	90.77			97.5% Chebyshev (MVUE) UCL			107.7
1667				99% Chebyshev (MVUE) UCL	140.9						
1668											
1669					Nonparametric Distribution Free UCL Statistics						
1670					Data do not follow a Discernible Distribution (0.05)						
1671											
1672					Nonparametric Distribution Free UCLs						
1673				95% CLT UCL	68.75			95% Jackknife UCL			69.89
1674				95% Standard Bootstrap UCL	68.24			95% Bootstrap-t UCL			77.05
1675				95% Hall's Bootstrap UCL	74.29			95% Percentile Bootstrap UCL			69.53
1676				95% BCA Bootstrap UCL	72						
1677				90% Chebyshev(Mean, Sd) UCL	82.05			95% Chebyshev(Mean, Sd) UCL			95.4
1678				97.5% Chebyshev(Mean, Sd) UCL	113.9			99% Chebyshev(Mean, Sd) UCL			150.3
1679											
1680					Suggested UCL to Use						
1681				95% Chebyshev (Mean, Sd) UCL	95.4						
1682											
1683					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
1684					Recommendations are based upon data size, data distribution, and skewness.						
1685					These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).						
1686					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.						
1687											
1688	Selenium										
1689											
1690					General Statistics						
1691				Total Number of Observations	15			Number of Distinct Observations			14
1692				Number of Detects	13			Number of Non-Detects			2
1693				Number of Distinct Detects	12			Number of Distinct Non-Detects			2
1694				Minimum Detect	0.48			Minimum Non-Detect			1.4
1695				Maximum Detect	9.3			Maximum Non-Detect			1.5
1696				Variance Detects	8.937			Percent Non-Detects			13.33%

1697				Mean Detects	2.8				SD Detects	2.989	
1698				Median Detects	1.2				CV Detects	1.068	
1699				Skewness Detects	1.355				Kurtosis Detects	0.526	
1700				Mean of Logged Detects	0.548				SD of Logged Detects	0.99	
1701											
1702				Normal GOF Test on Detects Only							
1703				Shapiro Wilk Test Statistic	0.746	Shapiro Wilk GOF Test					
1704				5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level					
1705				Lilliefors Test Statistic	0.323	Lilliefors GOF Test					
1706				5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level					
1707				Detected Data Not Normal at 5% Significance Level							
1708											
1709				Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs							
1710				KM Mean	2.55	KM Standard Error of Mean	0.74				
1711				KM SD	2.75	95% KM (BCA) UCL	3.709				
1712				95% KM (t) UCL	3.853	95% KM (Percentile Bootstrap) UCL	3.761				
1713				95% KM (z) UCL	3.767	95% KM Bootstrap t UCL	4.505				
1714				90% KM Chebyshev UCL	4.769	95% KM Chebyshev UCL	5.774				
1715				97.5% KM Chebyshev UCL	7.169	99% KM Chebyshev UCL	9.909				
1716											
1717				Gamma GOF Tests on Detected Observations Only							
1718				A-D Test Statistic	1.028	Anderson-Darling GOF Test					
1719				5% A-D Critical Value	0.755	Detected Data Not Gamma Distributed at 5% Significance Level					
1720				K-S Test Statistic	0.3	Kolmogorov-Smirnov GOF					
1721				5% K-S Critical Value	0.242	Detected Data Not Gamma Distributed at 5% Significance Level					
1722				Detected Data Not Gamma Distributed at 5% Significance Level							
1723											
1724				Gamma Statistics on Detected Data Only							
1725				k hat (MLE)	1.178	k star (bias corrected MLE)	0.957				
1726				Theta hat (MLE)	2.377	Theta star (bias corrected MLE)	2.925				
1727				nu hat (MLE)	30.62	nu star (bias corrected)	24.89				
1728				Mean (detects)	2.8						
1729											
1730				Gamma ROS Statistics using Imputed Non-Detects							
1731				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
1732				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
1733				For such situations, GROS method may yield incorrect values of UCLs and BTVs							
1734				This is especially true when the sample size is small.							
1735				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
1736				Minimum	0.48	Mean	2.535				
1737				Maximum	9.3	Median	1.1				
1738				SD	2.855	CV	1.126				
1739				k hat (MLE)	1.175	k star (bias corrected MLE)	0.984				
1740				Theta hat (MLE)	2.157	Theta star (bias corrected MLE)	2.575				
1741				nu hat (MLE)	35.25	nu star (bias corrected)	29.53				
1742				Adjusted Level of Significance (β)	0.0324						
1743				Approximate Chi Square Value (29.53, α)	18.13	Adjusted Chi Square Value (29.53, β)	17.03				
1744				95% Gamma Approximate UCL (use when n>=50)	4.13	95% Gamma Adjusted UCL (use when n<50)	4.396				
1745											
1746				Estimates of Gamma Parameters using KM Estimates							
1747				Mean (KM)	2.55	SD (KM)	2.75				
1748				Variance (KM)	7.564	SE of Mean (KM)	0.74				
1749				k hat (KM)	0.86	k star (KM)	0.732				

1750				nu hat (KM)	25.79				nu star (KM)	21.97	
1751				theta hat (KM)	2.966				theta star (KM)	3.483	
1752				80% gamma percentile (KM)	4.185				90% gamma percentile (KM)	6.333	
1753				95% gamma percentile (KM)	8.54				99% gamma percentile (KM)	13.79	
1754											
1755				Gamma Kaplan-Meier (KM) Statistics							
1756				Approximate Chi Square Value (21.97, α)	12.31				Adjusted Chi Square Value (21.97, β)	11.43	
1757				95% Gamma Approximate KM-UCL (use when n>=50)	4.549				95% Gamma Adjusted KM-UCL (use when n<50)	4.901	
1758											
1759				Lognormal GOF Test on Detected Observations Only							
1760				Shapiro Wilk Test Statistic	0.884				Shapiro Wilk GOF Test		
1761				5% Shapiro Wilk Critical Value	0.866				Detected Data appear Lognormal at 5% Significance Level		
1762				Lilliefors Test Statistic	0.26				Lilliefors GOF Test		
1763				5% Lilliefors Critical Value	0.234				Detected Data Not Lognormal at 5% Significance Level		
1764				Detected Data appear Approximate Lognormal at 5% Significance Level							
1765											
1766				Lognormal ROS Statistics Using Imputed Non-Detects							
1767				Mean in Original Scale	2.562				Mean in Log Scale	0.477	
1768				SD in Original Scale	2.838				SD in Log Scale	0.936	
1769				95% t UCL (assumes normality of ROS data)	3.852				95% Percentile Bootstrap UCL	3.751	
1770				95% BCA Bootstrap UCL	3.991				95% Bootstrap t UCL	4.498	
1771				95% H-UCL (Log ROS)	4.837						
1772											
1773				Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution							
1774				KM Mean (logged)	0.459				KM Geo Mean	1.583	
1775				KM SD (logged)	0.922				95% Critical H Value (KM-Log)	2.622	
1776				KM Standard Error of Mean (logged)	0.25				95% H-UCL (KM -Log)	4.616	
1777				KM SD (logged)	0.922				95% Critical H Value (KM-Log)	2.622	
1778				KM Standard Error of Mean (logged)	0.25						
1779											
1780				DL/2 Statistics							
1781				DL/2 Normal					DL/2 Log-Transformed		
1782				Mean in Original Scale	2.523				Mean in Log Scale	0.432	
1783				SD in Original Scale	2.862				SD in Log Scale	0.967	
1784				95% t UCL (Assumes normality)	3.825				95% H-Stat UCL	4.928	
1785				DL/2 is not a recommended method, provided for comparisons and historical reasons							
1786											
1787				Nonparametric Distribution Free UCL Statistics							
1788				Detected Data appear Approximate Lognormal Distributed at 5% Significance Level							
1789											
1790				Suggested UCL to Use							
1791				KM H-UCL	4.616						
1792											
1793				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
1794				Recommendations are based upon data size, data distribution, and skewness.							
1795				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
1796				However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
1797											
1798	Silver										
1799											
1800				General Statistics							
1801				Total Number of Observations	15				Number of Distinct Observations	14	
1802				Number of Detects	10				Number of Non-Detects	5	

1803				Number of Distinct Detects	10			Number of Distinct Non-Detects	5		
1804				Minimum Detect	0.2			Minimum Non-Detect	0.46		
1805				Maximum Detect	18			Maximum Non-Detect	0.71		
1806				Variance Detects	34.16			Percent Non-Detects	33.33%		
1807				Mean Detects	3.572			SD Detects	5.844		
1808				Median Detects	0.435			CV Detects	1.636		
1809				Skewness Detects	2.067			Kurtosis Detects	4.083		
1810				Mean of Logged Detects	0.0213			SD of Logged Detects	1.665		
1811											
1812				Normal GOF Test on Detects Only							
1813				Shapiro Wilk Test Statistic	0.666			Shapiro Wilk GOF Test			
1814				5% Shapiro Wilk Critical Value	0.842			Detected Data Not Normal at 5% Significance Level			
1815				Lilliefors Test Statistic	0.313			Lilliefors GOF Test			
1816				5% Lilliefors Critical Value	0.262			Detected Data Not Normal at 5% Significance Level			
1817				Detected Data Not Normal at 5% Significance Level							
1818											
1819				Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs							
1820				KM Mean	2.485			KM Standard Error of Mean	1.301		
1821				KM SD	4.781			95% KM (BCA) UCL	4.733		
1822				95% KM (t) UCL	4.777			95% KM (Percentile Bootstrap) UCL	4.581		
1823				95% KM (z) UCL	4.626			95% KM Bootstrap t UCL	9.941		
1824				90% KM Chebyshev UCL	6.389			95% KM Chebyshev UCL	8.158		
1825				97.5% KM Chebyshev UCL	10.61			99% KM Chebyshev UCL	15.43		
1826											
1827				Gamma GOF Tests on Detected Observations Only							
1828				A-D Test Statistic	0.911			Anderson-Darling GOF Test			
1829				5% A-D Critical Value	0.776			Detected Data Not Gamma Distributed at 5% Significance Level			
1830				K-S Test Statistic	0.323			Kolmogorov-Smirnov GOF			
1831				5% K-S Critical Value	0.281			Detected Data Not Gamma Distributed at 5% Significance Level			
1832				Detected Data Not Gamma Distributed at 5% Significance Level							
1833											
1834				Gamma Statistics on Detected Data Only							
1835				k hat (MLE)	0.506			k star (bias corrected MLE)	0.421		
1836				Theta hat (MLE)	7.054			Theta star (bias corrected MLE)	8.482		
1837				nu hat (MLE)	10.13			nu star (bias corrected)	8.423		
1838				Mean (detects)	3.572						
1839											
1840				Gamma ROS Statistics using Imputed Non-Detects							
1841				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
1842				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
1843				For such situations, GROS method may yield incorrect values of UCLs and BTVs							
1844				This is especially true when the sample size is small.							
1845				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
1846				Minimum	0.01			Mean	2.385		
1847				Maximum	18			Median	0.28		
1848				SD	4.998			CV	2.096		
1849				k hat (MLE)	0.29			k star (bias corrected MLE)	0.277		
1850				Theta hat (MLE)	8.22			Theta star (bias corrected MLE)	8.623		
1851				nu hat (MLE)	8.703			nu star (bias corrected)	8.296		
1852				Adjusted Level of Significance (β)	0.0324						
1853				Approximate Chi Square Value (8.30, α)	2.908			Adjusted Chi Square Value (8.30, β)	2.529		
1854				95% Gamma Approximate UCL (use when n>=50)	6.804			95% Gamma Adjusted UCL (use when n<50)	7.823		
1855											

	A	B	C	D	E	F	G	H	I	J	K	L
1856	Estimates of Gamma Parameters using KM Estimates											
1857					Mean (KM)	2.485				SD (KM)		4.781
1858					Variance (KM)	22.86				SE of Mean (KM)		1.301
1859					k hat (KM)	0.27				k star (KM)		0.261
1860					nu hat (KM)	8.105				nu star (KM)		7.817
1861					theta hat (KM)	9.199				theta star (KM)		9.537
1862					80% gamma percentile (KM)	3.661				90% gamma percentile (KM)		7.435
1863					95% gamma percentile (KM)	11.88				99% gamma percentile (KM)		23.64
1864												
1865	Gamma Kaplan-Meier (KM) Statistics											
1866					Approximate Chi Square Value (7.82, α)	2.629				Adjusted Chi Square Value (7.82, β)		2.274
1867					95% Gamma Approximate KM-UCL (use when n>=50)	7.388				95% Gamma Adjusted KM-UCL (use when n<50)		8.544
1868												
1869	Lognormal GOF Test on Detected Observations Only											
1870					Shapiro Wilk Test Statistic	0.85				Shapiro Wilk GOF Test		
1871					5% Shapiro Wilk Critical Value	0.842				Detected Data appear Lognormal at 5% Significance Level		
1872					Lilliefors Test Statistic	0.284				Lilliefors GOF Test		
1873					5% Lilliefors Critical Value	0.262				Detected Data Not Lognormal at 5% Significance Level		
1874	Detected Data appear Approximate Lognormal at 5% Significance Level											
1875												
1876	Lognormal ROS Statistics Using Imputed Non-Detects											
1877					Mean in Original Scale	2.506				Mean in Log Scale		-0.314
1878					SD in Original Scale	4.939				SD in Log Scale		1.424
1879					95% t UCL (assumes normality of ROS data)	4.752				95% Percentile Bootstrap UCL		4.563
1880					95% BCA Bootstrap UCL	5.543				95% Bootstrap t UCL		10.67
1881					95% H-UCL (Log ROS)	7.541						
1882												
1883	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
1884					KM Mean (logged)	-0.388				KM Geo Mean		0.678
1885					KM SD (logged)	1.423				95% Critical H Value (KM-Log)		3.47
1886					KM Standard Error of Mean (logged)	0.392				95% H-UCL (KM -Log)		6.989
1887					KM SD (logged)	1.423				95% Critical H Value (KM-Log)		3.47
1888					KM Standard Error of Mean (logged)	0.392						
1889												
1890	DL/2 Statistics											
1891					DL/2 Normal					DL/2 Log-Transformed		
1892					Mean in Original Scale	2.483				Mean in Log Scale		-0.384
1893					SD in Original Scale	4.95				SD in Log Scale		1.464
1894					95% t UCL (Assumes normality)	4.734				95% H-Stat UCL		7.967
1895	DL/2 is not a recommended method, provided for comparisons and historical reasons											
1896												
1897	Nonparametric Distribution Free UCL Statistics											
1898	Detected Data appear Approximate Lognormal Distributed at 5% Significance Level											
1899												
1900	Suggested UCL to Use											
1901					97.5% KM (Chebyshev) UCL	10.61				99% KM (Chebyshev) UCL		15.43
1902												
1903	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1904	Recommendations are based upon data size, data distribution, and skewness.											
1905	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1906	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1907												
1908	Thallium											

1909											
1910	General Statistics										
1911				Total Number of Observations	15			Number of Distinct Observations	11		
1912				Number of Detects	2			Number of Non-Detects	13		
1913				Number of Distinct Detects	2			Number of Distinct Non-Detects	10		
1914				Minimum Detect	1.1			Minimum Non-Detect	0.92		
1915				Maximum Detect	3.6			Maximum Non-Detect	2.8		
1916				Variance Detects	3.125			Percent Non-Detects	86.67%		
1917				Mean Detects	2.35			SD Detects	1.768		
1918				Median Detects	2.35			CV Detects	0.752		
1919				Skewness Detects	N/A			Kurtosis Detects	N/A		
1920				Mean of Logged Detects	0.688			SD of Logged Detects	0.838		
1921											
1922	Warning: Data set has only 2 Detected Values.										
1923	This is not enough to compute meaningful or reliable statistics and estimates.										
1924											
1925											
1926	Normal GOF Test on Detects Only										
1927	Not Enough Data to Perform GOF Test										
1928											
1929	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
1930				KM Mean	1.155			KM Standard Error of Mean	0.247		
1931				KM SD	0.659			95% KM (BCA) UCL	N/A		
1932				95% KM (t) UCL	1.59			95% KM (Percentile Bootstrap) UCL	N/A		
1933				95% KM (z) UCL	1.561			95% KM Bootstrap t UCL	N/A		
1934				90% KM Chebyshev UCL	1.896			95% KM Chebyshev UCL	2.232		
1935				97.5% KM Chebyshev UCL	2.699			99% KM Chebyshev UCL	3.615		
1936											
1937	Gamma GOF Tests on Detected Observations Only										
1938	Not Enough Data to Perform GOF Test										
1939											
1940	Gamma Statistics on Detected Data Only										
1941				k hat (MLE)	3.164			k star (bias corrected MLE)	N/A		
1942				Theta hat (MLE)	0.743			Theta star (bias corrected MLE)	N/A		
1943				nu hat (MLE)	12.65			nu star (bias corrected)	N/A		
1944				Mean (detects)	2.35						
1945											
1946	Estimates of Gamma Parameters using KM Estimates										
1947				Mean (KM)	1.155			SD (KM)	0.659		
1948				Variance (KM)	0.434			SE of Mean (KM)	0.247		
1949				k hat (KM)	3.073			k star (KM)	2.503		
1950				nu hat (KM)	92.19			nu star (KM)	75.09		
1951				theta hat (KM)	0.376			theta star (KM)	0.461		
1952				80% gamma percentile (KM)	1.683			90% gamma percentile (KM)	2.132		
1953				95% gamma percentile (KM)	2.556			99% gamma percentile (KM)	3.482		
1954											
1955	Gamma Kaplan-Meier (KM) Statistics										
1956								Adjusted Level of Significance (β)	0.0324		
1957				Approximate Chi Square Value (75.09, α)	56.13			Adjusted Chi Square Value (75.09, β)	54.12		
1958				95% Gamma Approximate KM-UCL (use when n>=50)	1.545			95% Gamma Adjusted KM-UCL (use when n<50)	1.602		
1959											
1960	Lognormal GOF Test on Detected Observations Only										
1961	Not Enough Data to Perform GOF Test										

1962											
1963	Lognormal ROS Statistics Using Imputed Non-Detects										
1964				Mean in Original Scale	0.68			Mean in Log Scale	-0.705		
1965				SD in Original Scale	0.839			SD in Log Scale	0.692		
1966			95% t UCL (assumes normality of ROS data)		1.062			95% Percentile Bootstrap UCL	1.074		
1967				95% BCA Bootstrap UCL	1.354			95% Bootstrap t UCL	2.197		
1968				95% H-UCL (Log ROS)	0.961						
1969											
1970	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										
1971				KM Mean (logged)	0.0632			KM Geo Mean	1.065		
1972				KM SD (logged)	0.335			95% Critical H Value (KM-Log)	1.911		
1973			KM Standard Error of Mean (logged)		0.135			95% H-UCL (KM -Log)	1.337		
1974				KM SD (logged)	0.335			95% Critical H Value (KM-Log)	1.911		
1975			KM Standard Error of Mean (logged)		0.135						
1976											
1977	DL/2 Statistics										
1978	DL/2 Normal							DL/2 Log-Transformed			
1979				Mean in Original Scale	0.981			Mean in Log Scale	-0.178		
1980				SD in Original Scale	0.774			SD in Log Scale	0.509		
1981				95% t UCL (Assumes normality)	1.332			95% H-Stat UCL	1.264		
1982	DL/2 is not a recommended method, provided for comparisons and historical reasons										
1983											
1984	Nonparametric Distribution Free UCL Statistics										
1985	Data do not follow a Discernible Distribution at 5% Significance Level										
1986											
1987	Suggested UCL to Use										
1988				95% KM (Chebyshev) UCL	2.232						
1989											
1990	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
1991	Recommendations are based upon data size, data distribution, and skewness.										
1992	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
1993	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
1994											
1995											
1996	Vanadium										
1997											
1998	General Statistics										
1999				Total Number of Observations	15			Number of Distinct Observations	13		
2000								Number of Missing Observations	0		
2001				Minimum	17			Mean	31.13		
2002				Maximum	69			Median	27		
2003				SD	14.43			Std. Error of Mean	3.726		
2004				Coefficient of Variation	0.464			Skewness	1.59		
2005											
2006	Normal GOF Test										
2007				Shapiro Wilk Test Statistic	0.831			Shapiro Wilk GOF Test			
2008				5% Shapiro Wilk Critical Value	0.881			Data Not Normal at 5% Significance Level			
2009				Lilliefors Test Statistic	0.213			Lilliefors GOF Test			
2010				5% Lilliefors Critical Value	0.22			Data appear Normal at 5% Significance Level			
2011	Data appear Approximate Normal at 5% Significance Level										
2012											
2013	Assuming Normal Distribution										
2014	95% Normal UCL							95% UCLs (Adjusted for Skewness)			

2015				95% Student's-t UCL	37.7			95% Adjusted-CLT UCL (Chen-1995)			38.9
2016								95% Modified-t UCL (Johnson-1978)			37.95
2017											
2018					Gamma GOF Test						
2019				A-D Test Statistic	0.571			Anderson-Darling Gamma GOF Test			
2020				5% A-D Critical Value	0.738			Detected data appear Gamma Distributed at 5% Significance Level			
2021				K-S Test Statistic	0.184			Kolmogorov-Smirnov Gamma GOF Test			
2022				5% K-S Critical Value	0.222			Detected data appear Gamma Distributed at 5% Significance Level			
2023					Detected data appear Gamma Distributed at 5% Significance Level						
2024											
2025					Gamma Statistics						
2026				k hat (MLE)	6.27			k star (bias corrected MLE)			5.06
2027				Theta hat (MLE)	4.965			Theta star (bias corrected MLE)			6.152
2028				nu hat (MLE)	188.1			nu star (bias corrected)			151.8
2029				MLE Mean (bias corrected)	31.13			MLE Sd (bias corrected)			13.84
2030								Approximate Chi Square Value (0.05)			124.3
2031				Adjusted Level of Significance	0.0324			Adjusted Chi Square Value			121.3
2032											
2033					Assuming Gamma Distribution						
2034				95% Approximate Gamma UCL (use when n>=50))	38.01			95% Adjusted Gamma UCL (use when n<50)			38.97
2035											
2036					Lognormal GOF Test						
2037				Shapiro Wilk Test Statistic	0.935			Shapiro Wilk Lognormal GOF Test			
2038				5% Shapiro Wilk Critical Value	0.881			Data appear Lognormal at 5% Significance Level			
2039				Lilliefors Test Statistic	0.16			Lilliefors Lognormal GOF Test			
2040				5% Lilliefors Critical Value	0.22			Data appear Lognormal at 5% Significance Level			
2041					Data appear Lognormal at 5% Significance Level						
2042											
2043					Lognormal Statistics						
2044				Minimum of Logged Data	2.833			Mean of logged Data			3.356
2045				Maximum of Logged Data	4.234			SD of logged Data			0.401
2046											
2047					Assuming Lognormal Distribution						
2048				95% H-UCL	38.38			90% Chebyshev (MVUE) UCL			40.69
2049				95% Chebyshev (MVUE) UCL	45.13			97.5% Chebyshev (MVUE) UCL			51.28
2050				99% Chebyshev (MVUE) UCL	63.36						
2051											
2052					Nonparametric Distribution Free UCL Statistics						
2053					Data appear to follow a Discernible Distribution at 5% Significance Level						
2054											
2055					Nonparametric Distribution Free UCLs						
2056				95% CLT UCL	37.26			95% Jackknife UCL			37.7
2057				95% Standard Bootstrap UCL	36.95			95% Bootstrap-t UCL			41.45
2058				95% Hall's Bootstrap UCL	41.47			95% Percentile Bootstrap UCL			37.47
2059				95% BCA Bootstrap UCL	38.4						
2060				90% Chebyshev(Mean, Sd) UCL	42.31			95% Chebyshev(Mean, Sd) UCL			47.38
2061				97.5% Chebyshev(Mean, Sd) UCL	54.4			99% Chebyshev(Mean, Sd) UCL			68.21
2062											
2063					Suggested UCL to Use						
2064				95% Student's-t UCL	37.7						
2065											
2066					When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test						
2067					When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL						

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc

General Statistics

Total Number of Observations	15	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	100	Mean	1354
Maximum	9600	Median	280
SD	2579	Std. Error of Mean	665.9
Coefficient of Variation	1.905	Skewness	2.738

Normal GOF Test

Shapiro Wilk Test Statistic	0.558	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.379	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	2527	95% Adjusted-CLT UCL (Chen-1995)	2952
		95% Modified-t UCL (Johnson-1978)	2605

Gamma GOF Test

A-D Test Statistic	1.663	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.791	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.337	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.233	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.528	k star (bias corrected MLE)	0.466
Theta hat (MLE)	2567	Theta star (bias corrected MLE)	2903
nu hat (MLE)	15.83	nu star (bias corrected)	13.99
MLE Mean (bias corrected)	1354	MLE Sd (bias corrected)	1982
		Approximate Chi Square Value (0.05)	6.567
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	5.951

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2885	95% Adjusted Gamma UCL (use when n<50)	3184

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.247	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

2121											
2122					Lognormal Statistics						
2123				Minimum of Logged Data	4.605			Mean of logged Data	6.017		
2124				Maximum of Logged Data	9.17			SD of logged Data	1.452		
2125											
2126					Assuming Lognormal Distribution						
2127				95% H-UCL	4614			90% Chebyshev (MVUE) UCL	2371		
2128				95% Chebyshev (MVUE) UCL	2973			97.5% Chebyshev (MVUE) UCL	3810		
2129				99% Chebyshev (MVUE) UCL	5453						
2130											
2131					Nonparametric Distribution Free UCL Statistics						
2132					Data do not follow a Discernible Distribution (0.05)						
2133											
2134					Nonparametric Distribution Free UCLs						
2135				95% CLT UCL	2449			95% Jackknife UCL	2527		
2136				95% Standard Bootstrap UCL	2439			95% Bootstrap-t UCL	4312		
2137				95% Hall's Bootstrap UCL	5498			95% Percentile Bootstrap UCL	2470		
2138				95% BCA Bootstrap UCL	3101						
2139				90% Chebyshev(Mean, Sd) UCL	3352			95% Chebyshev(Mean, Sd) UCL	4256		
2140				97.5% Chebyshev(Mean, Sd) UCL	5512			99% Chebyshev(Mean, Sd) UCL	7979		
2141											
2142					Suggested UCL to Use						
2143				95% Chebyshev (Mean, Sd) UCL	4256						
2144											
2145					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
2146					Recommendations are based upon data size, data distribution, and skewness.						
2147					These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).						
2148					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.						
2149											
2150											
2151	Mercury										
2152											
2153					General Statistics						
2154				Total Number of Observations	15			Number of Distinct Observations	14		
2155								Number of Missing Observations	0		
2156				Minimum	0.022			Mean	0.369		
2157				Maximum	2.7			Median	0.11		
2158				SD	0.683			Std. Error of Mean	0.176		
2159				Coefficient of Variation	1.85			Skewness	3.232		
2160											
2161					Normal GOF Test						
2162				Shapiro Wilk Test Statistic	0.527			Shapiro Wilk GOF Test			
2163				5% Shapiro Wilk Critical Value	0.881			Data Not Normal at 5% Significance Level			
2164				Lilliefors Test Statistic	0.337			Lilliefors GOF Test			
2165				5% Lilliefors Critical Value	0.22			Data Not Normal at 5% Significance Level			
2166					Data Not Normal at 5% Significance Level						
2167											
2168					Assuming Normal Distribution						
2169				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
2170				95% Student's-t UCL	0.68			95% Adjusted-CLT UCL (Chen-1995)	0.817		
2171								95% Modified-t UCL (Johnson-1978)	0.704		
2172											
2173					Gamma GOF Test						

2174				A-D Test Statistic	1.012	Anderson-Darling Gamma GOF Test					
2175				5% A-D Critical Value	0.781	Data Not Gamma Distributed at 5% Significance Level					
2176				K-S Test Statistic	0.258	Kolmogorov-Smirnov Gamma GOF Test					
2177				5% K-S Critical Value	0.231	Data Not Gamma Distributed at 5% Significance Level					
2178				Data Not Gamma Distributed at 5% Significance Level							
2179											
2180				Gamma Statistics							
2181				k hat (MLE)	0.669	k star (bias corrected MLE)	0.579				
2182				Theta hat (MLE)	0.552	Theta star (bias corrected MLE)	0.637				
2183				nu hat (MLE)	20.06	nu star (bias corrected)	17.38				
2184				MLE Mean (bias corrected)	0.369	MLE Sd (bias corrected)	0.485				
2185						Approximate Chi Square Value (0.05)	8.947				
2186				Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	8.21				
2187											
2188				Assuming Gamma Distribution							
2189				95% Approximate Gamma UCL (use when n>=50))	0.717	95% Adjusted Gamma UCL (use when n<50)	0.782				
2190											
2191				Lognormal GOF Test							
2192				Shapiro Wilk Test Statistic	0.951	Shapiro Wilk Lognormal GOF Test					
2193				5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level					
2194				Lilliefors Test Statistic	0.166	Lilliefors Lognormal GOF Test					
2195				5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level					
2196				Data appear Lognormal at 5% Significance Level							
2197											
2198				Lognormal Statistics							
2199				Minimum of Logged Data	-3.817	Mean of logged Data	-1.906				
2200				Maximum of Logged Data	0.993	SD of logged Data	1.285				
2201											
2202				Assuming Lognormal Distribution							
2203				95% H-UCL	1.026	90% Chebyshev (MVUE) UCL	0.658				
2204				95% Chebyshev (MVUE) UCL	0.816	97.5% Chebyshev (MVUE) UCL	1.034				
2205				99% Chebyshev (MVUE) UCL	1.463						
2206											
2207				Nonparametric Distribution Free UCL Statistics							
2208				Data appear to follow a Discernible Distribution at 5% Significance Level							
2209											
2210				Nonparametric Distribution Free UCLs							
2211				95% CLT UCL	0.659	95% Jackknife UCL	0.68				
2212				95% Standard Bootstrap UCL	0.652	95% Bootstrap-t UCL	1.377				
2213				95% Hall's Bootstrap UCL	1.575	95% Percentile Bootstrap UCL	0.683				
2214				95% BCA Bootstrap UCL	0.885						
2215				90% Chebyshev(Mean, Sd) UCL	0.898	95% Chebyshev(Mean, Sd) UCL	1.138				
2216				97.5% Chebyshev(Mean, Sd) UCL	1.471	99% Chebyshev(Mean, Sd) UCL	2.124				
2217											
2218				Suggested UCL to Use							
2219				95% Chebyshev (Mean, Sd) UCL	1.138						
2220											
2221				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
2222				Recommendations are based upon data size, data distribution, and skewness.							
2223				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
2224				However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
2225											
2226	Cyanide										

	A	B	C	D	E	F	G	H	I	J	K	L
2227												
2228	General Statistics											
2229	Total Number of Observations					15	Number of Distinct Observations					13
2230	Number of Detects					10	Number of Non-Detects					5
2231	Number of Distinct Detects					10	Number of Distinct Non-Detects					4
2232	Minimum Detect					0.24	Minimum Non-Detect					0.57
2233	Maximum Detect					3.4	Maximum Non-Detect					0.85
2234	Variance Detects					1.308	Percent Non-Detects					33.33%
2235	Mean Detects					1.152	SD Detects					1.144
2236	Median Detects					0.45	CV Detects					0.993
2237	Skewness Detects					1.006	Kurtosis Detects					-0.292
2238	Mean of Logged Detects					-0.347	SD of Logged Detects					1.052
2239												
2240	Normal GOF Test on Detects Only											
2241	Shapiro Wilk Test Statistic					0.8	Shapiro Wilk GOF Test					
2242	5% Shapiro Wilk Critical Value					0.842	Detected Data Not Normal at 5% Significance Level					
2243	Lilliefors Test Statistic					0.295	Lilliefors GOF Test					
2244	5% Lilliefors Critical Value					0.262	Detected Data Not Normal at 5% Significance Level					
2245	Detected Data Not Normal at 5% Significance Level											
2246												
2247	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
2248	KM Mean					0.872	KM Standard Error of Mean					0.265
2249	KM SD					0.972	95% KM (BCA) UCL					1.322
2250	95% KM (t) UCL					1.338	95% KM (Percentile Bootstrap) UCL					1.317
2251	95% KM (z) UCL					1.307	95% KM Bootstrap t UCL					1.643
2252	90% KM Chebyshev UCL					1.666	95% KM Chebyshev UCL					2.026
2253	97.5% KM Chebyshev UCL					2.526	99% KM Chebyshev UCL					3.507
2254												
2255	Gamma GOF Tests on Detected Observations Only											
2256	A-D Test Statistic					0.856	Anderson-Darling GOF Test					
2257	5% A-D Critical Value					0.745	Detected Data Not Gamma Distributed at 5% Significance Level					
2258	K-S Test Statistic					0.283	Kolmogorov-Smirnov GOF					
2259	5% K-S Critical Value					0.273	Detected Data Not Gamma Distributed at 5% Significance Level					
2260	Detected Data Not Gamma Distributed at 5% Significance Level											
2261												
2262	Gamma Statistics on Detected Data Only											
2263	k hat (MLE)					1.161	k star (bias corrected MLE)					0.879
2264	Theta hat (MLE)					0.992	Theta star (bias corrected MLE)					1.31
2265	nu hat (MLE)					23.22	nu star (bias corrected)					17.59
2266	Mean (detects)					1.152						
2267												
2268	Gamma ROS Statistics using Imputed Non-Detects											
2269	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
2270	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
2271	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
2272	This is especially true when the sample size is small.											
2273	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
2274	Minimum					0.0346	Mean					0.861
2275	Maximum					3.4	Median					0.32
2276	SD					1.014	CV					1.177
2277	k hat (MLE)					0.972	k star (bias corrected MLE)					0.822
2278	Theta hat (MLE)					0.887	Theta star (bias corrected MLE)					1.048
2279	nu hat (MLE)					29.15	nu star (bias corrected)					24.65

2280				Adjusted Level of Significance (β)	0.0324						
2281				Approximate Chi Square Value (24.65, α)	14.35				Adjusted Chi Square Value (24.65, β)		13.38
2282				95% Gamma Approximate UCL (use when n>=50)	1.48				95% Gamma Adjusted UCL (use when n<50)		1.587
2283											
2284				Estimates of Gamma Parameters using KM Estimates							
2285				Mean (KM)	0.872				SD (KM)		0.972
2286				Variance (KM)	0.944				SE of Mean (KM)		0.265
2287				k hat (KM)	0.805				k star (KM)		0.688
2288				nu hat (KM)	24.15				nu star (KM)		20.65
2289				theta hat (KM)	1.083				theta star (KM)		1.266
2290				80% gamma percentile (KM)	1.434				90% gamma percentile (KM)		2.197
2291				95% gamma percentile (KM)	2.985				99% gamma percentile (KM)		4.869
2292											
2293				Gamma Kaplan-Meier (KM) Statistics							
2294				Approximate Chi Square Value (20.65, α)	11.33				Adjusted Chi Square Value (20.65, β)		10.49
2295				95% Gamma Approximate KM-UCL (use when n>=50)	1.588				95% Gamma Adjusted KM-UCL (use when n<50)		1.716
2296											
2297				Lognormal GOF Test on Detected Observations Only							
2298				Shapiro Wilk Test Statistic	0.835				Shapiro Wilk GOF Test		
2299				5% Shapiro Wilk Critical Value	0.842				Detected Data Not Lognormal at 5% Significance Level		
2300				Lilliefors Test Statistic	0.265				Lilliefors GOF Test		
2301				5% Lilliefors Critical Value	0.262				Detected Data Not Lognormal at 5% Significance Level		
2302				Detected Data Not Lognormal at 5% Significance Level							
2303											
2304				Lognormal ROS Statistics Using Imputed Non-Detects							
2305				Mean in Original Scale	0.888				Mean in Log Scale		-0.579
2306				SD in Original Scale	0.996				SD in Log Scale		0.918
2307				95% t UCL (assumes normality of ROS data)	1.341				95% Percentile Bootstrap UCL		1.329
2308				95% BCA Bootstrap UCL	1.454				95% Bootstrap t UCL		1.65
2309				95% H-UCL (Log ROS)	1.624						
2310											
2311				Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution							
2312				KM Mean (logged)	-0.629				KM Geo Mean		0.533
2313				KM SD (logged)	0.915				95% Critical H Value (KM-Log)		2.612
2314				KM Standard Error of Mean (logged)	0.252				95% H-UCL (KM -Log)		1.535
2315				KM SD (logged)	0.915				95% Critical H Value (KM-Log)		2.612
2316				KM Standard Error of Mean (logged)	0.252						
2317											
2318				DL/2 Statistics							
2319				DL/2 Normal					DL/2 Log-Transformed		
2320				Mean in Original Scale	0.883				Mean in Log Scale		-0.59
2321				SD in Original Scale	0.998				SD in Log Scale		0.92
2322				95% t UCL (Assumes normality)	1.337				95% H-Stat UCL		1.611
2323				DL/2 is not a recommended method, provided for comparisons and historical reasons							
2324											
2325				Nonparametric Distribution Free UCL Statistics							
2326				Data do not follow a Discernible Distribution at 5% Significance Level							
2327											
2328				Suggested UCL to Use							
2329				95% KM (Chebyshev) UCL	2.026						
2330											
2331				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
2332				Recommendations are based upon data size, data distribution, and skewness.							

	A	B	C	D	E	F	G	H	I	J	K	L
2333	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
2334	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
2335												